Creativity, Art and Cartography in Geographic Education

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Elementary children can learn about maps, but what they do learn depends in large part on the background and training of the teacher. Teachers who engage in mapping activities often lack training in the technical aspects of map making, along with a lack of knowledge of the role of art, design, and creativity in the cartographic process. An activity designed to help elementary and middle school teachers integrate artistic perspectives and mapping is outlined. The workshop proved to be an effective vehicle for increasing teachers' knowledge of both map making and art and gave them an outline for a map making activity that could be adapted to any grade level.

Keywords: children and mapping, thematic maps, map design

INTRODUCTION

How children use and make maps have been topics of concern for geographic educators and cartographers for many years. There has been considerable debate about what children can learn and when they can process and interpret spatial information (Downs, Liben, Daggs, 1988; Blaut, 1991). It is generally accepted that children between the ages of 5 and 12 can learn about maps, but much depends on how and when they are exposed to maps. The development of map skills in children depends on, "...what children can learn, what children should learn and what children typically do learn, at particular ages, in a particular culture" (Petchenik 1984, p.801). What children do learn is often a result of the background and training of the elementary and middle school teacher and the map materials available. To ensure that children receive appropriate mapping experiences we need to provide these teachers with information on the nature of maps and mapping, if not in the undergraduate educational experience, then in other settings, such as in-service training and workshops.

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Maps are more than static presentations of the world, "... Maps break down our inhibitions, stimulate our glands, stir our imagination, loosen our tongues." (Sauer 1956, p. 289). Maps also require imagination and creativity in the design and production process if they are to adequately communicate information (Robinson and Petchenik 1976, p. 19). Introducing teachers to map making expands their ideas and perceptions of maps and makes them aware of the steps in the cartographic design process. Imagination and creativity in map making can then become key elements of the teachers' lesson plans.

The two goals of this paper are: first, to explore the nature of cartography as an art and a science and to investigate the role of creativity in the cartographic design process. Second, it encourages elementary and intermediate school teachers to integrate artistic perspectives and creativity into classroom mapping activities by providing an outline of an activity to expand the teachers' and students' ideas of maps and mapping.

BACKGROUND

Many textbooks, articles and research into the nature of cartography often describe it as being both an art and a science. (Dent 1999, p.4; Muehrcke and Muehrcke 1998, p.11). The word "science" implies exact rules and formulas, while "art" implies a pleasing design. The scientific component is one that

is necessary if we are to accurately represent our world. Courses offered in geography programs for those focusing on a career in geography provide many opportunities to gain proficiency in the scientific realm. Typical activities range from making measurements and calculations from topographic maps, to developing map projections using trigonometry. There is also a scientific component to thematic mapping, where students work with a base map and statistical table. The specifying of color systems can become a numerical activity. Modern developments in surveying, global positioning systems, and satellite technology bring more science into the map making process and are important and necessary elements.

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The elements included in the artistic component are perhaps less well-defined or agreed upon. At the university level, geography programs do provide courses and activities related to design for those focusing on a major or career in geography. These courses focus on many important topics: balance, harmony, symbols, classification, color, multimedia and interactive maps. Individuality, uniqueness and creativity are components of the art of cartography that are associated with cartographic design. The design component relates to aesthetics and the creation of a pleasing map display, something necessary not only in maps for adults but in maps for children as well.

In a map experiment designed to test children's understanding of map symbols, a second grade subject was asked which of four types of symbols portraying numerical or statistical information was the best. She indicated that they were all good, and perhaps her answer meant that the science part was correct: that the maps conveyed the meaning accurately or made it possible to determine correct answers to a series of questions. But she put an artistic qualifier on her statement. She said if you want people to remember the information better, then the "prettiest map" was best because people will like looking at it, and she thought the map that used color was the prettiest (Trifonoff 1995, p. 373). So an artistic or aesthetically pleasing design is a necessary component of map design for all grade levels.

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In recent years advances in technology indicate that the scientific component is accelerating beyond the art component. MacEachren summarizes both sides of this issue in *How Maps Work* (1995). He suggests that as cartography emerged as a specialized field of study in the 1950s the focus on functionality and communication relegated the art of cartography to a somewhat minor role. He notes,

> A new view of the role of art and science in cartography is clearly needed. It is probably a mistake to view maps as objects that contain varied amounts of scientific or artistic content for which we must determine an appropriate balance.... Instead, it makes more sense to consider complementary artistic and scientific approaches to studying and improving maps, both of which can be applied to any given cartographic problem. The artistic approach is intuitive and holistic, achieving improvements through experience supplemented by critical examination.
>
> (MacEachren 1995, p.9)

For this viewpoint, MacEachren considers art, "... in a broader sense of grappling with emotions, prompting subjective responses, contemplating aesthetics, along with concerns for the production of pleasing designs," while science involves "... following methods that involve systematic progress through: observation, theory development, test of theory empirically, and modification of theory in response to results" (MacEachren 1995, pp. 16-19).

Cartographers are comfortable working with both the scientific and artistic components, and we provide our majors with experience in both realms. But one of the questions facing geographic educators and cartographers today is how to convey this information to young children, or more specifically, to the teachers of young children. In many preservice programs for elementary education and elementary social studies teachers, only minimal course work in geography is required. Any map instruction received is usually in the context of a general geography course focusing more on map use than map making and map design. Cartography courses are not part of the normal fare in the elementary education curriculum. This limited exposure of the teacher to the map making and design process has a direct bearing on what children learn about maps. Since teachers are not educated in map making and map design they do not realize that imagination and creativity are important parts of the cartographic design process. We need to find other opportunities, such as in-service training, to expose elementary teachers to the concepts and principles of cartographic design. By providing instruction in cartography to elementary teachers we can guide them through the steps of making aesthetically pleasing maps, and also foster activities that encourage them to bring more creativity to the mapping process.

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CREATIVITY AND CARTOGRAPHY

Creativity is often mentioned when discussing map aesthetics and design, but the term is used rather freely and the meaning is unclear, not only in cartography, but in psychology and art as well. The dictionary defines creativity as the act of producing something new through imaginative skill, and making or bringing something new into existence. Psychologists expand on this definition, with some viewing creativity as nothing more than releasing impulses or relaxing tensions, while others see it as the process of change, development, and evolution in the organization of subjective life (Kneller 1965, pp. 1-2). A synthesis of the research on creativity within psychology has resulted in a more comprehensive definition: "Creativity seems to involve certain mental abilities. These include the ability to change one's approach to a problem, to produce ideas that are both relevant and unusual, to see beyond the immediate situation, and to redefine the problem or some aspect of it" (Kneller 1965, p.13).

Artists view creativity as the process of taking familiar things which belong to the culture and using them in individual ways, resulting in images that are often novel and unique (Wilson and Wilson 1982, p. 77). Creativity is also viewed as part of a process that combines the uniqueness of the individual, along with the materials, events, people or circumstances, and results in the emergence of a novel product (Rogers 1971, pp. 3-4). When viewed in this way, creativity is therefore not unconscious, but an intentional process and activity that involves the rearrangement of existing knowledge and allows for expansion of that knowledge, appropriate to a given situation, that can result in solving a problem.

Cartographers often use the term "creative" when referring to aesthetics or map design, but seldom provide a complete explanation of its meaning. In a report on the role of cartography in liberal education, Robinson states that cartography has ". . . a wide range of qualitative aspects, such as symbolism, design, creativity – and even decoration;" (Robinson, 1965). He notes that aesthetics, art and creativity are all related and essential to the communication process, but does not define creativity. A more specific explanation is provided by Castner, who suggests creativity can be viewed in two ways: first, as the complete freedom to think up something and to provide a product in the absence of constraints, and secondly, where the materials are constrained and the student is given a specific goal (Castner,

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1990, pp. 117-118). Creativity from a cartographic perspective involves systematic thinking where students and / or cartographers create unique maps that express some idea or experience of their world (Castner 1998). If this definition and viewpoint are accepted by cartographers, then we need to provide students at all levels with situations and experiences that will foster constructive creativity.

". . . cartographers can challenge conventional perceptions by giving a world map a southern orientation instead of the traditional view with north at the top."

In his textbook, *Cartography, Thematic Map Design*, Borden Dent (1999) mentions several activities that can encourage new ways of thinking in the process of transforming real world data into a map presentation (Table 1). This is not a list of steps to become creative, but rather a list of approaches or perspectives that through gradual practice and incorporation into various problem solving situations will lead a person to creative interpretations. For example, cartographers can challenge conventional perceptions by giving a world map a southern orientation instead of the traditional view with north at the top. With North and South America reversed from their normal representation, students and teachers can gain a fresh view of the world.

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Two workshops were conducted to introduce map design principles to elementary and middle school teachers. The objectives were to encourage them to bring imagination and creativity to the map making process, both the artistic and scientific components, and to have the teachers recognize patterns of spatial data, look at maps in new ways, challenge old assumptions, and construct a network for asking questions, exchanging ideas and providing encouragement to each other.

TEACHER WORKSHOPS

A workshop called "The Art of Mapping" was presented at the North East Intermediate Unit (in Archbald, north of Scranton, Pennsylvania). The workshop had two presenters, a cartographer and an artist, who worked

CREATIVE ACTIVITIES

1. Challenging assumptions - daring to question what most people take as truth.
2. Recognizing patterns - perceiving significant similarities or differences in ideas, events, or physical phenomena.
3. Seeing in new ways - looking at the commonplace with new perceptions, transforming the familiar into the strange, and the strange into the familiar.
4. Making connections - bringing together seemingly unrelated ideas, objects, or events in ways that lead to new concepts.
5. Taking risks - daring to try new ways, with no control over the outcome.
6. Using change - taking advantage of the unexpected.
7. Constructing networks - forming associations for the exchange of ideas, perceptions, questions, and encouragement.

Table 1. List of creative activities. (From: Dent 1999, p.238)

together to develop a presentation integrating thematic mapping concepts with aesthetic and design principles. The insights into aesthetics, design and creativity provided by the artist were a valuable component of the workshop. The participants were all active teachers, most in the elementary and middle grades; each taught a variety of subjects and all but one had participated in previous geography workshops. Twenty of the twenty-six had taken a geography course as part of their degree work, while only fifteen had taken an art course.

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Procedures

The workshop began with an explanation of current trends in geography and art education. This required a review and listing of the standards and themes in geography and the visual arts (Tables 2 and 3). Many of the workshop participants were familiar with the geography standards, but not those of the visual arts. The emphasis was on discovering the elements common to both disciplines: both geography and art are concerned with space and spatial representation, but geographic space is often constrained by location (Table 4). For example, in a map of the United States, the states cannot be moved around individually in order to provide a better balance for the design. There are also certain conventions, such as the creation of perspective or three dimensional views, which are common to both areas.

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THE SIX GEOGRAPHIC ELEMENTS AND SELECTED STANDARDS

Elements	Standards
The World in Spatial Terms	How to use Maps
Places and Regions	The physical and human characteristics of place
Physical systems	The physical processes that shape the patterns of earth's surface
Human systems	The characteristics, distribution, and complexity of earth's cultural mosaic
Environment and Society	How human actions modify the physical environment
The Uses of Geography	Interpret the past, the present Plan for the future
Geographic Skills:	Asking geographic questions Acquiring geographic information Organizing geographic information Analyzing geographic information Answering geographic questions

Table 2. National Geography Standards. (From: Geography Education Standards Project 1994, pp.34-35)

THE NATIONAL VISUAL ARTS CONTENT STANDARDS AND SELECTED ACHIEVEMENT STANDARDS FOR K-4

Content Standard	Achievement Standard
Understanding and applying media, techniques, and processes	Students describe how different materials, techhniques, and processes cause different responses.
Using knowledge of structures and functions	Students know the differences among visual characteristics and purposes of art in order to convey ideas.
Choosing and evaluating a range of subject matter, symbols, and ideas	Students select and use subject matter, symbols, and ideas to communicate meaning.
Understanding the visual arts in relation to history and culture.	Students demonstrate how history, culture, and the visual arts can influence each other in making and studying works of art.
Reflecting upon and assessing the characteristics and merits of their work and the works of others.	Students understand there are various purposes for creating works of visual art.
Making connections between visual arts and other disciplines	Students identify connections between the visual arts and other disciplines in the curriculum.

Table 3. Visual Art Standards. (From: Fredrich and Fuller 1996, p. 255)

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From an education perspective, both cartography and art can be used in situations to enhance critical thinking and problem-solving, and both also have individualistic components. Finally, a map or a work of art can be perceived or interpreted differently by each individual.

Once the framework for mapping and art was established, the teachers were asked for examples of the types of maps they used in the classroom. The vast majority were location and reference maps, and the teachers' perception was that these were rigid and fixed representations - more a work of science than art. The teachers indicated they used traditional wall maps frequently, with little or no thought given to how or why these maps were created or why certain elements were included. Likewise, the navigation maps provided in elementary texts, which have the student determine the best route to take from a specific house to the school or park, were the limits of how the teachers thought maps could be used in geography lessons. Most of these teachers had attended other workshops regarding the geography standards and implemented many of the ideas from these workshops into their geography lessons. Despite this fact, the maps for

COMMON THEMES IN MAPS AND ART	
Space and spatial representation	
Content and elements	
Cartographic and artistic filters and conventions	
Education perspective:	student acquisition of ideas, concepts, knowledge; problem-solving, critical thinking
Individualistic components:	Perception and interpretation

Table 4. Common themes in maps and art.

these lessons were still primarily used only for location and navigation situations, and not to show human-environment interaction or geographic patterns and distributions.

In order to encourage the teachers to be more creative in their approach to mapping and to expand their view beyond general reference maps, thematic maps were chosen as the focus of the workshop. A special purpose or thematic map representing a specific data set poses a very different set of map making strategies and techniques than a reference map (Castner 1983, p. 88-89). Thematic maps can be integrated into all of the geography standards and help explain patterns, distributions and the relationships between variables. Children have exhibited success with maps in general, and expanding to maps other than those involving navigation seems realistic. Bartz notes,

> More often they (children) should have to map things themselves; not just the schoolyard or the classroom or the route home, but the conversion of observations or numerical data into spatial form. The child could convert rainfall figures into a simple map, or try to think of ways to show different sizes of cities on a population map... . Making one map like this is far more valuable than just looking at dozens of population maps . . . (Bartz, 1970, p. 24).

Examples of thematic maps from the local to global scale were presented, and experiences with such maps in books, newspapers, magazines were noted. Once discussion started, the teachers realized they had been exposed to thematic maps, but had not formalized them as a specific type of map. A broad set of guidelines was given for them to create their own thematic map, with directions purposefully kept to a minimum to see what they would come up with on their own (Table 5). The objective was to design an original base map of a neighborhood, develop a quantitative data set, and then symbolize the data with the appropriate visual variable. For the data set, traditional examples, such as population density and median income were given, with the teachers encouraged to make their base map and data different from the examples. Since the base maps were maps of hypothetical neighborhoods, the data sets were also hypothetical, with each group encouraged to brainstorm and come up with an individual and unique map. Their final products included base maps and symbols that were

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QUANTITATIVE SYMBOLIZATION NEIGHBORHOOD SCALE	
Base map:	10 to 20 houses; 5 streets
Data set:	numbers (quantitative)
Representation:	symbolization
	visual variables: size, tone, texture
Medium:	paper, crayons, markers, colored pencils
Map elements:	parts common to all maps
Communication and design considerations:	"showing continuity of data using tone and texture."
Critique:	display and discussion symbol conventions in cartography aesthetics suggestions for change

Table 5. Directions for making the quantitative map.

completely different from the grid street map example with generic houses. The data sets generated ranged from the number of fish caught in each home in a native American village, to the amount and type of body piercing occurring in each neighborhood or region.

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The teachers worked in groups and were given a little less than two hours to complete the task. One of the most important parts of the exercise was the critique session in which the participants were asked to evaluate the effectiveness of their own and others' maps in terms of communication of the purpose of the map, general legibility and design. It was at this point that the teachers began to see the connection between data and symbols and design; between the science and the art, and much value was gained "... through experience supplemented by critical examination" (MacEachren 1995, p. 9).

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The afternoon session followed a similar outline, only this time the task was to make a map at the national scale containing categorical information (Table 6). The medium was also changed. Students used fabric scraps, cardboard food and beverage boxes, pieces of metal and wood, and other materials to create their unique map representations. One group made their United States map on a 4' by 6' piece of cardboard, representing the physiographic regions with cut up pieces of food and beverage boxes.

A second workshop was conducted with 30 teachers enrolled in a two week course at a summer geography institute. The thematic map workshop was on the second day, after teachers had been exposed to themes and standards, and was confined to a 3 hour morning session instead of an all-day session. The procedures followed were the same, with the critique session once again proving to be a most valuable component of the activity. For this workshop, the second maps created integrated many of the ideas discussed in the first critique session.

QUALITATIVE SYMBOLIZATION NATIONAL SCALE	
Base map:	United States
Data set:	Categorical (qualitative) Real or hypothetical data
Representation:	symbolization visual variables: shape, color, pattern
Medium:	fabric, cardboard, miscellany
Map elements:	parts common to all maps
Communication and design considerations:	showing contrast versus showing continuity use of fabric and other materials

Table 6. Directions for making the qualitative map.

Implications for future workshops

The workshop was balanced between two components: content regarding thematic mapping and design, and the hands-on activity. The content presented focused on the development of symbols from the primary graphic elements or visual variables and data classification. For the primary graphic elements, particular attention was given to the distinction between symbols used for qualitative and quantitative data. Examples using many different types of symbols were given, but participants were reminded that each map represented only one of the many solutions possible for each map. By having two presenters for the workshop, both the cartographic and artistic components received equal weight. The artist's viewpoint or explanation of graphic elements, such as tone or value, was well received by the participants.

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Evaluations of the workshop indicated that the teachers also found the information on data classification useful. The equal interval, equal observation and natural breaks methods were explained in detail and a bibliography provided (Robinson, et al 1995; Dent 1999; and Slocum 1999). Teachers viewed the development of data classes as an excellent way to integrate math concepts with mapping.

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CONCLUSIONS

The 50 teachers who participated in the two workshops were enthusiastic and willing to accept new ideas and perspectives. They incorporated Dent's list of creative activities into the map design process. The ideas presented and activities performed were new to them and opened their eyes to possible ways of integrating the new techniques into not only geography lessons but other areas of the curriculum, including history, mathematics, science and literature. Combining literature with geography was the most common example given by teachers as to what they already do with the integration of geographic themes. Many novels incorporate the geographic setting into the story line, and *Out of this Furnace* by Thomas Bell (1976) was identified by the teachers as a volume appropriate for a mapping activity.

"One way to encourage students to create new and innovative map presentations is through competitive events."

This book discusses the rise of the steel industry in the valley of the Monongahela River, and variables such as the number of factories, the tons of steel produced, the number of employees and the ethnicity of the workers were identified as potential map themes. Another area seen as having great potential was the use of data classification to integrate mathematics concepts with geography. The comparison of the different classification methods and their effect on the look of the final map intrigued many of the workshop participants.

One way to encourage students to create new and innovative map presentations is through competitive events. Geography Awareness Week provides an ideal setting for teachers and schools to conduct geography fairs and map competitions that require creative map solutions to a well-defined problem. The International Cartographic Association (ICA) sponsors the worldwide Barbara Petchenik Children's Map Competition for students ages 5 to 16. For the 1999 competition in Ottawa, the students were asked to draw a map of the world on any theme of interest to them. Directions were kept to a minimum, except to state that maps should be of a certain size and "creative". Preparing students to enter such a competition requires that teachers be willing to help their students look for new ways to represent the earth. The ICA has a website where past winners are displayed (www.library.carleton.ca/madgic/maps/children/winners/index.htm). The maps from this site can be used by students and teachers to generate a discussion of the elements that make the maps "creative". Cartographers need to be more aware of the needs of elementary teachers and provide opportunities for them to explore the creative aspects of the map making process and pass this knowledge on to their students.

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