The Nature of Creativity in Cartographic Design with Special Reference to the Barbara Petchenik Map Design Competition

Henry W. Castner[1]
164 Fearrington Post
Pittsboro, NC 27312
hcastner@mindspring.com

Every other year, the International Cartographic Association sponsors an international map design competition, for children 15 years old or younger, that coincides with its biennial congress. The competition promotes the creative representation of the world. The theme of the latest competition was "A World Map." The breadth and ambiguity of this theme does not convey information about its conceptual basis or the grounds upon which entries might be judged. In promotional material, words like "creativity" often appear but it is unclear what is meant in this cartographic context. In comparing what cartographers and art educators say about creativity, it is clear that there are perceptual skills and a body of principles of graphic design which cartographers can systematically apply to enhance creative map design particularly when specific problems are being addressed. This paper provides some background on these and other related questions and suggests ways that the Map Design Competition might provide more useful guidance for competitors and judges alike.

"Whatever creativity is, it is in part a solution to a problem."
–Brian Aldiss (1990), British science-fiction writer

INTRODUCTION

Every other year, the International Cartographic Association sponsors an international map design competition, for children 15 years old or younger, that coincides with its biennial international congress. To date there have been four competitions: Cologne (1993), Barcelona (1995), Stockholm (1997), and Ottawa(1999).[2] The competition, named in honor of Barbara Bartz Petchenik, aims to promote children's creative representation of the world, to enhance cartographic awareness, and to make children more aware of their environment. The ICA's Commission on Children and Cartography advises the ICA Executive on ways that the Competition can be improved and made more effective in achieving its aims. Any suggestions should, of course, have the understanding and support of cartographers in general because it is in their interest that the next generation of mappers become increasingly literate. Guidelines to the Competition set out certain technical requirements[3] and state the theme, most recently "A World Map", and for the 2001 Competition, "Save the Earth."

"The competition . . . aims to promote children's creative representation of the world, to enhance cartographic awareness, and to make children more aware of their environment."

Given the breadth and ambiguity of these themes, it is difficult to understand the conceptual basis of the Competition. In discussions about the Competition, words like "creativity" or "creative representation" often appear. But it is unclear what is meant in this cartographic context. Is it a spontaneous expression of one's feelings or a more deliberate attempt to present, in cartographic ways, certain ideas about the world, no matter how elementary? If it is the former, how do we begin to measure success? If it is the latter, then there is an opportunity to call attention to basic ideas about design and communication and to make use of them in acknowledging achievement. But it doesn't appear that this opportunity has been seized or even acknowledged.

Can it be that our concepts concerning communication, mapping, and geography are so complex and abstract that they cannot be made accessible to young children? I hope not. Have we assumed that teachers will already know these concepts and have ways of connecting them to the Competition? Perhaps. But I suspect that teachers do not have this knowledge, either of the concepts or the ways. The Petchenik Competition provides an opportunity 1) to help children work with their experiences of the world, 2) to inject into their experiences some concepts about graphic expression and creative design, and 3) to help us, as cartographers, decide what we want children to know about the nature and role of creativity in mapping. How do we introduce these ideas in classrooms? What specific tools should we be providing? This paper explores some of these questions and offers some suggestions, in addition to those I have offered in the past (Castner, 1990, Chapt. 5; 1995).

"Can it be that our concepts concerning communication, mapping, and geography are so complex and abstract that they cannot be made accessible to young children?"

CREATIVITY IN CARTOGRAPHY

Cartographers have long been interested in the relationship between art and cartography. In 1938, Erwin Raisz (226-228), for example, reveals our bias, when talking about maps in newspapers and periodicals, by stating "Unfortunately, they are made by artists and not by cartographers, and by their single desire to appeal to the eye they often violate every rule of good cartography." He continues by noting that:

> A charming type of artistic map is coming into fashion nowadays, which shows the roads leading to suburban homes. As these maps rarely show anything other than roads and landmarks, they may well be decorated with characteristic pictures and still serve their purpose. The preparation of this kind of map is a welcome *play* [my emphasis] for the cartographer's imagination between long hours of dry and precise work.

"Cartographers have long been interested in the relationship between art and cartography."

A fascinating contrast here in Raisz's vision of two kinds of cartographic practice, "a vision" which I hope is no longer representative.

Arthur Robinson (1953,12-13) considered two quite different questions concerning the relationship between art and cartography. The first is whether cartography is a legitimate branch of art. He answers by noting that "Prior to the last century the question never arose for cartography was very definitely an art . . . in which great emphasis was laid on fine pen and brush skill. Today [writing in 1953] a great many people still think of cartography as being an artistic calling, and it is likely that a considerable number of otherwise intelligent students shy away from it for fear they are 'not artistic.'" This led Robinson into his second question: What function does an artistic talent play in the making of a map? Robinson's answer was that ". . . there is no question that it [cartography] is a creative kind of endeavor which repays the effort by the satisfaction that comes from producing something that has never been done before. For every map is a different *problem* [my emphasis] requiring a new solution." But, more significantly, I think, he states that "Good judgment, based on principles, is the major requirement of design in cartography; and such judgment may be easily acquired in training." Thus creativity clearly has an intellectual component, based on principles and focused on a problem.

"Thus creativity clearly has an intellectual component, based on principles and focused on a problem."

Sixteen years later, Robinson and Sale (1969, 17-18) suggest what those principles are when they observe ". . . that as we learn more and more about communication that more of the principles and precepts of cartography are being based on understanding and less on individual aesthetic intuition." They go on to draw the parallel between the cartographer and the engineer, each of whom must study the characteristics of his building materials and know the ways of fitting them together so that the end product conveys the

correct intellectual meaning to the user. This is the same idea as the symbol systems which the art educator Elliot Eisner (1980, 4) defines as:

> . . . the means through which personal images are transformed into public forms that can be shared with others. Thus becoming literate in the variety of symbol systems available in a culture is one of the major means through which those forms of thought we call human intelligence are fostered.

"Curiously, by the 6th Edition of the Elements*, Robinson and his co-authors (Robinson et al, 1995), no longer isolate the questions of art in cartography in either the index or the text."*

Surely, we can say this about cartographic communication systems as well.

In Robinson's collaboration with Barbara Petchenik (1976, 108f), the parallel is drawn between cartography and architecture where there is more of an aesthetic dimension. Yet, a building, like any utilitarian article, must be designed with primary attention to how it functions. Curiously, by the 6th Edition of the *Elements*, Robinson and his co-authors (Robinson et al, 1995), no longer isolate the questions of art in cartography in either the index or the text.

Meanwhile, Borden Dent (1985, 21) declares that: "The art in cartography is the cartographer's ability to synthesize the various ingredients involved in the abstraction process into an organized whole that facilitates the communication of ideas." Dent goes on to describe in some detail the nature of thematic map design, the abstracting processes involved (pp. 22-24), and activities that are associated with creativity (pp. 24-27). He defines creativity as ". . . the ability to see relationships among elements . . . Although there is no recipe for creativity, there appear to be certain activities shared by people considered to be great thinkers, scientists, or artists." He discusses what may be called the seven heuristics of creative design. Dent appears to consider these activities to be a useful part of any course in cartographic design. Similarly, Trifonoff (1999, 50-1) notes that many university level cartography courses already focus on artistic topics such as balance, harmony, symbols, and color.

"He defines creativity as '. . . the ability to see relationships among elements . . . '"

In summary, cartographers generally recognize a creative dimension to map design; one that can be enhanced through the knowledge of principles of graphic design and with heuristics that help designers organize their ideas about particular communication goals and become more creative in their designs. Clearly, whatever skills are used, they are aimed at a product that addresses some problem and is not merely decorative.

CREATIVITY IN ART EDUCATION

It is interesting to compare these comments with those of art educators speaking about creativity. Betty Edwards (1986, 2) confesses that "Creativity has been studied, analyzed, dissected, documented." However, she argues that: "To date, we still have no generally accepted definition of creativity – no general agreement on what it is, how to learn it, how to teach it, or if, indeed, it can be learned or taught."

A progressive view is expressed by Wachowiak and Ramsay. They state (1965, 2) that:

> Children are more inquisitive, more alert, and more discerning than we have been led to believe. Children with imagination, sensitivity, heightened perception, and vivid recall, who express their experiences and their reactions with a feeling ordered and disciplined by compositional structure and design, create *art*.

But for the majority of children, they continue, this sense of design, of composition, of order, and of an aesthetic form must be learned or "caught" from their teacher, their parents, . . . trips to art museums . . .

and so on. What then should we as teachers be "throwing" for our students to "catch" the message?

"What then should we as teachers be "throwing" for our students to "catch" the message?"

Wachowiak and Ramsay (1965, 5) go on to state that when the art period is

> . . . bogged down in a continuous demand for posters, signs, charts, stage decorations, table favors, and factually dominated dioramas, it is no longer a valid and meaningful art program. It is senseless to justify its inclusion in the elementary school curriculum on this basis. Either it has a body of vital subject matter and skills to be mastered or it hasn't; either it has merit as a unique avenue to mental, social, and personal growth through creative action, or it hasn't. We believe it has.

Curiously missing is any reference to improving the skills of graphic communication and visual perception, and of learning how to look with discrimination. This seems to provide a wide open door for cartographers to develop these curriculum areas. The Barbara Petchenik Competition may be one instrument for that.

The idea of innate creative skills in children is challenged by Elliot Eisner (1974, 7) who outlines seven myths of art education. The first myth is that "Children develop best in art if left to their own resources provided they have plenty of art materials and emotional support from the teacher." For Eisner, ". . . the skills needed for artistic expression are not acquired simply by getting older." (p. 8) They must be taught or learned through self instruction, i.e., practice and experiment. Betty Edwards (1986, 3-6) is more proactive when she describes three stages in the creative process and attacks the traditional belief about creative talent. Why, she asks, do we assume that a rare and special "artistic" talent is required for drawing? We don't make that assumption about other kinds of abilities – reading, for example. "What if we believed that only those fortunate enough to have an innate, God-given gift for reading will be able to learn to read?"

"The idea of innate creative skills in children is challenged by Elliot Eisner who outlines seven myths of art education."

Perhaps, Edwards asks, "artistic talent" has always seemed rare and out of the ordinary only because we expect it to be rare and out of the ordinary (1986, 7). Her experience has taught her that any person of sound mind can learn to draw and that the probability is the same for learning to read. The universality of creativity is echoed by Hirshberg who contends that "People treat creativity as something to deal with off-site, or down the hall with the odd people, the creatives. Creativity is not an element of human behavior that's limited to a certain kind of humanoid. Everybody has great potential." (Evarts, 1998). Can we cartographers not take heart in Edward's claim that:

> It is simply a matter of learning basic perceptual skills – the special ways of seeing required for drawing. Once these perceptual skills are learned, their use can be as varied [as creative?] as subsequent uses of basic language and arithmetic skills.

"It is simply a matter of learning basic perceptual skills – the special ways of seeing required for drawing."

She proposes that visual, perceptual skills are enhanced by training, just as the verbal and analytic skills are benefitted by education (Evarts 1986,8). Later, she is more specific in saying that "The rules and heuristics of drawing are broad enough to allow infinite variation – a necessary characteristic because the visual information 'out there' is infinitely variable and complex" (Edwards, 1986, 43).

Bruno Bettleheim (1980, 413) offers another perspective when he observes that:

> To the psychoanalyst, it is appalling how progressive education, and art teaching in particular, have responded to the insights of psychoanalysis. It is a response showing equal confusion about art teaching and about psychoanalysis. It is especially hard to see how art teachers came to harbor the notion that giving the unconscious 'free rein' can be of value, either as education, aesthetics, or therapy. Art teachers should know from their own creative efforts what tremendous discipline is necessary to achieve a significant work of art.

"'Art teachers should know from their own creative efforts what tremendous discipline is necessary to achieve a significant work of art.'"

On the discipline necessary for creativity, Sir Peter Ustinov puts it this way: "You need the ability to be alone with yourself to do the *hard work* [my emphasis] that creativity requires" (Goodale, 1999).

One aspect of discipline is noted by Wilson and Wilson (1982, 77) who state that "Children cannot produce drawings without the necessary information about objects, places, actions, and processes that they wish to draw." The Wilsons insist that children must be provided with a variety of images from which they can begin to *extract information* about the subject. Only from these can ideas for their own work emerge. They explain the process in this way:

> What artists and children do is to take existing cultural images and extend them, alter them, recombine them, place them in new contexts, and use them in new ways. Creativity is seldom achieved through the production of the utterly new but rather through taking those things which belong to the culture and using them in individual ways, resulting in images that are often novel and unique.

"'Creativity, as has been said, consists largely of rearraning what we know in order to find out what we do not know . . . Hence, to think creatively we must be able to look afresh at what we normally take for granted.' (Kneller, 1965 quoted by Edwards, 1986, 38)"

This seems to be a most succinct but useful definition for us to utilize. Another writer (Kneller, 1965 quoted by Edwards, 1986, 38) puts it this way: "Creativity, as has been said, consists largely of rearranging what we know in order to find out what we do not know . . . Hence, to think creatively we must be able to look afresh at what we normally take for granted."

Another dimension of creativity is found in Eisner's fifth myth that art teachers should not evaluate children's art work. But, he contends, "Children respect thoughtful evaluation and criticism because it testifies to them that their teachers are taking them and their work seriously." (Eisner, 1974, 13). Similarly, his sixth myth is the belief that teachers should not attempt to talk about art since verbalization usually kills art. But Eisner (1974, 14) points out that the language used in criticism is not intended as a surrogate for the work but as pointers to illuminate the work and, thus, to better understand its structure *and how it works* [my emphasis, for this is something we have been studying with maps].

This brings us back to the question of the nature of creativity: Is it a spontaneous expression of feelings or part of a deliberate attempt to communicate a certain idea? What is the basis of its verbalization and criticism in the first instance? Clearly, cartographers have a body of concepts and principles which we can use in addressing specific questions. Thus any attempt to help children be creative with maps demands that children know something about these concepts and principles as tools of cartographic presentation.

"Clearly, cartographers have a body of concepts and principles which we can use in addressing specific questions."

Isabel Carley, an American pioneer in Orff Schulwerk, *Music and Movement for Children*, summarizes much of this by asking whether the creative processes that are scheduled nowadays in classrooms actually lead to creative thought, or whether they are simply shots in the dark, done for the sake of appearances? She wonders if the superficial use of "creative projects" does more harm than good, since it denies the basic seriousness

of the endeavor – of purposeful design. She then declares: "There must be a definite problem with definite limits for which preparatory training has been so complete that the children can be allowed to solve the problem almost entirely by themselves, with help and guidance on call if they feel inadequate." (Carley, 1977). This approach, of course, calls for a different role for teachers, one that they may not be willing to take.

CREATIVITY AND THE PETCHENIK COMPETITION

What parts of this discussion are applicable to the Barbara Petchenik Competition? If we want our contestants to be creative, what does this mean? There appears to be some consensus among both cartographers and art educators that creativity has an important intellectual dimension, and it isn't just a matter of expressing one's feelings. Thus, to be creative, one must first be familiar with a variety of exemplars and models of the subject (in our case, maps and the earth) in order to be able to develop a new perspective upon them. Fortunately, there are recognizable skills and heuristics that can be applied to map design. There are also a variety of graphic guidelines for creating symbols which make appropriate contrasts in both quantitative and qualitative information. The principles so eloquently set out by Bertin (1973) are exemplary. Hence we have a significant basis for developing activities where these skills and guidelines can be applied to specific problems. In them, the selection and manipulation of graphic elements would have a communication purpose and not be chosen by whim.

This is reminiscent of the old saw saying that creativity is 90% perspiration and 10% inspiration. Graphically, problem solving (Samples, 1976, 76) is a combination of work and play as in Figure 1. Play, or metaphoric, non-linear or lateral thinking, is the principal cognitive activity in starting to consider a problem, not waiting for some idea to strike. Rather it involves a systematic review of possible associations that one can make. As ideas and possibilities appear, more of the designer's time is spent working toward a solution, i.e. refining the image. This is a simple heuristic or rule for any kind of problem solving, including map design.

In terms of heuristics, the seven activities described by Dent (1985, 24) involve challenging assumptions, recognizing patterns, seeing in new ways, making connections, taking risks, using chance, and constructing networks. These are certainly ways of thinking that all map designers should aspire to master. But how do we start teaching them to children? One strategy is to give them problems with solutions that require them to think systematically about their cultural images or associations that relate to such abstract ideas as peace or a clean environment. In such tasks, specific objects like white doves or green plants and healthy animals provide graphic connections that allow a map or graphic design to carry a recognizable message. These objects become another design element or motif that is common to mapper and viewer alike. Such topics are often considered in our studies of map symbols, their design, and how they work in complex visual environments. This is particularly true for concept-related or associative map symbols which act as graphic metaphors (Castner, 2000a) .

The principles of graphic design are an example of what we can and should talk about in evaluating cartographic designs. Perhaps they should be a more visible part of the Petchenik Competition? We might also consider making the competition less competitive by adjudicating participants in light of such principles. In non-competitive festivals, for instance in music, the entrants receive commentary and insights about their creative efforts in terms of the principles of expression and communication in that medium.

Another way of generating topical motifs for a map competition is with map projections, one of our shared images of the earth itself. Traditionally, we think of various aspects of projections – equatorial, polar, and

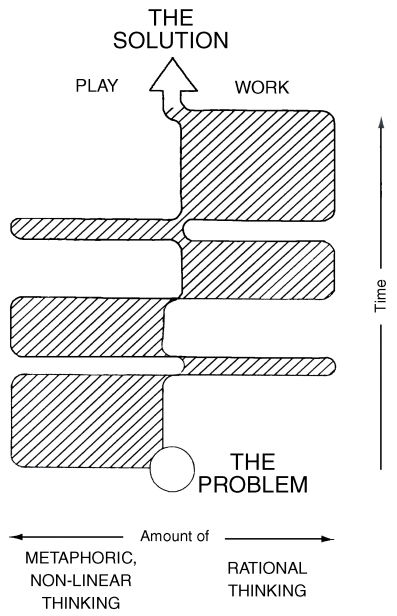

Figure 1. The two types of thinking involved in problem solving. From Castner (1990, 120) after Samples (1976, 76).

"Thus, to be creative, one must first be familiar with a variety of exemplars and models of the subject (in our case, maps and the earth) in order to be able to develop a new perspective upon them."

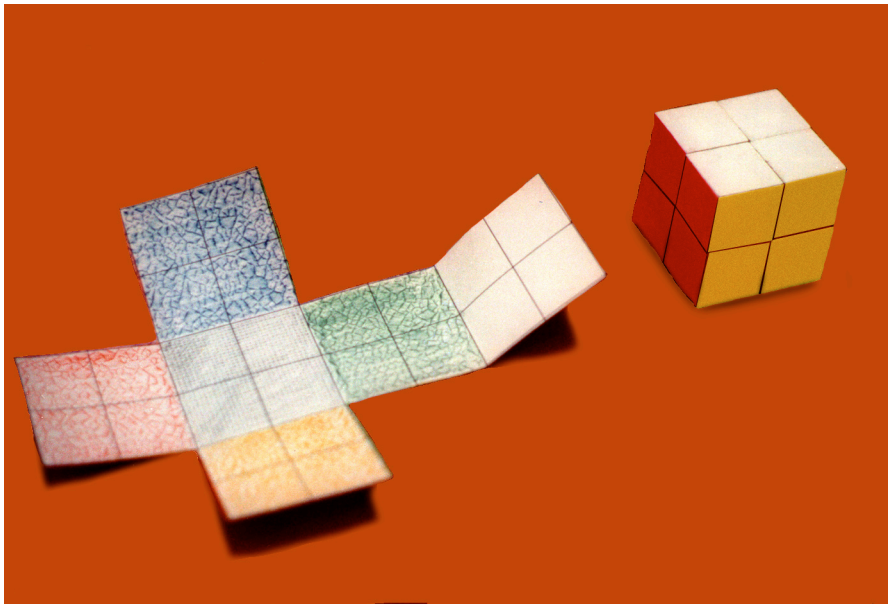

Figure 2. A stack of eight cubes and the unfolded box that would contain them.

oblique. This big idea, that we can create all sorts of images of the earth with a single projection by recentering or reorienting it, is missing from most discussions of map projections aimed at children (and perhaps at adults as well). In practical terms, this means we can center a projection on any place in the world, as with rectifying a globe, without changing the pattern of deformation of that projection. To get to this idea, there is a sequence of activities, as explained in a report on a school district in Wisconsin (Brinkman, 1997) where students are building math skills using spatial reasoning. The simplest example describes an eight-year-old trying to sketch how a box capable of holding some small wood blocks, stacked on her desk, might look if she could unfold it and lay it flat as in Figure 2. This simple transformation activity uses paper with one inch grid squares, the same size as the block facets. These researchers have found a strong positive connection between spatial reasoning or the ability to visualize, and doing well in mathematics.

"Recently, a group of second graders in this Wisconsin program performed as well or better than college honors students in an exercise to create two-dimensional representations of three-dimensional objects!"

As if that were not enough, these Wisconsin children are reported to be learning other useful skills. For example, students who develop their own ways of solving problems also learn the value of making conjectures and then finding ways of supporting them through math. In science, a firm foundation in spatial skills, e.g., visual exploration, seems to help children create and revise models, the principal way that scientists explain the world. Recently, a group of second graders in this Wisconsin program performed as well or better than college honors students in an exercise to create two-dimensional representations of three-dimensional objects! Here is further evidence that supports a useful collaboration between cartography and mathematics in schools.

"This approximation of the earth has six facets. Children can begin moving them around to create different 'map projections.'"

The only thing that prevents the eight year old, contemplating her stack of blocks, from making a map projection is having some shapes on the sides of her blocks. But that is easily remedied by drawing simplified continents on the stack of eight cubes as in Figure 3. We can identify the equator, two parallels, the poles, and 4 different meridional great circles. This approximation of the earth has six facets. Children can begin moving them around to create different "map projections." Coloring each facet with a different hue facilitates discussion. Some of you will recognize that the block pile is also a simple model of the color solid -- a concept easily

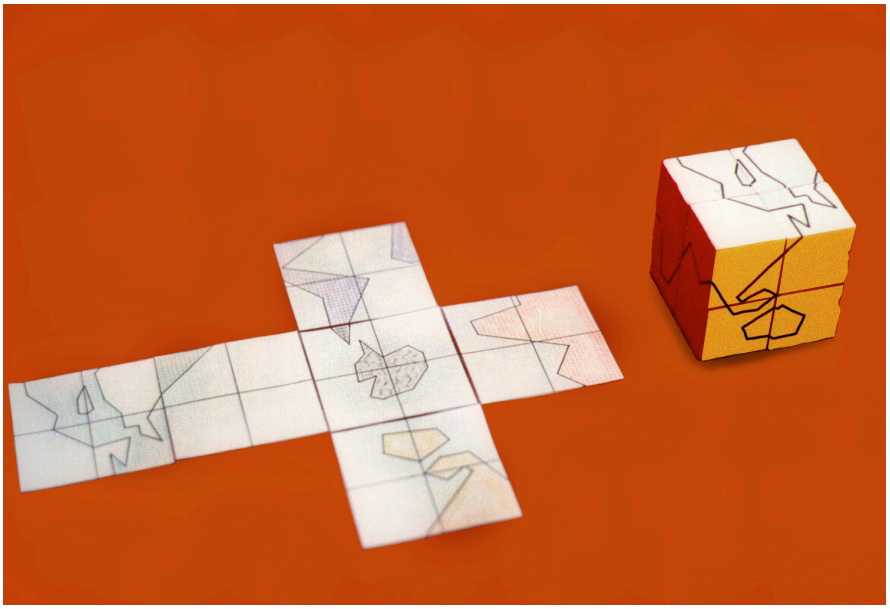

Figure 3. A stack of eight cubes with the simplified continents drawn on their sides. By transferring these outlines to the enclosing box (by tracing through to the opposite side), and unfolding it, one produces a map projection of the six facet cube.

associated with the globe and one which is useful in selecting colors for making qualitative and quantitative distinctions in mapping. It may also be advantageous to reinforce their understanding of the earth's graticule by using it in introducing concepts about color use.

A more complex, but more accurate approximation of the earth is, with one of the variations on Fuller's Dymaxion Air-ocean world map – a map on the 20 equilateral triangles of the icosahedron. It is one of the Platonic solids—the developable solids which have 4, 6, 8, 12 (in two versions), and 20 uniform geometric facets. Irving Fisher (1943) created another variant that the American Geographical Society has kindly granted the Commission permission for children to reproduce for use in the Competition. There is also a commercially available variation known as the game "Flight Lines."[4] Then there is the Guyou Projection (Snyder and Voxland, 1989) made up of 32 or 72 squares by Athelstan Spillhaus. They are marketed under the game name *Geodyssey*[5]. The relationship to the pile of 8 blocks is clearer with these squares than with the icosahedron, but this latter map produces a greater variety of outlines and is easier to manipulate.

One strategy for the Petchenik Competition could be to provide children with manipulative projections, e.g., a set of such triangles or squares, which they could manipulate by hand to create their own projections of the world. Three obvious possibilities present themselves[6]: create a home-centered projection where your home country or continent is central to the rest of the surrounding world as in Figure 4; create a projection whose outline forms a shape that relates to the theme of the map, for example a map about dinosaurs as in Figure 5; or merge the image of the globe with some other element(s). One can easily discover such motif ideas in advertisements or political cartoons. The earth as cow, Figure 6, has been used in reference to the exploitation of the natural resources of Antarctica. The earth on the wings of a water bird, Figure 7, is an appropriate association for an air mail stamp. An "empty pocket" projection, Figure 8, suggests a bankrupt southern hemisphere. These and others like them are the kinds of associations that children should be able to make as part of their own "creative efforts."

"One strategy for the Petchenik Competition could be to provide children with manipulative projections, e.g., a set of such triangles or squares, which they could manipulate by hand to create their own projections of the world."

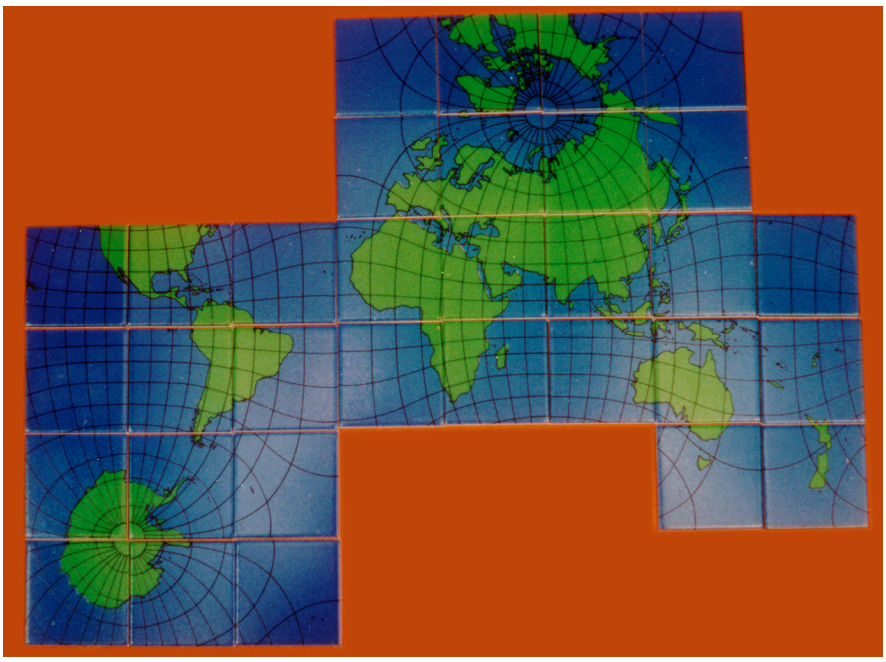

Figure 4. The world on the Guyou projection, on 32 squares, centered on Africa.

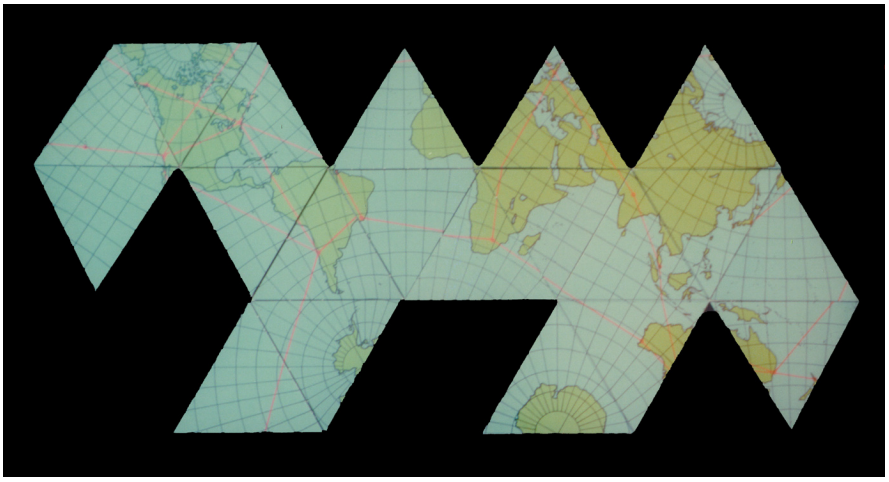

Figure 5. The "stegosaurus projection" showing the world on the icosahedron rearranged into the shape of a dinosaur.

CONCLUSIONS

This review of what cartographers and art educators have said about creativity suggests that map design is a problem-solving activity that can be applied to a number of concepts in graphic communication, and can utilize heuristics of design in order to create a map product which addresses a particular question. In this, map design is clearly a disciplined but creative activity and not simply a spontaneous expression of one's feelings. The Barbara Petchenik Competition represents a great opportunity to make teachers aware of concepts in graphic communication, concepts which we have found useful in constructing meaningful and creative maps; and to provide children with a problem-oriented activity in which to practice this applied form of problem-solving in creative ways, thus enlarging their ideas about or experiences in the world. Making unique images of the world with manipulative map projections is one example of a creative activity that 1) reinforces the mapper's knowledge of the major

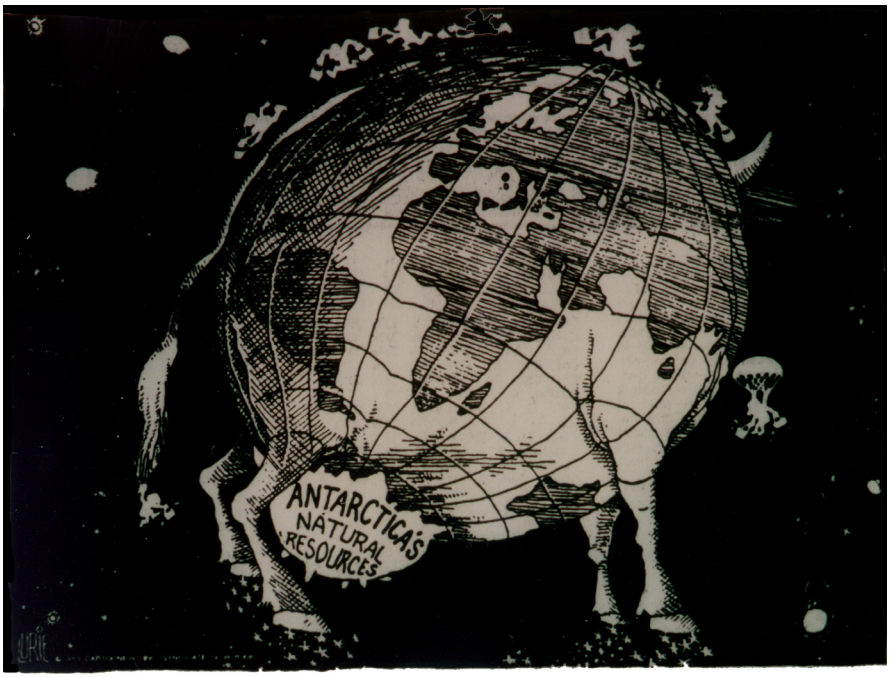

Figure 6. The earth as cow waiting to be milked of the natural resources of Antarctica.

Figure 8. The "empty pocket projection" suggesting, symbolically, the dire economic straits of southern hemisphere countries.

Figure 7. The world on the back of a water bird on a Peruvian air mail stamp.

features of the earth; 2) provides an opportunity to consider what culturally important motifs, whether in the map outline or the symbols used, can contribute to the map's message; and 3) allows the mapper to focus all these elements in their design on a specific theme or problem. With these skills, map design becomes a more useful tool for informing students and teachers alike about what "creative" map design can be.

BIBLIOGRAPHY

Aldiss, Brian. 1990. *Bury My Heart at W.H. Smith's*. Gordonville, VA: St. Martin's Press.

Bertin, Jacques. 1973. *Semiologie graphique*. 2nd ed. Paris: Gauthier-Villars.

Bettleheim, Bruno. 1980. Art and Art Education: a Personal View. In *Surviving, and Other Essays*, pp. 412-26. New York: Vintage Books.

Brinkman, Phil. 1997. Students Build Math Skills by Visualizing Problems. *The Christian Science Monitor*, Monday, November 24, 10.

Carley, Isabel. 1977. On Creativity. *Orff Echo*. 75-6.

Castner, Henry W. 1990. *Seeking New Horizons: A Perceptual Approach to Geographic Education*. Montreal & Kingston: McGill-Queen's University Press.

Castner, Henry W. 1995. *Discerning New Horizons: A Perceptual Approach to Geographic Education*. Pathways in Geography Title #13. Indiana, PA: National Council for Geographic Education.

Castner, Henry W. 2000a. *Can a Map Design Competition be Truly Geographic? How the Petchenik International Competition Can Contribute to Geographic Education*. Paper for presentation to the IGU Commission on Geographic Education, Kyongju, Korea, August 2000.

Castner, Henry W. 2000b. Manipulative Map Projections: What Can be Discovered from Their Classroom Use? Paper presented at the Annual Meeting, Canadian Cartographic Association, Edmonton, June, 2000.

Dent, Borden. 1985. *Principles of Thematic Map Design*. Reading, MA: Addison-Wesley.

Edwards, Betty. 1986. *Drawing on the Artist Within*. New York: Simon and Schuster.

Eisner, Elliot. 1974. Examining Some Myths in Art Education. *Studies in Art Education*, XV, #3, 7-16.

Eisner, Elliot (1980). "The role of the arts in the invention of man," *New York University Education Quarterly*, Spring, 2-7.

Evarts, Eric C. 1998. Management's Role in Fostering Creativity. *The Christian Science Monitor*, Thursday, 6 August, B3.

Fisher, Irving 1943. " A world map on a regular icosahedron by Gnomonic projection," *Geographical Review*, 33 (4), 605-619.

Goodale, Gloria. 1999. Interview/Peter Ustinov: Renowned Actor on Culture, Courage. *The Christian Science Monitor*, Friday 20 August, 20.

Kennedy, Stephen B. 1977. Why it is Important for Young Children to Experience the Arts? *Orff Echo*, IX, #2 Winter.

Kneller, George. 1965. *The Art and Science of Creativity*. New York: Holt, Rinehart and Winston.

Raisz, Erwin. 1938. *General Cartography*. New York: McGraw-Hill.

Robinson, Arthur H. 1953. *Elements of Cartography*. New York: John Wiley.