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Commentary on
Wula Na Lnuwe'katiyek—An Electronic Mixed Media Atlas

by Ken Francis, B.Sc.

Part of a thesis submitted to the Faculty of Graduate Studies and Research
in partial fulfilment of the requirements for the degree of

Master of Arts

Department of Geography, Carleton University, Ottawa, Ontario, K1S 5B6

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Wula Na Lnuwe'katiyek—An Electronic Mixed Media Atlas

submitted by *Ken Francis, B.Sc.*

in partial fulfilment of the requirements for the degree of

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Abstract

Interactive electronic mixed media, when applied to cartographic practice, revolutionizes previously established ways to communicate through maps. Text, maps, sound, digital video and photography meet in the fertile ground of digital technology, providing cartographers with an impressive means to excite, entertain and inform an audience.

Wula Na Lnuwe'katiyek—An Electronic Mixed Media Atlas is the documentation of a process of exploration and creation which examines electronic mixed media as applied to cartography. The electronic mixed media atlas which has been developed during my experimentation with these many communication forms is offered as a personal creative endeavour and an academic enterprise. This text is the accompanying statement, the intention of which is to provide insight into Wula Na Lnuwe'katiyek—An Electronic Mixed Media Atlas.

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Complete acknowledgements can be found in Wula Na Lnuwe'katiyek—An Electronic Mixed Media Atlas.

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Introduction

Map makers are quick to use new methods and technologies in their quest to design the perfect map. We have recognized the usefulness of computers as map making tools as readily as we have adopted lithographic film in map reproduction. Only very recently, however, has digital technology had such a revolutionary impact on the way cartographers think and work. The availability of desktop systems and the wizardry of commercially available electronic mixed media software have fostered this revolution in cartographic expression.

Interactive electronic mixed media is a convergence of media forms that informs and entertains by stimulating readers' senses as well as engaging their intellects. Image, video, text and sound are intertwined and their individual impacts compounded through the participation of the reader. The synthesis of digital information sources, combined with reader interaction, engenders a capacity to re-examine traditional channels of information, accompanied by the desire to replace formerly rigid ways of knowing with the ideal of media democratization [Gagnon, 1994:13]. For cartographers, interactive electronic mixed media is a forum for creating communicative map products that propel the map reader into the role of participant in the unfolding of the cartographic form.

This text documents the development of 'Wula Na Lnuwe'katiyek—An Electronic Mixed Media Atlas'; it represents my explorations in digital cartographic forms. The paper begins with a brief look at the theory of cartographic practice and the movements within the discipline. My experience with interactive electronic mixed media is discussed and the concept of Wula Na Lnuwe'katiyek is considered. Next, technical problems and processes are described. The paper continues with a look at the possibilities ahead for cartographic practice within the scope of electronic mixed media and the future of cartographers' creative efforts. The concluding section is devoted

to the impacts my work on 'Wula Na Lnuwe'katiyek—An Electronic Mixed Media Atlas' have had on the way I practise cartography.

2

Defining the Practice

The profession we know as cartography has been defined in many ways. Those written or adopted by the official representative organization, the International Cartographic Association (ICA), have been challenged and changed over the years to reflect advancing technologies and shifting interests. The first definition I learned as an enthusiastic first year cartography student was simple and straightforward: "The art and science of making maps." In 1989 the British Cartographic Society considered this definition: "... the science and technology of analyzing, interpreting and communicating spatial relationships by means of maps [BCS, 1989:1]." In 1991, the ICA adopted this definition: "... the discipline dealing with the conception, production, dissemination and study of maps [WGCD, 1991:17]."

As complete as these definitions seem to be, we can be sure that their evolution will continue. Since all these definitions refer to the map, the parallel challenge is to find a comfortable, inclusive definition for the word (noun or verb?) 'map'. In 1992, the Working Group on Cartographic Definitions proposed this definition of a map: "A representation or abstraction of geographic reality: a tool for presenting geographic information in a way that is visual, digital or tactile [Board, 1992:1]."

While computer algorithms which analyze geographic data may be the concern of some, and the study of maps as cultural texts may occupy others, the nucleus of the cartographic discipline is always the map. The recent challenge

to define what cartography is has undermined previously rigid ideas of what a map is and what cartographic practice is. There have been attempts to give one's memory of the route to the pharmacy the label of 'mental map' [Zimbardo, 1992:398]. There have also been suggestions that bees make maps when they return to the hive and 'dance' the instructions of how to get to a new patch of clover [Dyer, 1983:587]. Even if these kinds of suggestions are not enthusiastically embraced by all practising cartographers, the ideas they represent serve to expand our understanding of what constitutes a map.

Cartographers search for ways and means to design the most communicative map. Cartographic research has led the practice down a number of avenues: some of them more fashion than substance and others less fruitful than hoped. Through these academic musings, practising map makers have remained focused on the ideal of designing the most communicative map possible. Map design is fundamentally the practice of designing, building or constructing a map which communicates the spatial information in the very best way possible. Working within the boundaries of map design principles will help the cartographer craft a map that answers the particular design question, but will not necessarily yield a product that satisfies the cartographer's desire to design the most communicative map possible. While the parameters of any design task are the bounding directional forces, as in every creative/artistic endeavour, the map is subject to the aesthetic tendencies of the designer. Working within the framework of the parameters—audience, budget, tools, deadline and art direction (if the map is to be harmonious with a larger design project)—the cartographer is free to be as expressive as he or she chooses to be. This creative liberty is what attracts me to the profession of cartography.

The plethora of devices that may be used to arrive at the perfect map design are subject to the aesthetic sensibilities of the designer: every cartographer will come to his or her own unique conclusion. This opens up the possibility of multiple solutions that meet the ideal. When this creative idealism is met with new material and technological possibilities, designing the ideal map becomes more achievable. Digital technologies have been embraced by cartography and have played a fundamental role in the way cartographic practice has evolved since the mid 1960's.

Advances of Computers in Cartography

Since 1472, when the first European map was printed in Germany [Peterson, 1995:11], the form of the printed map has changed very little. Some innovations such as using a series of transparent overlays and moulding a map on plastic to a relief model have helped to make the printed map more communicative. However, for the most part, the restrictions of the printed material have constrained the communicative possibilities of the map.

Within the last 30 or so years, advances in computer hardware and software and their availability have fostered the use of these tools in cartography. The early attempts at making maps with computers are rather exciting to examine when one considers that these first attempts mark the beginning of a frenzy of experimentation and exploration of computer aided cartography. Cartographers recognized the potential of computers to turn out maps, but their original approach was to use computers to drive drafting instruments and/or as data storage devices.

In 1967, SYMAP, a computer program written specifically for mapping and designed at the Graduate School of Design, Harvard University, was launched [Carter, 1984:44]. SYMAP was well received. It was the first multi-platform software package devoted to the manipulation of geographic information and data display. The one main

drawback to SYMAP was the crude rendition of maps from the line printer, its output device. SYMAP was the beginning of computer aided thematic mapping and the advances that followed it have solved the problem of output quality as well as creating the opportunity to push cartography ahead in many directions. However, not all of the avenues taken have pushed cartography in positive directions. The inclusion of computer technology in map making has led to particular problems for cartography and frustration for cartographers.

5

Peter Keller articulated the frustration of the cartographic community in the following observation:

More and more, I see published maps that fail to "communicate". All too often do I find images that contain geographical boundaries, points, lines, areas, text, and shading—but there is no message...

Yes you are right—the bulk of these images carry that distinctive look we have learned to associate with brand X of a digital mapping software product; but it does not stop there.

So what is happening? Have we cartographers forgotten those tedious hours of lectures and labs spent on map design, figure-background relationships, composition, flow depth, balance...? Or has the world decided that it does not need cartographers to draw maps [Keller, 1992:11]?

Keller suggested that a look through an issue of The Operational Geographer will provide evidence that perhaps the world has decided that it no longer needs cartographers.

When hardware and software resources become easily accessible, those who decide that map making is well within their domain—even though they may have no more foundation in map design than seeing the weather map during the

television supper hour news—start pretending to be professional cartographers. Others who are unaware of the communicative value of a properly designed map become the clients of these pretenders [Francis, 1992:10].

The first geographic information systems (GIS) were developed in the middle of the 1960's. A GIS "consists of the hardware and software components to manage large volumes of data with a spatial context [Lee, 1988:163]." These computer software programs combine the ability to store digitized geographic information, to analyze the data and to output the result of user driven inquiries. The mid 1980's saw a pronounced drop in the cost of microcomputers. The affordability of personal computers combined with the low cost of some GIS software has attracted the attention of many professionals whose work involves the production of maps. Environmental consulting firms, engineering companies, urban planning operations and others may purchase a GIS turnkey system and begin turning out maps. As map makers, these professionals also contribute to the abundance of poorly designed maps discussed above. However, as map users, they are an example of one of the extremes of map users in a system of user descriptions formulated by Alan MacEachren [MacEachren, 1994:6]. While a GIS is a tool ordinarily requiring a fair amount of training before use, it can still serve as a basis to explain MacEachren's system.

Public versus Private

MacEachren sees a continuum of users. This ranges from the fellow whose work does not involve maps (public) to those whose work centres around map use (private). This is referred to as the public-private axis. The notion here is that the expert user (an urban planner, for example, who is on the private end of the axis) will approach the tools in a more determined way than the novice user (an x-ray technician, let's say, who is situated on the public end of the axis). The expert user would be searching for answers to specific questions and use the tool in a

highly directed way. The urban planner might make a comparison between the congestion of a downtown street between 4:00 pm and 6:30 pm on Monday afternoon, and the same time on Friday afternoon. The novice would want to scan more, to check on a few things of passing interest. The x-ray technician might be curious about the number of hospitals in each county of the province. In this case, the GIS is more suited to the expert user as the expert would be very willing to invest time in learning to use the GIS, and have specific needs that the software could fill. However, the novice would benefit more from a tool that offers more general functions and is more in-

tuitive in its operation.

A clear definition of the target audience is critical when starting the design process. In this regard, the public-private axis falls within this examination of intended map reader. The palette, typography, illustrative materials, accompanying text, etc. all will depend on the target audience. If the product is intended for public library patrons, the cartographer will need an approach that is markedly different than that which might be adopted if the target audience is students in early elementary school grades. The importance of a clear understanding of the target audience cannot be overestimated.

The concept of the public/private axis is centrally important when a cartographer sets out to design a product to be used for visualization. Visualization is not a thing, it is a process in which a reader

1

Diagram illustrating Alan MacEachren's public versus private axis. (Adapted from MacEachren and Taylor, 1994.)

engages. A cartographic product may facilitate that process but is not the visualization itself. For example, if a certain quality of a geographic distribution is obscure and difficult to understand, a map may help to make sense of it. A reader may be aided in visualizing the obscure quality through accompanying explanatory text, a photograph or—what interests me the most—a cleverly designed map. This map would, through whatever devices the designer saw fit to use, draw the user's attention to those aspects of the distribution that might otherwise remain unseen.

Interactive Electronic Mixed Media

In the last 30 years, geographic information systems have been the major innovation in map making. A GIS is software that uses a computer to analyze geographic data and, normally, outputs map compilations to paper. Very recently, however, there has been mounting excitement about a new way for cartographers to create. Interactive electronic mixed media has emerged from the computer design, film, animation, television and visual communications professions. Electronic mixed media is too often called multimedia. My first introduction to multimedia was artistic production. Multimedia is art which explores and exploits many materials and forms of art making. Video, sound, performance, painting, sculpture, text, and digital elements all may be included in the work. This expansive form of artistic mixed media production seems to be denied in the rather flat term, 'multimedia', so often thrown about by vendors of home computer hardware and software. I have chosen the term 'electronic mixed media' to align my work with the broader arena of artistic production that embraces a variety of forms of artistic and personal expression.

Electronic mixed media is a remarkable coming together of ways of working, ways of communicating, which offers almost endless possibilities for cartographers. Interactive electronic mixed media is particularly fertile ground for cartographers to create map products that excite users, pulling them into the process of cartographic communication .

Interactive electronic mixed media is a "highly effective, compound form of expression whose arsenal includes combinations of text, graphics, animation, video and audio. When welded together by the proper creative vision, these parts form an impressive gestalt [Craig, 1993:26]." Electronic mixed media offers artists, designers and cartographers in the visual communications professions a means to create in ways that once could only be considered unrealistic and whimsical. The opportunity to excite, seduce and inform an audience through interactive electronic mixed media is, indeed, very powerful.

The electronic mixed media is, from my own observation and experience, a powerful communication tool which is replete with possibilities. As the Dada movement breached the compartmentalization of artistic expression, opening every avenue to all who created [Freeman, 1989:47], electronic mixed media affords a freedom of exploration to the visual communication arts. Most designers working in electronic mixed media have come from the traditional fields of graphic design, film and television, fine arts, theatre, and audio engineering. They have all embraced electronic mixed media as the engine that drives a new creative vision. As a cartographer immersed in electronic mixed media production, I am engaged in a dialogue with earlier communication forms and styles, even joining conventionally separated traditions: cartography, graphic design, audio engineering, video production, typography and art direction [Koh and Sharp, 1995:3].

Interactive electronic mixed media is also an information management system. With interactive programmes, we have the ability to communicate ideas of a very complex nature through an intuitive and seamless interface. Information is assembled and its complexity elegantly managed so that the user is presented with an information delivery system which is easy to use and has maximum communicative power.

As a new form of communications, interactive electronic mixed media has little vocabulary of its own with which designers can discuss their products. The acronyms of computer science merge with the terminology of film and are accompanied by the grammar of designers and fine artists. We have found ourselves welcome borrowers, dipping into the vocabulary of other fields to build a new language with which to discuss our work. We are also lucky to have the talent of the many disciplines that have come together to work in interactive electronic mixed media.

Why be Limited by Paper?

This is the question I asked when I began to experiment with the computer as a tool with which to make maps. Raster based paint programs and vector based design programs offered a multiplicity of ways to draw interesting maps and helped me move away from the constraints of traditional map production tools (scribing instruments, peel coats), but a paper map was still the end product. I wanted to free my maps from the limitations of paper by using the computer screen as the display device.

Maps, of course, are only one part of the electronic mixed media experience. Text, sound, video, photographs and other imagery fill out the list of media components. When all of these elements are fused together their meanings are "reiterated and metamorphosed beyond their popular meanings into a collective abstraction [Cagnon,

1994:11].” It is into and out of this abstraction of accumulated sounds and images that the reader enters an “expanded field of spectatorial activity [Koh and Sharp, 1995:3].”

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Certainly, an inventively designed printed map would be able to encourage reader participation, but only to a much smaller degree than that offered by the interactive electronic mixed media map. For example, a series of transparent overlays containing mapped thematic data, text, illustrations and photographs might be used in various combinations to produce a number of information interpretations. While this involves printed matter it is considerably removed from traditional cartographic practice. By working with digital tools, my intention was to create a cartographic experience that invites the reader to play, to be entertained, to be challenged, to be informed and to become part of the process of information delivery. Interactive electronic mixed media was my best choice to arrive at a product with so many offerings.

The idea that maps can be energized with motion and responsiveness first occurred to me as a student at the Nova Scotia College of Art and Design. With the opportunity for independent studio explorations, I made a proposal to the Design Division to create an animated map of the Nova Scotia fishery. The map was a two part atlas. The first section showed 20 years of fishing activity through total landed weight of fish in each county. The second section provided a breakdown of each county's catch by species. The histograms showing the total landed weight of each commercially important species grew and shortened as the value changed for each year of the twenty year period. There was a great deal of data to tabulate, but the greatest challenge was designing an optimally usable interface that was inviting and easy to operate. As well, I had to devise a legend that would let the map reader keep track of time as the animation ran through the twenty years of data. The map was a much more demanding project than I had

outlined in my proposal, but the experiment in this new form of cartographic expression and the lessons I learned from it deepened an already keen fascination with interactive electronic mixed media.

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The Interactive Electronic Mixed Media Map

Interactive electronic mixed media and animation in cartography offer an opportunity to communicate which was previously unavailable. The static map is replaced by an exciting, engaging, animated map image that brings an immediate sense of temporal change to the data. The effect of animation on a cartographic image is to deliver the true nature of temporal data. As a phenomenon evolves and shifts over a geographic region through time, the map series showing stages of development of an associated distribution is imbued with life through animation.

Before interactive electronic mixed media, the map reader was a passive participant in the transfer of information from map to reader. Interactivity carries the map user into an active role. Turning page 20 will always reveal page 21 when reading a traditional atlas, but in an interactive electronic mixed media cartographic environment, the click of the mouse button can reveal many, many options to the map user. The pathways of hyperlinked information can place the user in a low flying aircraft making a pass over the Eskasoni Reserve in Cape Breton, Nova Scotia or invite the user to participate in a circle of dancers at a powwow. The user may wish to read about the totem attributed to a certain sociopolitical division of the Mi'kmaq Nation or a smaller scale map of the influence of political alliances within the Wabenaki Confederacy can be called to the computer screen. These are only several of countless possibilities available to the map user through the simple click of the mouse button. All this happens while the person reading the atlas, has ventured on to page 21.

The Research Question

The multiple information sources available in electronic mixed media represent opportunities for a richly communicative, expressive enterprise for map makers. The question that Wula Na Lnuwe'katiyek seeks to answer is: How can screen based maps, photography, illustrations, text, sound, and video, be crafted into a cartographic product that offers an engaging, interactive experience for the map reader while opening up clearer understandings of the history and geography of the Mi'kmaq Nation?

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What are the Goals of Wula Na Lnuwe'katiyek?

There are three clearly identifiable goals of Wula Na Lnuwe'katiyek. First to provide an opportunity in which to address a variety of different yet complimentary media forms within a cartographic context. Particularly, the use of audio and digital video components was explored in order to create an atmosphere and establish a frame of reference for the cultural context of the work.

The second goal was to inform the readership about the geography, history and stories of the Mi'kmaq people. This promotes the reader's understanding of the Mi'kmaq as a nation with a fundamental history that resides in the land, and a present moulded by the events of the past.

The third goal of Wula Na Lnuwe'katiyek was to create a dynamic laboratory setting for the development of an alternative artistic/cartographic strategy... one which offers opportunities for a personal perspective on the practice by embracing a previous definition of cartography as, "The *art* and science of making maps."

Structural Design

Wula Na Lnuwe'katiyek has a structural foundation whose role is to serve as the interface's skeletal form. It is to this skeletal structure that information sources are secured. The basis of this structural foundation are several carefully constructed subroutines of code that describe the action/reaction of user interactivity. These programmed descriptions intend to make allowances for any possible contingent of reader engagement. Once in place, these subroutines may be called repeatedly, or recycled in modified forms to fit ad hoc conditions.

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These subroutines also support established protocol of the appliance metaphor. To this end, the code does the work of creating the audio responses to a reader's selections and affecting the visual change in the appearances of navigation devices.

An important function of this interface is that it offers the reader the ability to journey through the atlas, visiting sections and information sources in no particular fashion except that of *the reader's own choosing*. I call this reader determined movement through the atlas 'non-linear exploration' [Cotton and Oliver, 1993:29]. A number of strategies have been used to foster this approach.

The sections or themes in Wula Na Lnuwe'katiyek are not explicitly named in the interface. I do not want the reader to be encumbered by type in the basic interface structure. Naming the sections or listing titles would encourage a reader to fall back to a linear approach. I want to encourage non-linear exploration. Reducing the basic interface to visual communication alone equips the reader with strong visual signals. The reader will, I hope, select a button because of the visual appeal of its pictograph. The six section buttons operate even while video is playing or several items of information are on the screen; there is no need to close everything down—turn every-

thing 'off'—before choosing another section. A reader may move to a different section at any time. This is an important feature as I want the reader to have the freedom to explore the atlas with minimal restrictions. Such freedom of movement allows the reader to gather information that follows his or her own curiosities from a complex of possibilities.

A brief tutorial is offered in the 'Information' section. This tutorial explains how to navigate through Wula Na Lnuwe'katiyek and how to operate the buttons and navigation devices which are encountered. As removing type from the section buttons serves to promote a non-linear exploration of the atlas, so does relegating the reader tutorial to the information section. The instructions are available to the reader but he or she is not confronted with the information. I want to give no suggestion of how the reader should interact with the work. Reader engagement must be encouraged to unfold naturally.

One particularly difficult aspect of removing suggestions of approach to the reader was met when adding references to the atlas. Tradition numbering for end notes and references proved problematic; these numbers would themselves impose order and linearity on the work. Also, I was hesitant to insert references that might rupture the flow of media to a reader who has given over to the experience of the atlas (suspended disbelief). The solution was not to use any numbering within the atlas and to relegate the media references to the information section of the atlas. This remains consistent with the idea of non-linear exploration and freedom of movement.

Genre and Metaphor

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In interactive electronic mixed media, the designer is building a 'reality' other than that which is familiar to the user. It could be a virtual appliance, an interactive electronic mixed media presentation, an arcade game or a linear animation that the designer has created. Each of these products must supply the viewer with the sensory input necessary to make sense of the action (or lack of action) on the screen and, ultimately, to make using the programme an engaging experience. In addition, the user must come to the programme with a willingness to embrace the interface's metaphor. When faced with a virtual appliance programme, the reader must be willing to suspend disbelief. The interface must be accepted as the controls with which to operate the appliance and not continued to be seen as only a touch screen, mouse or the detached manipulations of a joystick.

Important in helping the user feel comfortable while using an electronic mixed media programme is an interface that is intuitive, logical and complete with all the visual and auditory clues that may be expected in the physical world (if building a virtual appliance prototype). Because almost everything that would be built as an interactive electronic mixed media programme needs controls, these controls must behave in expected ways. What is expected is, of course, relative, but once a control device behaves in a certain fashion and causes a particular action, it must continue to do so.

It is a very common (tried and true) tactic to evoke a certain genre and remain within it throughout the designing of the interface. As a culture, we are comfortable with certain genres because they have been seen so many times before and their form and the way they unfold are familiar to us. Film noire, slapstick and science fantasy are a few genres within cinema. If, during a science fantasy movie, a character were to begin to address the camera in

the fashion of a Shakespearean soliloquy, the viewer would find it a rather curious or even confusing circumstance. The genre would have been violated and the effect, a very noticeable discord in the form.

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In a similar fashion, genre and metaphor are used in human-computer interface design. Establishing a metaphor (also called user illusions) sets up the expectations for the experience of the interface [Kay, 1990:191]. This is the genre—the structure and foundation for the growth and unfolding of the work. Metaphor recognition invokes our memories of familiar interactions we have experienced before; through the use of metaphors, the user is not asked to re-learn the basics of operation. However, there are no rules that restrict the look and action of the interface to the behaviour of dials, knobs, or buttons such as we meet in the physical world. The designer may see it more cogent to construct interface controls that are fully animated, anthropomorphized, or take on a form that is unique to the presentation. No matter what the genre, or what metaphor is employed, the only requirement here is that careful consideration be given to the final operation of the interface: it must be optimally useful.

For an interface navigation device based on an appliance metaphor, a button must have all the characteristics of a real button. For example, the button must depress when clicked, or otherwise indicate its activation. A sound reinforces the action and the requested function of the 'on condition' of the button then takes place. This will be examined more closely later on when we look at the specific navigation devices used in Wula Na Lnuwe'katiyek.

System Architecture

In a creative environment that is bound to computer technologies, the choice of computing system must be given serious consideration. As I needed to rely on a number of commercial service bureaus for digitizing and output

services, it was clear that I needed to use a computer system prevalent in the graphic design industry. This is the Apple Macintosh. The important features of the Macintosh computer are an intuitive graphic user interface, the standardization of basic operation features of software and the compatibility of files from one application to another. The standardization in operational procedures from one application to another translates into an accelerated learning period when a new software package is first encountered. The ease of transferability of files from one package into another minimizes frustration and wasted time when sitting at the computer. The resulting technological agility creates a smoothly flowing working environment which gives time back to a designer fostering creativity rather than the designer having to devote energy to operating the system. Wula Na Lnuwe'katiyek was created with an Apple Macintosh LC 475 computer. The LC 475 has a 69040 microprocessor and runs at 25 MHz. It is paired with a 13 inch colour Apple monitor based on Sony trinitron technology. The computer benefits from Apple's Quicktime 2.0 and has system 7.1 software. Quicktime uses sophisticated data compression/decompression algorithms as a means of showing motion video in a window on the Macintosh screen, with no extra hardware required [Cotton and Oliver, 1993:64].

Software

A number of software packages were used in the production of Wula Na Lnuwe'katiyek. Maps were drawn using Aldus Freehand 3.11. Textured map fills, hill shading and special presentation effects were produced using Adobe Photoshop 2.5. Digital video clips were compiled with Adobe Premiere 3.0. Sounds used in the atlas were sampled and engineered using SoundEdit Pro. Type for maps was designed using Adobe Illustrator 5.5.

single platform. Three-dimensional animations can be imported into Director, and digitized sound tracks added [Cotton and Oliver, 1993:69].

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The Director interface is based on movie production design. An animation produced with Director is called a 'movie'. Those elements which are involved in the action are called 'cast members'. A cast member can be text, graphic, sound, video, a colour palette or code, and specially designated cast members are called 'puppets'. These graphic and text cast members interact with one another on the 'stage'. There is a movie script to be followed which is called the 'score'. The score is sectioned into 'frames' of the movie and channels where each cast member on the stage is placed. Director movies may be joined with each other, with programmes built with other applications and external sources (video disc player, audio CD) by using software such as Macromedia MediaMaker to create elaborate presentations complete with high end dissolves and transitions.

The Work

Target Audience

The first task in a communication design project is to gain a clear understanding of who is the target audience and what are their information needs.

A brief (and informal) survey of the material presented in geography and history classes in local area high schools (Ridgemont High School—Ottawa Board of Education; St. Patrick's High School—Roman Catholic Separate School Board; Lisgar Collegiate Institute) indicates an under-representation of the history and stories of the First Nations of this land as compared to European immigrants. There is a need to provide more balanced instruction in social studies to high school students. A similar perception is held by painter Luke Simon. In Simon's words:

"A national program should be implemented to educate all high school students on the details of the Native struggle for survival, justice and dignity within their own lands [Simon, 1992:184]."

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The importance of presenting First Nations generated histories is articulated by photographer and mixed media artist Marianne Nicolson in her assertion that "the act of remembrance among First Nations people is imperative. In understanding who we are today, we must remember and understand what has happened to us in the past [Nicolson, 1996:18]."

Wula Na Lnuwe'katiyek is intended for mature audiences interested in Mi'kmaq geography and history. This would include senior high school students and university undergraduates, as well as young adults re-entering the education system. The audience may be Mi'kmaq or of non-native heritage.

While this is the readership on which I have decided to focus, I hope the atlas will appeal to a broad scope of potential readers. Also, I hope that Wula Na Lnuwe'katiyek will eventually find a home in M'kmaq Friendship Centres.

Selection of Sections

A number of possible themes for the sections of the atlas were considered. Those that were considered, but not selected, were: the geography of resistance, loss of territory due to European encroachment, and sacred sites. Noel Knockwood, Elder and Spiritual Leader of the Grand Council of the Mi'kmaq Nation provided significant advice in these decisions. While the geography of resistance is very instructive, particularly for a non-native readership, it is the pointedly political (and potentially offensive) nature of the topic which makes its presentation problematic

for the academic context of this project. Issues surrounding the discussion of spiritually important geographic sites is, as well, problematic because "there are some things one cannot appropriate: the sacred." There are consequences. [McMaster, 1995:90]. Loss of territory is a theme that I, regretfully, had to leave out of this version of Wula Na Lnuwe'katiyek. Research, compilation and the design and execution of maps to realize this theme would require far more time and energy than the scope of the thesis would allow. I feel sure it will be represented in future developments of the atlas. The themes that were selected are described below.

The 'Place Names' theme represents a re-appropriation of the land. The re-insertion of Mi'kmaq place names into the landscape asserts the fact that this is a territory of Mi'kmaq occupation ... past and present. These Mi'kmaq names tell the reader: 'Our history, present and our future is here. This is our continuing record of the land.'

Stories of how the land was formed is the theme of the 'Legends' section. This section was selected for reasons similar to 'Place Names'; it offers the reader the chance to know the Mi'kmaq people as part of the land from time immemorial. The Mi'kmaq have developed a sophisticated understanding of the forces which have shaped the land and which bring order to the world which sustains them. Glooscap, the Mi'kmaq culture hero, is central to many legends of how Mi'kma'kik was created. The 'Legends' section relates some of these stories.

The 'Geopolitics' section was chosen for its potential to instruct the reader on issues concerning the structures of political organization. This theme opens up an examination of Mi'kmaq political life in the context of a sovereign nation and as a member of a wider international political association. 'Geopolitics' provides discussions on the family as the basic unit of Mi'kmaq political structure and places this within physical geographic realities.

The 'Trade' section was selected for reasons similar to 'Geopolitics'. This topic allows the reader to understand the Mi'kmaq as an enterprising people who historically exploited opportunities to trade with other nations for goods not produced domestically. In this way, the 'Trade' section describes the Mi'kmaq in an international context.

Mi'kmaq population distributions, discussions of forces which shape these distributions, as well as explanations of pressures contributing to population decline are offered in the 'Population' section. The reason to include this theme in the atlas is to offer alternative readings which counter historic misinformation [Paul, 1993:182]. "I think about the recovery of history, looking at history again, reeducating whoever happens to be exposed to it [Poitras, 1995:87]."

The 'Canoe Routes' section was selected to provide an opportunity to use previously learned animation techniques. Its discussion of rivers and streams as transportation routes also plays well with the 'Population' section of the atlas which underscores waterways as favoured camp sites.

The 'Information' section was included to create a place to give the map reader instructions on the atlas's functions, give an artist's statement and biography, references, acknowledge the contributions of others and to let the reader close the atlas.

Media Choices

Excepting maps and text, the various media that were included in Wula Na Lnuwe'katiyek were selected as a result of their availability and the time constraints of the work. While I would have liked to have used many more

digital video clips in the atlas, those ideas had to be put to the side. Similarly, colour photographs would have been welcome additions to the piece had available resources allowed these pictures to be researched and included.

However, the media examples selected for the project served the purpose of experimentation and study of their effects in the design and use of an interactive electronic mixed media atlas.

Maps

Maps published by Natural Resources Canada (International Map of the World 1:1 000 000; sheets NK/NL-20, NL-19, NM-19, NM-20) served as my base maps for this work. The sheets were too large to be scanned whole using a flat bed color scanner so I had to scan the images in sections: all of Nova Scotia, Prince Edward Island and the south of New Brunswick to Fredericton, and all of the Gaspé and the south of New Brunswick to Fredericton, and finally southern Newfoundland. The scans were saved as PICT files. These files tend to be rather large. Since I need to preserve as much of the detail as possible, the scanner software was set to capture 256 colours; image integrity and clarity was maintained by balancing brightness and contrast. (Even though the scanning hardware and software could be set to capture millions of colours, the LC 475 only displays 256 colours.) The distortions introduced through scanning were removed at the same time the sections were joined together using Adobe Photoshop. The distortions were minimized by spreading their effect over the maps by slicing the images into strips about two inches wide and pasting each strip into a new document. During this exercise, I paid particular attention to maintaining acceptable registration across the whole image while at the same time correcting the distortion. The finished compilation was saved as a new EPS file and the original scan files archived. The size of Photoshop documents can grow very large and, due to RAM restrictions, they can be difficult to work with. To

avoid these problems, the base map was divided into four portions: Nova Scotia and Prince Edward Island, New Brunswick, Newfoundland, and the Gaspé peninsula.

A new Photoshop EPS compilation was then imported into a new Freehand document and served as my template for generalizing and tracing shorelines, watercourses and contours. Freehand is excellent software for map design, primarily because it allows a map to be built in layers (scribe negatives, rubylith and golden rod masks, type compilation copy) as a map produced in conventional materials is. As well, images created with a variety of other graphic software packages were compatible with Freehand.

A feature of the Wula Na Lnuwe'katiyek base maps which is a key to developing a rich surface texture—as well as a vehicle for topographic information delivery—is hill shading. The 100 feet, 200 feet, 300 feet and 500 feet contours were drawn and hypsometric tints were applied to each contour interval (100 feet—20% black; 200 feet—30% black; 300 feet—40% black; and 500 feet—50% black). Water features were drawn in white. This design served as the foundation for hill shading which was developed using Photoshop.

In drawing the map, an important consideration was: How well will the linear complexities of the design hold up when converted from a vector drawing in Freehand to a raster drawing in Photoshop? There is, of course, an expected loss of acuity in moving from vector to raster. This was minimized by working with a line weight and level of generalization to accommodate this translation in form and avoid disappointments such as line break-up and degradation of the image. A ½ point line was the best choice for water courses. The completed base map drawing was saved as a Freehand document.

The next step was to import the base map drawing into Photoshop. Image Grabber is a handy utility that lets an operator select all or a portion of the current screen and save the selection as a PICT file. Image Grabber was used to make a PICT of the base map which was then imported into Photoshop.

In the past, the maps that I have designed for the computer screen tended to be rather sterile. The colours are flat; the line work precise; the contrast sharp; but the overall impression not very appealing. I had a strong impression of the environment that I wanted to create for the reader of Wula Na Lnuwe'katiyek and this environment depended upon maps that were warm, inviting and tactile. I wanted the maps to be presented as both information *and* image. Two products which I admire for the quality of comfort in their maps are Mi'kma'kik [NCNS Micmac Language Program, 1993] and The Gaia Atlas of First People [Burger, 1990]. In both cases the maps are richly textured, approachable, wonderfully executed hand drawn illustrations. These qualities make them lovely to look at. With the same approach, I hoped to create maps for Wula Na Lnuwe'katiyek that invite the reader to linger for awhile and enjoy the image. With this accomplished, the information on my maps is more available to the reader because the reader is likely to pay more attention to it.

Textured fills for the maps are based in the work of a number of Canadian First Nations artists: Columbus Decelebration Series: Past, Present and Future, 1990 by Luke Simon and Sacred "Iniskin" Buffalo Stone, 1992 by Jane Ash Poitras. My intention here was to acknowledge the influence of other visual artists and to invite this influence to make a direct contribution to my work through pastiche based on borrowings from their art. The images, taken from exhibit catalogues, were digitized and imported into Adobe Photoshop where they were modified. For each texture, a section (or sections) of an image was isolated and its structure used as the basal ele-

ment from which to build a conglomerate. The constituent forms that came from this process guided the direction of the work to reveal a fresh synthesis which has its reference in the original work. Variations of colour were produced for each texture which together constitute a palette. This process of selection and isolation is not divorced from a concern for the perceptual logic of each selection's form; rather, it is grounded in the understanding of the original contexts of the borrowings. These textures are, at once, a deferential acknowledgment of the talent of artists whose work I admire, and a technique that bares skeletal visual elements and explores syntax to designate meaning bound to a newly created visual form.

A number of steps were needed to take the base map image to its final form. Experimentation established a formula that would perform consistently to produce images that are similar in style, colour and mood. These were the steps in the development of the base map: [1]The PICT drawing was opened as a new Photoshop document. [2]The document was converted to RGB (red, green, blue) mode and saved. [3]The water areas were selected with the marquee and the selection copied. [4]The selection was released from the marquee and the image blurred. [5]An embossing filter was applied to the image. [6]The copied water areas (still being held in the internal clipboard) were pasted over the embossing leaving only a hill shaded relief map. [7]This image was saved as a PICT file under a new name. [8]The original PICT file and a texture file were opened. Both were in RGB colour mode. [9]Using Photoshop's rubber-stamp tool, the texture image was applied to the land mass. [10]This new textured land mass file was saved under a new name. [11]The next stage was to combine the texture file with the hill shade file for which Photoshop offers a number of possibilities. The blend option was used and set the strength of the texture file to 60%. (This setting lets the hill shading show through the texture just enough to

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Flow chart of the development of the map image.

produce a hint of topographic relief while the texture is quieted and muted by the greys of the hill shade image.)

[12]I have a propensity toward unsaturated hues that are touched with a bit of black. The blue for water fill from my original sketches was characteristic of this palette and had to be reproduced that hue on the computer screen.

Photoshop uses Apple's colour picker which is based on the Munsell colour solid, a well known system of colour organization and selection. It also lets an operator type in cyan, magenta, yellow and black (CMYK) or red, green

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A map from the Legends section of the atlas

and blue (RGB) values to numerically determine the desired hue. Once the colour was found, the RGB values were recorded to be entered again when producing other maps for Wula Na Lnuwe'katiyek. [13]The blue for the water was added to the map using the paint bucket and the land area was deleted. [14]The water area was blurred and this water image was saved under a new file name. [15]The final step in this production was to select the land fill/hill shade image (just the land mass, not the water areas) and paste this into the water image file. [16]This completed map was saved under a new name.

Before any of the files were put away and a new map image begun, each saved file was converted to indexed colour using the system palette. A file saved in indexed colour mode is smaller than a file saved in RGB mode. It also prepares files for importing into other documents that use the system palette as Wula Na Lnuwe'katiyek Director movies do.

5
The basemap
from the
Geopolitics
section of the
atlas.

A map from the 'Place Names' section of the atlas.

7

A map from the 'Geopolitics' section of the atlas.

The sixteen step procedure just described was modified slightly to produce other maps for the atlas. This standardisation helped achieve a degree of sameness that assured that my maps would adhere to the art direction protocol which was determined in my sketches. It is assumed that works made in a series automatically acquire the status of a foregone conclusion because they are essentially the product of decisions taken well in advance of their individual making. I did not want the making of these maps to occur as a perfunctory act. While it was important to maintain seriality in the look of my maps, I did not want them to be uniform and without individuated nuances. The means of production being as mechanical as a computer would only magnify this danger. It became very important that my focus remain on the process of developing the map as image, not on the mechanics of production. This became central to the maps being made. Taking advantage of the tolerances (or limitations) of the software, I was able to imbue the maps with subtleties of difference and character. A consciousness of the work was applied to the images along with colour and texture. This consciousness translates into a painterly quality apparent in the treatment of coastlines, the variations in the execution of the waterways, and the restrained palette.

Adobe Illustrator was used to design the map type. Illustrator allows type to be arranged on curved paths which is very important for designing cartographic typography. I followed cartographic convention and made type for water features blue and type for land features black. I did not feel necessarily bound to this convention but its usefulness served the maps well.

Typography

Designing type for the computer screen that is legible and attractive is difficult. Those type faces which are favourites or felt to have certain applications in print are, in my experience, likely not very applicable when designing for the computer screen. In an ideal design environment, I would choose a sans serif face with a small x-height such as Frutiger or Gill Sans. But for body text to be displayed on a computer screen, these would not be good choices.

Long ago, as the Mi'kmaq people made seasonal journeys across their land, certain places came to have importance. In time, names were attributed to these places. Usually, the name given is descriptive, and related directly to an important use, occurrence or a topographic or geographic characteristic of the place.

A close look at the structure of Mi'kmaq place names will show how these names are constructed and the kinds of information given by a name.

One type face which has been designed specifically for display on the computer screen is Chicago. It is very readable at small sizes and holds up well at larger sizes as well. Chicago, however, is not a very attractive font and so is not the best to use.

Palatino 14 point with 14.5 point leading is the most readable typographic configuration for the purposes of Wula Na Lnu'we'katiyek. Palatino was my best choice to create text that is both attractive and readable. The serifs create fluidity and the clarity of letter forms ensures readability in a raster environment. Inset caps are

Lithos Black 36 point and are decorated with strikes of colour that represent the four direc

tions. Section title type is Lithos Black in various sizes. Political district names are Lithos Bold, water feature and land feature names are Gill Sans Bold. Some type was designed in colours other than black and blue. Here, attention was paid to compatibility and contrast of type with the map image.

Imagery

The background for the type is birch bark my Dad selected for me from my parents' wood pile. It was scanned with a flat bed colour scanner and the digital file modified in Photoshop. Birch bark also has been used for many start and end screens for digital video clips in Wula Na Lnuwe'katiyek. Birch bark is an important material for the Mi'kmaq people. It is the material used for canoes and wigwams, it is fashioned into cooking containers and it is a surface onto which decorative designs are worked with porcupine quills and teeth marks. Using the image of birch bark in Wula Na Lnuwe'katiyek is a link to the more traditional artistic practice of the Mi'kmaq people.

Navigation devices have been carefully designed to be integrated decorative elements in Wula Na Lnuwe'katiyek and to contribute to the experience of a reader's visit. Paging is done with arrowheads and other navigation buttons are drawn to resemble chips of flint.

Through a number of encounters with the work of Mi'kmaq artist Luke Simon (Beaverbrook Art Gallery, 1988; The Museum of Civilization, 1992; The Osgoode Native Art Gallery, 1994) I developed an affinity for his aesthetic. It is from this that I adopted a process of pastiche that resulted in the drawings which were used as section buttons. Pastiche refers to "a work of art created in the style or with the motifs of another artist or even several artists [Diamond, 1992:124]." Rather than being associative in their form, the button drawings were arrived at

Decorative	Screen used in the Eskasoni video clip	Decorations used to enliven drop caps in text displays	Screen used in the St Ann's Feast Grand Entrance video clip

	Basemap texture & topographic relief	'Place Names' map topographic relief & shoreline vignette	'Canoes Routes' map topographic relief & shoreline vignette	Wabenaki Confederacy international boundaries

	Political district boundaries	Surround used for media elements	'Place Names' map topographic relief & shoreline vignette	Decorations used to enliven drop caps in text displays

Hard	Interface button drawn to resemble flint	Interface button drawn to resemble flint	Interface button drawn to resemble flint	Interface button drawn to resemble flint

	Interface button drawn to resemble flint	Interface button drawn to resemble flint	Interface button drawn to resemble flint	Interface button drawn to resemble flint
Rough	Interface button drawn to resemble flint	Interface button drawn to resemble flint	Interface button drawn to resemble flint	Interface button drawn to resemble flint

Crisp	Water texture from the basemap & 'Legends' section maps

Wabenaki Confederacy map shoreline	Wabenaki Confederacy map shoreline	'Trade Routes' map shoreline	'Canoes Routes' map line symbols	'Trade Routes' map line symbols

Population' map point symbol	Population' map point symbol

Political district boundaries	Political district boundaries

9
Summary table of
design characteristics

10

The seven
section
buttons

through a more subjective method. Further to this, Simon explains: "I attempt to arrive at what subjectively feels right, creating imagery that has an affinity to spirit [Simon, 1992:181]." The section buttons are adapted from details from Columbus Decelebration Series: The Cracifixion, 1991 by Luke Simon; and Lithic Spheres, 1991 by Lance Belanger. Several of the button icons were drawn on a base from Simon and Belanger while others are direct borrowings from Simon, modified in Photoshop. What is important about these drawings for the map reader is not the encoded messages that refer to the work of Belanger or Simon. The reader is invited to enjoy the imagery for the sake of its style, not to unpack the messages within.

Art Direction

There are many types of information appearing on the computer screen. Maintaining a cohesive appearance throughout the entire atlas depends on every element conforming to a well thought through design scheme. Art direction is an important aspect of a design project. Once solutions are found for specific design problems, the art director pulls all the elements together, ensuring the continuity and design integrity of the whole design project. Through careful, creative art direction, a consistent style is promoted. It is an intuitive rather than a formulaic process and one which is not easy to articulate, but I will give several examples of the importance of the practice in Wula Na Lnuwe'katiyek.

Wula Na Lnuwe'katiyek's continuity and coherent look are the result of continuous evaluation of every element made for it. The maps used in any one section conform to a specific palette and style which makes them distinctive while also complementing the base map. This is apparent in the maps of the 'Legends' section as well as the maps of 'Canoe Routes'. In the 'Population' section, the inset map of southern Newfoundland is presented on a

mortised panel, similar to the panel containing the section buttons on the left of the screen. Consistency in the use of type for titles and text displays, and the colour of type for titles and for clickable words in text displays also contribute to making Wula Na Lnuwe'katiyek an integrated whole.

Another way I have achieved consistency is by employing a single device for framing the information elements. The smokey quality of the grey field serves not to bound the elements but to provide a space in which they may exist. The indistinct boundary of the grey field suggests a continuation from one element to another while the neutrality and haziness of the grey pulls the elements up above the plane. The gradation in the figure-ground relationship reinforces the idea of continuation and integration between information sources.

Audio

Sounds for Wula Na Lnuwe'katiyek were sampled from a number of sources. Every choice made by the reader is met with an auditory response. These audio clues are distinct for each type of interface navigation device helping to distinguish one from another. The response to clicking on section buttons is a guitar lick from a recording by Don Ross. This sound was sampled using SoundEdit Pro and modified by working with tempo, modulation and echo, and other filters. The paging arrows, text button and other function buttons respond with a recognizable 'click'. (The 'click' sound is consonant with the idea of a button.) The 'Geopolitics' section contains a video of Allen's Creek that is accompanied by an atmospheric sound bite that was created with SoundEdit Pro from a recording by Miles Davis. Sound bites from Ross and Davis were sampled because they are among my favourite recording artists. Selections made from maps as well as hot words on maps and text are signalled by a modified sound sampled from stock sounds offered by Macromedia Director 4.0.3. Other sounds sung in Mi'kmaq by

George Paul are sampled from a recording by The Eagle Call Singers. This music was selected as an extension of my homage to those involved in the preservation and re-invention of the Mi'kmaq culture. These songs were re-worked in SoundEdit to minimize the distortions introduced through the recording hardware, but essentially they have been left unmodified. The final sound was added to the video clip in Adobe Premiere. The end sequence features my Mother's voice offering the reader a final thought as the atlas closes.

Video

Digital video easily lends itself to cartographic communication. Motion video can be used cartographically by selecting clips that offer a look at the topography of the land (in the case of a fly over) or that continue the discussion of an event at a specific location. Video must be edited to focus attention on important elements alluded to in the map or to offer an alternative perspective on the information. In this regard, video is applied in a digital cartographic environment in much the same way that still photography is used in a printed atlas.

Four digital video segments can be found in Wula Na Lnuwe'katiyek. Sources of digital video were limited but those clips that were selected demonstrate how this medium may be used in an interactive cartographic experience. Digital video is surprisingly memory intensive. Even the shortest video clip included in Wula Na Lnuwe'katiyek (the aerial view of the community of Eskasoni and running only 30 seconds) is 3.9 Mbytes. The longest clip (the scenes of the Grand Entrance at the Feast of St. Ann which includes sound) is 15.9 Mbytes.

The video included in Wula Na Lnuwe'katiyek were digitized from the analog cassette tapes at a service bureau. All but one of the four digital video clips in Wula Na Lnuwe'katiyek are borrowed from The National Film Board of Canada. The exception is the video of Allen's Creek which I shot with the cooperation of my Father.

Adobe Premiere was used to compile and edit the raw digital video footage. All video clips included in Wula Na Lnuwe'katiyek are set to run at 30 frames per second and are formatted to 160 pixels x 120 pixels. This is the largest standard format for digital video which can be played on all colour Macintosh computers. The next largest format is 240 x 180. (This and larger formats are preset in Premiere.)

Videos created at larger formats can be played on the Mac LC 475 but I want this work—and the video files which contribute to the experience—to be available to readers using CPU's of lesser speeds. This way, Wula Na Lnuwe'katiyek has a larger potential readership.

Most digital video clips are fronted and finished with a decorative screen. Screens featuring stars are used in the video of the reserve community of Eskasoni and screens decorated with curves are used in the video of the

Feast of St. Ann. A picture of a sturgeon is featured in the video of Allen's Creek. All these screens were drawn in Photoshop and added to the videos in Premiere. Pictures of five pointed stars were often etched into rock drawings to relate a message about heaven or to enliven the picture. The double curve is a traditional decorative motif, and is used today in more traditional Mi'kmaq art.

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Screen from the video of Eskasoni from the Geopolitics section of the atlas.

Interactivity

Macromedia Director allows interactivity to be built using a special scripting language called Lingo. Lingo not only provides possibilities for creating interactivity, it ensures precise control over sound and video and the look of any element on the stage. Because Lingo is a programming language, it takes some knowledge of computer programming to use it well. However, Lingo works according to a straightforward set of syntax rules which makes the user's manual easy to understand.

It is very important that a reader learn how to operate a navigation device and be confident that every time the same device is encountered it will behave as expected. This reliability helps a reader suspend disbelief and enter into the experience of Wula Na Lnuwe'katiyek. Should a navigation device behave in an unexpected way, a reader's confidence in the atlas and his or her ability to navigate through the atlas would be impaired. The operation of Wula Na Lnuwe'katiyek's navigation buttons have been very carefully examined and their behaviour designed so as to enhance a reader's visit to Wula Na Lnuwe'katiyek. Every button has an 'on condition'. The 'on condition' may differ from one button to another with different graphic devices used as signals and different sounds used to provide auditory feedback telling the reader a click was on target. These differences are important clues to help the reader learn how each of the different buttons and navigation devices may be used to explore Wula Na Lnuwe'katiyek.

I have embedded interactivity in the maps, text and navigation buttons. With only three exceptions, larger scale theme maps are reached through selecting the outlined areas on the base map. One exception is the 'Trade' section where a smaller scale map is given at the start of the section. Another occurs in the 'Geopolitics' section

where a smaller scale map is available through the text. The final exception is in the 'Population' section where the outlined areas of population concentration are not hyperlinked elements. These exceptions were made only because the information to be offered to the reader depended on a wider geographic perspective or, in the case of the 'Population section exception, the map symbol did not represent an avenue to another information source.

The atlas has been constructed to offer the responsibility of choice to the reader. The reader is challenged to explore the atlas in an individually determined way. Wula Na Lnuwe'katiyek breaks down any formerly established narrative and invites the reader to construct a new, self-directed narrative. If a reader interprets my work in a way that is totally new to me, I am pleased. If this is achieved I know it has a life of its own: I have created a situation for the reader to do with the atlas what he or she will. I have not created an encapsulated moment [Keedy, 1990:12]. The aim of electronic mixed media production is to promote multiple rather than fixed readings and to provoke the reader into becoming an active participant in the construction of the message. My explorations within electronic mixed media, particularly in creating Wula Na Lnuwe'katiyek, are oriented toward action—explicitly and/or more directly—in expanding the roles and responsibilities of reader and map.

There is no voice of authority in Wula Na Lnuwe'katiyek; however, there are alternative views taken from Mi'kmaq history. By offering a focus for consideration of source material outside of his or her own cultural experience, Wula Na Lnuwe'katiyek heightens the reader's awareness of these other ways of knowing. This perspective challenges rather than serves as a model for existing thought.

The particular interests of the reader, a curiosity existing at the moment the visit takes place, previous visits to Wula Na Lnuwe'katiyek, or any number of other variables will potentially influence the depth and scope of a reader's engagement with the piece.

The openness of Wula Na Lnuwe'katiyek's encouragement to explore and make inquiries is, in part, a result of interactivity. With fully realized interactivity, the boundary between information and the means of information retrieval becomes more and more plastic. Eventually, the two spheres begin to commingle and the interface construction begins to more fully engage the medium. The result is an interface that provides an enriched experience which calls on the reader to ask more of the programme, and so gain more from it.

I can visualize two extreme scenarios of reader engagement. In one case, the reader will be very reserved or timid and there will be no willingness to suspend disbelief and begin to satisfy curiosities or ask questions of himself or herself. In this scenario, the atlas will not be coaxed into giving more to the reader than the static base map image first appearing on the computer screen. The other possibility of reader engagement would be complete exhaustion of the material. A reader could (as I have had to do when testing the interface's functional integrity) explore every corner of the atlas, calling up every item of material and travelling every avenue and still, perhaps, wishing for more. An enthusiastic level of reader engagement with the work is what I hope would happen with Wula Na Lnuwe katiyek. However, the success of the work does not depend upon the amount of user inquiry it sets into play. Rather, it is the ownership of responsibility of choice... if anything... that might measure the success of the work. Once that ownership is accepted, Wula Na Lnuwe'katiyek meets the reader's responsibility with its offering of interpretive possibilities.

Storage media

Originally, I had planned to master a CD-ROM from this project. CD-ROM technology is very popular and many home computers marketed today feature CD drives. An alternative to a computer with a CD drive is CD-I. CD-I (Compact Disk Interactive) is a hardware/software package which plays CD-ROM's independent of a computer. I find this technology very appealing. The equipment resembles a VCR and is connected to a television which serves as the display device. A hand held remote control unit contains the controls needed to run the CD-ROM. Perhaps the most appealing aspect of CD-I is that it is familiar and non-threatening to VCR users and operates on a worldwide standard. It also doubles as an audio CD player when connected to audio stereo equipment.

CD-ROM and CD-I technologies are inviting, but several factors lead me to decide against cutting a CD-ROM in favour of using 3.5" floppy disks. A CD is not editable once information is written to it. Beyond the scope of this thesis, Wula Na Lnuwe'katiyek is an evolving work which I will continue to develop. I have decided that a CD-ROM will not be cut until this version of the work reaches its final form.

Cost is another factor which convinced me that storage for this project should be 1.44 Mbyte, 3.5" floppy disks. Floppy disks are much less expensive than compact disks. The total size of the atlas is 44.1 Mbytes, but when all the files are compressed, they require only 20 Mbytes of storage space. They can be made to fit on fifteen 3.5" disks. Commercial software is often distributed on as many as fourteen 3.5" disks (Aldus PageMaker 5.0). In comparison, fifteen disks does not seem to be an unreasonable number on which to store and distribute Wula Na Lnuwe'katiyek. The original files will, of course, remain on my computer system's hard drive with multiple backups for protection.

Within the question of digital storage, there is also the issue of equipment compatibility to consider. The computer system used to create this work does not have a CD-ROM drive and it can be assumed that not all computers are so equipped. There are other forms of storage media such as removable hard drive cartridges and re-writable digital tape for which the hardware needed to access the media are less common than CD-ROM drives. However, it is guaranteed that every desktop computer will be equipped with a 3.5" floppy drive.

Cartography and Interactive Electronic Mixed Media

Cartographers have not been shy to embrace new tools for map production and creative enhancement. The media fusion represented by interactive electronic mixed media represents all the vehicles of expression cartographers could ask for, outside of engaging a reader's sense of smell and touch. Beginning with the map as the basic unit of information currency, any number of media sources can be used to round out the message, assume responsibilities for data delivery or provide the reader with an alternative reading. Some cartographers are examining sound as a primary information carrier [Krygier, 1994:149]. For example, audio delivers information about topography when pitch is modulated: an increase in pitch would signal going up a hill, while a drop in pitch would signify going down a hill. This is one example, but it is clear that the possibilities for this type of audio application are many.

Other cartographers are working on 'digital video tours' of landscapes. Rather like using a telescope or binoculars to see into the distance, a digital video tour of a landscape would let a user choose a view, and then zoom in on it or 'fly over' to a target point in the distance. The images used in an electronic mixed media project of this type are actual videos of the terrain presented on the computer screen. When paired with audio, these digital video tours are a particularly powerful representation of the land.

Carrying the idea of a digital video tour a bit further leads to the concept of creating a 'virtual geography'. This might be realized through position sensing and stereoscopic viewing technologies integrated within virtual reality systems.

In electronic mixed media, the computer screen is the delivery device. Working with colours for print is markedly different from working with colours for display on the computer screen. Some researchers are examining the use of colour in map design [Brewer, 1994:123]. This may help to maximize the way maps designed for the computer screen take advantage of the colour delivery capacity of CRT's.

Animation offers a number of ways to enrich the cartographic communication environment. Through map animation, temporal geographic data can be displayed as it shifts and varies over a land area. With map update animations, updating the computer screen occurs in the sequences of the map classes. The effect is a rebuilding of a choropleth map in a logical progression of values: those polygons "belonging to the highest category would be displayed first, followed by the next highest category and so on [Peterson, 1995:193]." The concept of map animation has been a part of cartography for many years but only recently have cartographers had the tools to create animation products that begin to match our imaginations.

The physical forms of electronic mixed media and of television are similar—both are presented via a cathode ray tube. It is here where the expectations of the electronic mixed media audience apparently finds common ground with the expectations of the television audience. The form and familiarity of the television and the approach we

take to it are important considerations in electronic mixed media. The work in which cartographers are now engaged—designing interactive electronic mixed media programmes—can benefit from acknowledging these similarities.

In electronic mixed media cartography, there are more technical aspects to be examined (working with colour display on the CRT) as well more sociological and philosophical concerns (parallels between television and electronic mixed media) to be considered. These are but a few elements of cartography which need to be examined in this new arena of interactive electronic mixed media production.

Conclusions

Wula Na Lnuwe'katiyek—An Electronic Mixed Media Atlas is a laboratory of cartographic communication forms as well as the documentation of a journey of learning, exploration and personal expression. Through the realization of this work, I have arrived at a number of determinations.

Electronic mixed media is, indeed, an exceptionally rich environment in which to create. As a cartographer, I am equipped with an exciting array of communication forms with which to craft a complex of possibilities for the map reader. Like most designers, I have a large visual data bank that I draw upon for inspiration. I can look toward a number of forms of communication. The skills gained from working in these other ways of communicating (or, indeed, being an aware audience of these information sources) can be applied to electronic mixed media. For example, the grid as a formalizing structure in page layout can be used to bring order to the arrangement of elements on the computer screen. Understanding, good taste and experience are needed to design

good typography whether for print or the computer screen. As well, the principles of map design need to be remembered and intelligently applied to cartographic images in an electronic mixed media programme.

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Cartographers working in electronic mixed media must not underestimate the basic needs of the map reader. If the audience is accepted as intelligent, discriminating and demanding, the cartographic products we design will be engaging and compelling. It is understandable that not every viewer is willing to challenge himself or herself (or the programme). The question is one of desire but, also, it is one of options. Indeed, our past experiences create the map readers we are. We may be equipped with a background knowledge of the subject matter of the project being read and therefore we are able to gain more from the product than another reader whose first introduction to the material is the project itself. While we must always remain aware of the needs and experience (or expertise) of our target audience, our intentions as cartographers should be to design products that assume the reader arrives with a willingness to engage with the interface and also possesses a sense of curiosity about the information.

It is true that there are rules to be followed. However, it is enriching and liberating to work instinctually by corrupting (even disregarding) what previously had been learned as *the* correct way of approaching a cartographic communication problem. I believe that Wula Na Lnuwe'katiyek has benefited immeasurably from a recently discovered courage to accept risks—both artistic and academic—even before the original sketches were finished, and particularly after the design was 'finalized'. This marks 'Wula Na Lnuwe'katiyek—An Electronic Mixed Media Atlas' as an experimental work.

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