

**MAPS FOR AND BY CHILDREN:
POSSIBLE CONTRIBUTIONS BY CARTOGRAPHERS**

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Abstract

The children of today are the cartographers and map users of the future. This paper examines why cartographers should be concerned with investing in the formation of the next generation (those children under 16 years of age) and the possible nature of their involvement -- a formal Working Group of the International Cartographic Association (ICA). It is argued that cartographers need to become actively involved in both improving the product and enhancing map use by providing appropriate training to the map user (teachers, individuals and children).

1 INTRODUCTION

In an era of ever increasing data availability the merits of maps, as a synthesis of spatial data, should be recognized. Similarly, it should be acknowledged that the ability to use maps is a life skill and an invaluable asset for every individual. Over the last ten years, technological innovations have significantly changed the face of cartography [1]. For many professional cartographers the availability of hardware and software has provided both an invaluable tool and an often frustrating challenge to their task of producing maps. The availability of such technology, however, has also created a reality in which many maps, in a variety of media, are being generated not by cartographers but by individuals with little or no formal cartographic training. The children of today are the next generation of map users and producers. This paper focuses on four themes related to this user group. The first theme examined is the question why cartographers need to concern themselves with maps designed for children and maps generated by children. A discussion of the literature about maps and children forms the second theme. The third theme explores what cartographers need to know about maps for children and provides a foundation for the fourth topic -- suggesting ways in which cartographers can contribute to improving mapping for children through forums such as a formal Working Group of the ICA.

2 WHY CARTOGRAPHERS SHOULD BE CONCERNED WITH CHILDREN AND MAPS

The current technology provides the opportunity for an increasing number of people, at work and in the home, to generate and use "maps" in a variety of forms and formats. These range from static conventional paper maps, to animated maps, digital maps on compact-disk read-only-memory (CD ROM), interactive multimedia and hypermedia. As we approach the twenty-first century this trend will inevitably continue. However, the availability of this technology is not without limitations: on a daily basis it is easy to find published maps, particularly thematic maps, in which no attention has been paid to basic

cartographic components such as the appropriate use of visual variables (e.g., hue is often used to represent quantitative area data), or an inappropriate number of a class intervals on a black and white choropleth map as presented by Bertin [2].

In many education systems attention is given to the written (letters and numbers) and spoken expression. There appears to be a basic assumption that mapping and using maps are easy. Perhaps, because they are universal and interdisciplinary, there is the belief that maps and the concepts associated with maps require little attention, if any, in the school curriculum. The problem of geographic literacy has been recognized and is well documented [3]. Recently, within countries such as the United States of America, active steps have been taken to confront and deal with this issue [4, 5]. Also widespread, but not well documented, is the problem of graphic literacy, one component of which is cartographic illiteracy -- an inability to understand and use maps as a tool for representing spatial information. Facility with maps should not be underestimated. Maps and images aid the perception and construction of space, the acquisition of geographical knowledge and the synthesis of geographic information. The importance of the role and use of the graphic language to child development and learning has been well documented [6, 7, 8]. It has been shown that activities involving maps and images activate the right side of the brain and, as a result, can help to increase experiences and neuron connections, which in turn assist the development of our multiple intelligences and different skills [9, 10].

Given the emergence and development of the "information highway" and the increasing emphasis being placed by nations, worldwide, on topics such as geopolitics, economic development and concern for the environment, it is inevitable that maps will play an increasing role in presenting information. Cartographers have the expertise to help educate the educators and other key individuals (such as parents) who will have an influence on children's appreciation and understanding of maps. However, there is an absence of literature to suggest that cartographers are actively helping members of the general public, parents or children, to understand the nature of a map or work with map products. The authors suspect that this situation is not the result of cartographers' apathy but rather the outcome of a lack of awareness of the true situation. In the following three sections what is known about mapping and children is reviewed, issues that need to be addressed are identified and strategies for action presented. This information is essential to developing an approach to facilitate the increased involvement of cartographers in educating children about maps.

3 STATUS AND KNOWLEDGE OF MAPPING FOR AN BY CHILDREN

If we accept that a map is, "A conventionalized image representing selected features or characteristics of geographical reality designed for use when spatial relationships are of primary relevance" [11, pp. 17] and that the process of mapping is concerned with the, "conception, production dissemination and study of maps" [11, pp. 17], what do we know about mapping for and by children?

In the psychological literature, there are increasing numbers of studies which reveal that, "infants and very young children acquire spatial abilities (perceptual and cognitive) at earlier ages than had previously been known to be the case" [12, pp. 60]. There have been many studies which have involved looking at maps drawn by children, for example the work of Matthews [13] who used children's "free recall mapping" to look at their understanding of large scale environments. The work of Spencer, Blades and Morsley [14]

suggest that from an early age children can relate a simple graphic plan to the reality it represents for navigation and/or object location. To date, however, there has been little investigation of the relationships between the design, production and use of children's maps and their more conventional counterparts. Studies have investigated the development of children's understanding of concepts considered basic to mapping such as scale [15, 16] and perspective [17]. Children's abilities to deal with various components of the graphic language have also received attention. Researchers have worked with different users including, the sighted [18, 19, 20] and those with special needs such as the blind and visually impaired [21, 22, 23]. A recent summary of research related to map design for children can be found in an article by Gerber [24].

Particular map products, such as school atlases have received a lot of research attention [25]. There are also articles that relate to the "use of maps" by children. These include the ability or inability to use particular maps such as topographic maps [26] or maps for particular tasks such as wayfinding [27]. The articles also reveal a controversy as to the need and role of instruction of children and teachers [12]. Blaut states that because young children and primitive tribes, without any formal training, exhibit mapping "mapping behaviour," mapping is therefore a "natural ability" [12, pp. 55]. Others argue it is a learned ability and that instruction in basic map concepts and early training in the map language should form an integral component of the school curriculum [28, 22]. Various efforts have been made to contribute to improving graphic literacy through instruction [29, 30, 31, 32, 33].

Despite the availability of all this literature, its close examination will reveal that although valuable individually they do not constitute a coherent body of empirical research. They do not provide comprehensive answers to the basic questions cartographers ask when designing a map such as, who is to use the map and for what purpose? Similarly, the literature does not provide the guidance needed for training individuals (teachers and interested adults) to instruct children of different abilities, to understand and work with maps. A similar problem arises in geographic education. In a recent article, Downs [34, pp. 176] wrote, "the literature does not exist to inform, let alone provide guidance on whether, why, what, when and how questions [of geographic education]. We do not have the answers because the questions have largely been unasked." What are the cartographic issues which need to be addressed?

4 ISSUES WHICH NEED TO BE ADDRESSED

By the end of this century, for all age groups, digital maps, accessible via the information highway, will constitute an important data source. Since we know very little about so many aspects of mapping by and for children there are several issues which need to be addressed. These can be grouped under the two general headings of map design and map use. Although considered separately in this paper they are not independent. In regard to design we need to gain a better insight into children's relationship to and understanding of both the correlation of reality to the map representation and the actual map communication process. In connection with children's map use, we need to look at the who, what, when and how questions: Who learns about maps and mapping? What do they learn? When and how do they learn about maps and mapping? The investigation of many of the myriad of research questions will require a greater involvement of cartographers in interdisciplinary research with psychologists, early learning specialists and computer scientists.

How does one design and produce an effective map for a child? It is an easy question to ask but a difficult one to answer. We really know very little about the use of colour for children's maps or how information should be symbolized, in different mediums, for different ages groups or for distinct users, such as the sighted, gifted, blind or visually impaired. Similarly, little work related to children has been done on what constitutes appropriate levels of map generalization and complexity. The question of how one designs and produces an effective map for a child has been further complicated by new products such as CD ROMS. These products give rise to additional questions such as, is the same map, disseminated in a analogue versus a digital format, equally successful in communicating the information contained? and what are the relative advantages and disadvantages of the available mediums?

An effective product does not mean that it will be used or, if used, that the information contained will be communicated automatically in an efficient and effective manner to the map user. Although the kind of map required by a student (such as a vegetation map of Canada) and the map format and medium (in a Grade 6 Social Science Text book) are often dependent on a specific curriculum, cartographers need to know a lot more about the conditions under which the product is used. Do children really consult and use maps or are they simply appendages to the central text? Under what conditions are the maps used (in isolation or in conjunction with other maps) and for what purpose (the location of a specific category of vegetation)? Answers to these questions have implications for basic assumptions which are being made with regard to map skills. How well prepared are teachers and parents to work with map concepts and the different types of maps? Despite the previous suggestion that mapping and map use are universal natural abilities of humankind [12] there is increasing evidence that much needs to be done in the provision of appropriate training [35], for both teachers and students, in how to graphically express the space in which we and to read maps and graphic images such as remote sensed data. As cartographers we rarely have the opportunity to work with other than our own children. Perhaps, therefore, an important role of cartographers is to assist in the preparation of teachers and parents so that they can pass on the necessary information and skills needed to work with maps. But how could this be successfully achieved?

Gazing into a crystal ball, the ideal product for both teachers and parents, would be a series of detailed guidelines designed to provide the basis for a training programme for the teaching of basic cartographic concepts. Such guidelines would identify what concepts can and should be taught and how these could be introduced to various target groups, taking into consideration variables such as differences in levels of prior spatial knowledge, age, cognitive development, experiences with the graphic language, geographic knowledge and culture.

To design such a programme in cartographic literacy, cartographers would be required, for each basic map concept to think about "levels" of map competence and task complexity as well as the sequencing of and integration of the basic concepts. Questions such as, what is the first and most important concept to be learned would have to be asked and answered. If it is scale, what other related concepts are required for children to understand and master the concept (e.g., proportion)? How can such concepts be introduced in a meaningful manner in different locations (e.g., school, home)? What activities would be appropriate for children with different abilities to learn these concepts? For the very young, exercises relating familiar life size objects to models as well as its graphic representation may be helpful. While, for other levels the use of aerial and conventional

photographs may prove to be a more valuable learning tool than a three dimensional model.

Other basic concepts which require a similar investigation into comprehension and mastery include "perspective" and "orientation," together with their graphic representation. Understanding "the point of view" (vertical, horizontal and oblique perspectives) of an object and, at a smaller scale, the location, is a difficult concept for many children to work with yet it is basic for map tasks involving location, Euclidean distance and orientation. What activities, exercises and strategies are appropriate for introducing and reviewing these concepts at the different levels from early childhood (a play environment), through the years of formal education (primary, and secondary school)? In North America, cardinal directions are often introduced at an early age (7 years). What do children of this age really comprehend about such concepts? Are they too abstract for such an age group? What steps and related exercises, games and activities are required to link such terms to more concrete relations, such as left, near, far, above, below, and introduce the ideas of grids and terms such as latitude and longitude. Questions such as these need to be answered.

These guidelines could only be generated after applied research designed to address questions such as those posed above. In addition, to examining the production and use of conventional cartographic materials (e.g., paper, audio-video, games, story books and toys, models and art drawings), cartographers would have consider digital materials (e.g., hypermedia and interactive multimedia on diskettes, CD-ROM) and the use of networks such as the INTERNET. The creation of tests and methods of evaluation for the different concepts and "levels" would also require attention. Ideally, it is also essential that any such guidelines be creative to ensure interest and motivation in learning about map creation and map use.

5 FUTURE ACTION - OR HOW CARTOGRAPHERS CAN MAKE A CONTRIBUTION

Concern for children and mapping is not enough -- concrete action is needed. The authors perceive the need for involvement of the cartographic community. The involvement should occur at three levels: international, national and individual.

At an international level, prior to 1993, the cartographic community had generally shown little interest in or concern for children as a user group. This changed with the attention received at the International Cartographic Associations's Cologne exhibit of the maps produced by 27 nations in connection with the Barbara Petchenick Map Contest for Children 16 years and under [36]. The success of the first competition is reflected in the fact that a second competition is being held in association with this conference. Such competitions should be continued, encouraged and supported. However, more is needed. Many children never participate in such competitions. There is also the problem that at a national level the mapping exercise is seen more as a Friday afternoon art project than as an invaluable tool for the communication of spatial information.

There is the need for a more formal structure which will work towards addressing some of the issues described earlier. Individuals, within many nations are interested in a wide range of issues associated with the design and production of maps as well as the need for and nature of mapping instruction. Major problems faced within the majority of these countries are: the small numbers actively working in the areas associated with children

and maps; and a sense of isolation and difficulty in obtaining information about the work which has been done or that is progress.

Following informal discussions at Cologne, the authors decided to investigate the level of international interest in and support for the idea of creating a formal Working Group of the ICA, to be called "Children and Cartography." In January of 1994, a bilingual letter and survey were distributed to the official body representing each of the member countries of the ICA. In September, individuals (identified primarily from the 1991 mailing list prepared by the Gender Working Group) in countries from which no survey had been returned received a follow-up letter and survey.

The response to the creation of a formal Working Group has been positive. Replies to serve on such a group have been received from 23 countries. Prior to 1 May 1995, 58 individuals from 24 countries have returned completed questionnaires. Based on survey responses, the following objective and four terms of reference have been formulated for a proposed joint Canadian-Brazilian formal ICA Working Group on "Cartography and Children." The stated objective is 'to improve general cartographic literacy by enriching the understanding of the relationships children have with maps.' The four terms of reference are:

1. To identify people working in the area of mapping and children (or who are interested in this subject area) and to prepare and make available an inventory of these people (in digital and paper format) including their names, addresses, and areas of interest.
2. To prepare for dissemination a select bibliography on topic/subject areas related to mapping and children. This will include the nature and impact of the new technologies such as multimedia.
3. To survey and document the nature of mapping instruction that elementary children receive in different countries (e.g., the sequence of the introduction of map skills, nature of the instructional materials, problems encountered, etc.).
4. To prepare a draft, for possible publication, of preliminary guidelines for encouraging children's interaction with maps, and introducing children to maps and spatial concepts through both traditional methods and the new technologies.

It is anticipated that successful implementation of the proposed Working Group's mandate could lead to:

1. Sensitizing more people to the relevance, nature and role of maps in both the formal education system and everyday life.
2. Stimulating children (as a result of being able to understand and use the graphic language) to enjoy cartography and recognize the need for maps in both analog and digital formats.
3. Improve cartographic education at all levels (teacher training, instruction for children at all ages and the education of parents) through the introduction of basic cartographic concepts prior to map use.

It is hoped that individuals members and corresponding members of the proposed Working Group in addition to carrying out the mandate of the Working Group, will form and lead, where possible, their own national group. This initiative has already been taken by Brazil. A one day colloquium, for cartographers and teachers, on the "State of the Art of Mapping for Children in Brazil" is proposed for June 1995. Presentations by invited specialists will be followed by discussions.

As individual cartographers we can also make an invaluable contribution. As parents, we can expose our children to maps and mapping. As a cartographer you can make a difference to the graphic literacy of other children and foster an interest in maps through contact with a local school principal, classroom teacher and community groups. By making these groups or individuals aware of your expertise with maps and offering to come and talk to children, lending map samples, assisting in field trips or providing information as to what map resources are available for the area (region and country) and how these can be acquired, your individual contribution can be significant.

6 CONCLUSION

If cartographers are genuinely interested in ensuring the production of maps, particularly thematic graphics, as tools for the efficient and effective communication of spatial information they need to become actively involved in both improving the available products and enhancing map use in conventional and electronic media. Relatively little is known about the cartographic design needs and abilities of this large user group. Research into many aspects of map design, cartographic instruction and training is needed if graphic literacy is to be improved for the future generation of map producers and users. But concern is not enough -- concrete action is required. In this task no contribution is too small. Progress in mapping for and by children will only be achieved if there is participation at all levels: national, international and at the grass roots level. The sooner we start our involvement the sooner we shall see results and the enhancement of a basic life skill.

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