Content Analysis, Semiotics, and Social Semiotics for Cartographic Analysis: Interpreting Geospatial Representations

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Several mutually informing methods for analyzing cartographic and geospatial images are presented and illustrated in this work. First, an apparently objective method, content analysis, is applied to a collection of corporate annual reports' geospatial imagery resulting in a categorization and description of those images. Then a traditional semiotic analysis is conducted on the same data done by experts who describe and express out of their personal expertise and intuitive insights the meaning of signs contained in the imagery. Subsequently, a user/viewer epistemological and ontological framework called sense-making is discussed and combined with semiotic processes enabling social semiotics. Sense-making permits map users to present their point of view providing a method to go beyond the experts' traditional semiotic interpretations. These user/viewer based interpretations incorporate postmodern meanings from the various users of signs exposed by the corporate annual reports' geospatial imagery.

Keywords: Content Analysis, Semiotics, Sense-making, Social Semiotics, Corporate Annual Reports, Geospatial Imagery

INTRODUCTION

Research in the use of maps and cartography in general has traditionally been reductionist in at least two ways. First, the methods applied to study map use have been reductionist because they have been rather limited, most such research has employed testable, statistical hypotheses that study extremely detailed issues in artificial settings. This form of research accounts for narrow aspects of map use and has been useful in understanding, for example, use of icon size, color, and legends (e.g., Mersey, 1990). Most frequently such cartographic use research has been driven by a psychological perspective which views humans as information processing machines. Time and error data are collected from subjects on limited tasks from which their internal processes are inferred. For example, speed and accuracy in the use of legends has been analyzed (e.g., Slocum, Robeson & Egbert, 1990). The hope endures that putting all the little pieces together (e.g., icon size, color) will ultimately lead to better maps. However, such research does not explain much variation in user behavior in natural settings.

Map use research has also been reductionist because it has usually studied maps in isolation from other materials real people use to resolve their information needs such as pictures, the actual landscape, other people, written material, etc. Of course, there are circumstances in which the map may be the only resource apparently used (wayfinding, orienteering, etc.). However, most map use is done in conjunction with goals for which the map serves as only one information source for the overall goal confronting

the user. For example, even in wayfinding, we often need to know what the destination actually looks like to match the address with the building to arrive at the appropriate destination; the map is rarely enough by itself.

To go beyond the traditional narrow and limited approaches to cartographic research, three methods of cartographic and geospatial imagery analysis are discussed in this paper. First, content analysis is shown to be an effective and efficient method for generating descriptions of imagery. Unfortunately, content analysis lacks the interpretive processes of semiotics, sometimes called the science of signs. Next a traditional semiotic analysis is presented that demonstrates the ability of semiotics to yield significant and meaningful denotations and connotations for cartographic and geospatial imagery. Unfortunately, traditional semiotic analysis privileges expert interpretations precluding the incorporation of real map users' views. Consequently, a third approach, social semiotics, is presented in this work. Social semiotics combines traditional semiotics with a sense-making framework privileging both the casual user and the expert in describing the meanings of geospatial imagery. Sense-making views humans as complex and values the human condition providing social semiotic analysis a rich ontological and epistemological approach to cartographic research. Why struggle to perform three related but distinct analyses for geospatial imagery? Each of these approaches to the analysis of geospatial and specifically cartographic imagery (content analysis, semiotics, and social semiotics) inform and make manifest various differing views of the imagery under study. Therefore, conducting content analytic, semiotic as well as social semiotic analyses provide a valuable integrated and more holistic analysis of the phenomena of geospatial imagery in corporate annual reports.

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There is a lack of mutual understanding between experts and casual users of geographic information in general. Explicating the role of experts is necessary before exploring these various approaches to image analysis presented below. The pervasiveness, routinization, and invisibility (to most people) of formal geographic knowledge and the lack of most academic scholars' understanding of the informal geographic expertise of the public (Egenhofer and Mark, 1995) provides one major motivation for this project. For example: How many people in the general population are aware of the spatial components of the commodification and exploitation of workers and the environment in the production, social production, and distribution of coffee, soft drinks, candy bars, stereo components, or computer chips? Correspondingly, how many scholarly experts are aware of the range of economic as well as non-economic reasons behind the choice of commuting routes of most people or the legitimate emotional criteria in the purchase of residential real estate?

"There is a lack of mutual understanding between experts and casual users of geographic information in general."

Permission to reproduce images from corporate annual reports was difficult to obtain and / or reproduction quality was inferior in black and white for this project. Consequently, only a limited number samples from corporate annual reports are displayed. The author can provide to individuals facsimile copies of the originals for research purposes or the individual corporations' media relations offices may be contacted to obtain the actual reports.

The remainder of this paper is divided into three sections. The first provides a background on content analysis and semiotics, the second is a discussion of an experiment underway that applies these two methods to the geospatial imagery found in corporate annual reports, the third provides background on sense-making and suggests how sense-making may be combined with semiotics to yield social semiotics. The third section also briefly describes tentative results of employing social semiotics to the same corporate annual report imagery.

BACKGROUND

Content Analysis

Content analysis is a process of forming a collection of categories called a "scheme" and for developing rules for placing the items under study in one and only one of the categories of the scheme. Weber's (1985) description provides the most common approach to the process of creating a content analysis scheme:

1) Determine the recording unit of the scheme used for all categories. A typical recording unit might be a word, phrase, sentence of open-ended text, map or other graphic item.
2) Develop categories that are mutually exclusive (distinct) and exhaustive (provide full coverage). The scheme may be developed inductively directly from the raw data or deductively from concepts or previous work.
3) Test for clarity of category definitions using different subsets of the data and different people as coders who make assignments of the items to categories. The scheme is then revised to eliminate ambiguities.
4) Test new data subsets until coder agreement reaches a predetermined threshold.
5) Code all the collected data so that each datum is in only one appropriate category.
6) Summarize the data for reporting, often collapsing categories for rhetorical clarity.

"Content analysts do not claim that a given categorization is the only one possible."

Content analysts do not claim that a given categorization is the only one possible. An additional approach to content analysis may be seen in Ericsson & Simon (1993). They develop a process to organize the verbalizations collected while users are executing various tasks with computer software. Simon and Ericcson extract from the verbal expressions links between computer tasks executed by users and users' short term memory use, in contrast to Weber's broad textual categories.

"The content analytic process depends upon an essentialist structure requiring a mutually exclusive and exhaustive categorization scheme."

Examples of content analysis in cartography are found in Gilmartin (1992) in which she uses content analysis to describe twenty five years of cartographic research, in Monmonier and Gluck (1994) which uses content analytic techniques to report focus group discussions of an animated cartographic software product, and in Gluck, Danley & Lahmon (1995) that describes librarians' views of recent geospatial information needs of their patrons.

The content analytic process depends upon an essentialist structure requiring a mutually exclusive and exhaustive categorization scheme. Content analysis ignores the view that items may *partially* belong to several categories simultaneously except through a tolerance for less than 100% agreement in the placement of items in the categories by coders. The dichotomy of an item either being in or out of a conceptual category (and in only one) is highly suspect. A post-Enlightenment view of categorization precludes the inherent essentialism of a place for everything and everything in its place (Mervis & Rosch, 1981; Lakoff, 1987). Such essentialism limits the overall usefulness of content analysis but does not preclude using content analysis as an entry point to a broad description of imagery content that additional methods can extend and refine.

"... essentialism limits the overall usefulness of content analysis but does not preclude using content analysis as an entry point to a broad description ..."

In practice ranging from sociology to communication to psychology, a category scheme is developed using 25-30% of the data. The scheme is tested for ability of coders to assign items consistently to categories (intercoder reliability). If there is low agreement, the rules for assignment to the categories are reworked until 90% agreement among coders is achieved. Retests of reliability are done on different subsets of the data and with

different coders. The number of categories is frequently taken into account to eliminate the random placement from contributing to the agreement. For example, with two categories 50% agreement is no more than chance or random agreement. Therefore, modified formulas for measuring reliability have been development that eliminate mere chance agreement.

Kerlinger (1986) describes the use of content analysis as both an analytic and observational tool. Content analysis provided both these functions for exploring the geographic images including maps in a sample of *Fortune* 100 and Global 1000 corporate annual reports. Content analysis permitted identification of categories and geographic images and maps as well as an analysis of the selection and distribution of these geographic images within the reports. Kerlinger attempts to make the process of content analysis seem value free and objective, a view not taken in this work. The categories pursued for analysis in this work are merely one set of categories among many that could have been chosen. Tests of the reliability of coders were conducted to avoid claims regarding the idiosyncratic or solipsistic nature of the categories as well as for the rules governing the placement of a particular datum in a category. An item could be added to the catch-all category of "other" when coders could not consistently place the item in a major category of the scheme. This process generated mutually exclusive categories with high reliability avoiding an idiosyncratic scheme but with concessions to the multiplicity of possible schemes and the minimization of reductionism through the use of the "other" category.

". . . content analysis . . . is adapted for use in this project to permit multiple voices to be heard and to minimize reductionism."

Traditional content analysis also seeks claims for validity of schemes through cross validation by repeated use of the scheme in other datasets and domains. This work only makes validity claims for construct and face validity of the schemes themselves (Cook and Campbell 1979). Thus, content analysis, derived from goals of rationality, essentialism, and epistemological completeness is adapted for use in this project to permit multiple voices to be heard and to minimize reductionism.

Semiotics

"Semiotics is the "science" of signs . . . "

Semiotics is the "science" of signs and seeks to understand signs by exploring triangular relationships among an object or concept, its representation, and its meaning (MacEachren, 1995). The terminology of semiotics can be confusing because different disciplines with differing jargon have approached the study of signs and their meaning. In addition, many terms have common usage which predates the scientific use of the term developed within semiotics. For example, the term "sign" has a narrow meaning in semiotics. The term "sign" in this work refers to the overall relationship among the entity encompassing an expression, the concept it stands for, and the in-the-world object or concept represented (if one exists). A sign is not used here as a symbol in the everyday sense nor does it represent marks carrying meaning. Rather, the "sign-vehicle" will be the term used to refer to the carrier of meaning. Thus, the common usage of a sign (for example, a stop sign) is a sign-vehicle; it is the expression of the sign. "Interpretant" refers to the meaning(s) the sign-vehicle elicits: the halting of a car at an intersection, for example. "Referent" refers to the actual, real-world object that relates to the sign vehicle: the cessation of the car that actually occurs at the intersection (cf. MacEachren 1995). A cartographic example: a stylized tree or tent is used to represent a campground with the sign-vehicle the tent or tree image, interpretant being a campground, and the referent being the actual campsites on the land.

"The term "sign" in this work refers to the overall relationship among the entity encompassing an expression, the concept it stands for, and the in-the-world object or concept represented . . ."

The formal study of signs developed along two different approaches. In 1916, Saussure, a linguist, described a dyadic relationship between the

sign-vehicle and the interpretant initiating one approach to the study of signs called semiology (Innis 1985). Saussure was a linguist and viewed semiotics as a grammar of arbitrary signs. (Saussure actually used the terms "signifier" for the sign-vehicle and "signified" for the interpretant.) Saussure focused on the relationship of sign-vehicles to their concepts, explicitly omitting the real world referents. He felt that any collection of associations of sign-vehicle with referent and interpretant or system of signs was totally arbitrary (Saussure 1966). For example, the word formed by the letters "t-r-e-e" is an arbitrary representation for the concept or the real world object of tree. Saussure believed that meanings form a network of relations and that semiotics need only concern itself with the differences between the meanings, not the identification of an object's meaning: a structuralist's point of view.

"Saussure believed that meanings form a network of relations and that semiotics need only concern itself with the differences between the meanings . . ."

In contrast, Peirce (1931, 1955), a philosopher and logician, considered the referent (the real or referred to object) of immense concern to the study of signs. Semiotics became the label attached to Peirce's approach to the analysis of signs. Peirce described a triad relationship among sign-vehicle, interpretant, and referent (Hervey 1982; MacEachren 1995). Peirce's triad relationship has permeated North American literature on the study of signs, with various authors emphasizing different components. Peirce stressed the sign-vehicle as the mediator between the referent (object) and interpretant (meaning) while Ogden and Richards, for example, stressed the role of interpretant as mediator between sign-vehicle and referent (cited in MacEachren 1995: 221).

"Peirce's triad relationship has permeated North American literature on the study of signs . . ."

Semioticians then developed typologies of signs based upon either the dyad or triad models. Peirce developed a three-term typology for the relationship between referent and sign-vehicle (from the point of view of the interpretant): icon, index, and symbol. These categories are not mutually exclusive nor exhaustive of the relationships. Further, a sign can serve as sign-vehicle itself generating myth as a secondary sign. Also, signs are associated with both literal and cultural messages with the literal image denoted and the cultural image connoted (Barthes 1968). Sless (1986) has summarized semiotics as the search for understanding and categorization of "stand for" relationships.

"Further, a sign can serve as sign-vehicle itself generating myth as a secondary sign."

The epistemological assumptions of the various approaches to semiotics have moved from privileged expert with essentialist views to postmodern and intersubjectively informed ones. Pierce, Saussure, and recent writers in cartography including Schlichtmann (1995) and Head (1984) have sought grammars that unambiguously tie the sign-vehicle to its interpretant and/or referent object at least for a particular time, place and culture. Geographers such Brian Harley (1989) and Denis Wood (1992) have expressed the need to deconstruct maps. Others such, as Barthes (1968), are more committed to the inherent ambiguity and total social construction of all signs and their components. Baudrillard (1968, 1993) and Derrida (1982) analyzed current culture and claim the supremacy of appearance in symbols over substance. They would claim that the sign vehicle and interpretant constitute "hyper-reality" and that referents (reality) are insignificant. They would further claim that there are only lost referents or free-floating signifiers, all meaning is arbitrary, and no sign is unproblematically associated with the real entity that may have initially spawned it. Signs are only connotative, denoting nothing in and of themselves; thus, these authors claim all signs are re-appropriated for purposes of power and control.

"Baudrillard and Derrida analyzed current culture and claim the supremacy of appearance in symbols over substance."

". . . these authors claim all signs are reappropriated for purposes of power and control."

Simultaneously, these experts privilege their own expertise in analysis. They defend their connotative inferences as equal to any. However, one gets the impression that these experts' views, as insightful as they may be, are more equal than others' views. Such an impression understates the subjec-

tive nature of interpretation. Others such as Gottdiener (1995; Sless 1986), seeking a socially-informed, postmodern understanding of semiotics, suggest the need for discussion with members of a group to inform current meanings of signs and their effect on the user community. Unfortunately, this latter group does not indicate a meaningful method for acquiring these intersubjective views. Such varied and conflicting epistemologies often co-exist within adherents to different postulates who can not quite free themselves from earlier settings (Barnes 1996 explores this issue in broader context for economic geography). Unfortunately, the postmodern views of semiotics fail to provide a practical and validated approach and method to understanding users' views of signs and myths. Sense-making (Dervin 1992), discussed at length in section four of this paper, poses an epistemological basis in concert with the postmodern semioticians but also provides a well-tested method for obtaining users' views. Sense-making posits an epistemology and ontology which privileges all users, not just experts, and concludes that the driving cognitive need of all humans is to make sense of the world they make and are, in turn, made by. Such a combination of expert and user views may permit a richer and more human understanding of representation to emerge.

". . . varied and conflicting epistemologies often coexist within adherents to different postulates who can not quite free themselves from earlier settings."

THE CURRENT PROJECT

Preparatory to the discussion of sense-making and social semiotics, the results of a case study applying content analysis and semiotic analysis to the cartographic and geospatial imagery of major corporate annual reports (ARs) is reported. The ARs of the *Fortune* 100 and Global 1000 provide a window on the rhetoric of the world's largest corporations. Such rhetoric is manifest in the ARs text, images, and statutory financial information (e.g., Miles 1988; Galant 1994). AR content reveals much about a company's espoused philosophy, mission, goals, objectives, behavior, and performance. They have also proven to be useful for almost 75% of shareholders asked, though not as useful as the daily newspaper (Epstein and Pava 1993). ARs' geographic content in image and text are components of the rhetoric surrounding financial and accounting information, yet the geographic content of ARs has not been critically examined (Hopwood 1996). The extensive audience for ARs includes current and potential individual and institutional investors, potential customers, professional analysts and stock brokers, interested members of the public, bankers, community leaders, financial reporters, unions, suppliers, consumer groups, and merger and acquisition candidates (e.g., Hill and Knowlton 1984). Thus, ARs provided a rich resource to compare user and expert views and with which to compare and contrast the methods of content analysis, semiotics, and social semiotics applied to cartographic and geospatial imagery.

"AR content reveals much about a company's espoused philosophy, mission, goals, objectives, behavior, and performance."

This study explored the imagery of the 1994 ARs for the 100 largest U.S. corporations as ranked by *Fortune* magazine, and 53 additional companies to complete the top 100 of *Business Week's* Global 1000. *Fortune* magazine revamped their rankings in 1995 merging the largest US service and US manufacturing categories into one category of largest US industrial corporations. *Fortune* ranks the companies only by sales but displays corporate profits, assets, stockholder equity, and the percentage changes of these parameters from the previous year. The Global 1000 as determined by *Business Week* ranks worldwide corporations by market value based on the number of outstanding shares multiplied by the price per share using several classes of stock. During 1993-1994 several companies merged, spun off independent companies, or changed their names, complicating the number of companies for analysis. This led to a sample of 153 ARs for analysis.

"ARs provided a rich resource to compare user and expert views . . ."

". . . content analysis forms a structure of sequential and related components of geographic images in ARs."

The current analysis approaches the interpretation of geographic signs including maps in corporate annual reports images as a three-fold process. First, content analysis is used to collect, categorize, and describe the structure of ARs' geographic content in images from all of the Fortune 100 and a sample of the Global 1000 corporate ARs. This content analysis forms a structure of sequential and related components of geographic images in ARs. This is only one expert and privileged narrative description of AR images. Second, a semiotic analysis initially explores a description of the denotative nature of the images displaying the range of manifest issues and concepts depicted in the geographic images of ARs. The semiotic analysis builds upon the denotative analysis generating a connotative representation by studying binary oppositions of the possible meanings represented in the geographic images. The connotative phase of the semiotic analysis seeks among several oppositions at least one that has some claim to express what the AR is " about." This semiotic "aboutness" addresses the connotative aspects of the ARs signs and derives from the uses, values or cultural associations of the signs as understood by experts (who are in this case faculty and graduate students with background in semiotics and semiotic analysis).

Third, recent purchasers of the stock or products of these companies will be interviewed to collect sense-making views of the images in the ARs; this last approach privileges all users' views of the maps and images (expert or casual users) providing the social semiosis. As mentioned earlier maps rarely stand alone as an information resource in natural settings. The social semiotic approach treats them in more isolation in the early stages of analysis but joins maps with other geospatial imagery at the later stages of analysis.

"The geographic domain can not and should not ignore tying the referent to sign-vehicle and interpretent."

The geographic domain can not and should not ignore tying the referent to sign-vehicle and interpretant. Therefore, in this work the content analytic and semiotic approaches used are Peircian in spirit. Although there may well be lost and free-floating signifiers (e.g., Baudrillard 1968, 1993; Barthes 1968) the attempt at recovering them should be made. Such attempts may provide interdiction to the hegemony of the dominant paradigm (Gottdiener 1995). Similarly, a strong sense of realism is present in this work. Geography is certainly real at the level of trees and cities and ravines, no matter what these objects are called or how their attributes are grouped or interpreted.

At this point two phases of the three-fold process have been completed. The data collection of the social semiotic sense-making interviews is not yet complete. Below brief results of the first two phases and the structure of the third phase are presented. These results motivate asking real users for their views on maps and other geographic imagery found in ARs fostering the use of social semiotics.

Content Analysis Results

Merrill Lynch (1994) states ARs have three sections: *Executive Letter, Business Review*, and *Financial Review*. According to Merrill Lynch, the Executive Letter is to provide "a broad overview of the company's business and financial performance," the *Business Review* "summarizes recent developments, trends, and objectives of the company, and the *Financial Review* describes "business performance ... quantified in dollars." The *Financial Review* itself according to Merrill Lynch contains two sections: Discussion and Analysis, a narrative with charts and graphs in which the corporate management describes the changes in operating results from year to year, and Financial Statements that include the balance sheet, income statement,

statement of changes in shareholder equity, statement of cash flows and footnotes. Our analysis confirms these components of structure. However, in addition, this work added two critical sections of images in which management communicates its vision, and in which geographic content is strongly present: *Front Matter*, such as the cover of the AR, and *Back Matter* that often includes corporate addresses, annual meeting information, and the AR's back cover. All corporate reports analyzed contained this five part structure regardless of their style, format of presentation, industry as determined by Standard Industrial Code (SIC), or national origin. The presentation format for these reports befit the image of "responsible and conservative" corporations. The general layout seeks to appease the stock purchasers and stock brokers but do not generally directly appeal to the consumers of their products. Thus, corporate reports are highly structured with these five sequential sections: *Front Matter*, *Executive Letter*, *Business Review*, *Financial Review*, and *Back Matter*.

". . . corporate reports are highly structured with these five sequential sections: Front Matter, Executive Letter, Business Review, Financial Review, and *Back Matter."*

A content analysis scheme for the 153 ARs' geographic images was developed which explored the geographic images of all five AR sections. This exhaustive review lead to a five category scheme for the geographic imagery structure: Informative Map, Incidental Map, Incidental Images, Geographic Symbol, and Geographic Chart. The section of the AR in which the image appeared was recorded as well as the size of the image as a function of the proportion of the page. Scheme coders consisted of faculty and graduate students with background in content analysis techniques forming the cadre of experts for this project.

The two cartographic categories were described as follows:

Informative maps in an AR present information explicitly about the company in cartographic form. The most common cartographic types included nominal point maps, route maps, interrupted maps, and various inset maps. The maps might be stylized attempts at two dimensional versions of three dimensional globes, topographic maps or simple outlines of countries. The "definition" of map and map types employed did not consciously follow or apply any well-known typology of maps. Our typology arose from the data and produced high intercoder reliability and agreement for the scheme by the three coders. Often an informative map was a combination of types such as global and nominal point map or nominal point map and route map. The coverage of the map, whether it attempted a three-dimensional look, presence or absence of graticules, amount of space occupied on the page, and a title were all recorded. Examples included Fleming's point map of operating units on its inside front cover (Figure 1), Occidental's pipeline route map, ARCO's interrupted world map indicating sites of their exploration projects (Figure 2), and ARCO's inset map from a full hemisphere map indicating the South China Sea and the location of China's first offshore natural gas field and the route of the subsea pipeline that will bring the gas to market (Figure 3).

"The most common cartographic types included nominal point maps, route maps, interrupted maps, and various inset maps."

"Often an informative map was a combination of types such as global and nominal point map or nominal point map and route map."

Incidental maps are of the same general types as indicated above but they fail to provide any data concerning the company. They may be decorative maps, logos, outlines of countries, or others. They perform no specific function beyond getting the reader's attention and being aesthetically pleasing though they may well influence opinions of the corporation. Some of these are difficult to spot and are frequently deeply embedded in the artwork. For example, Fleming's AR cover (Figure 4) includes the words "VISION 2000" enmeshed in a graticle accompanying the description of Fleming "Becoming a world-class marketing and distribution company." (Note how this is in contrast to the informative map on the inside front cover indicating that all Fleming operating units are within the U.S.) Litton Industries includes a picture entitled: "An operator tracks simulated targets

*"**Incidental maps** . . . may be decorative maps, logos, outlines of countries, or others."*

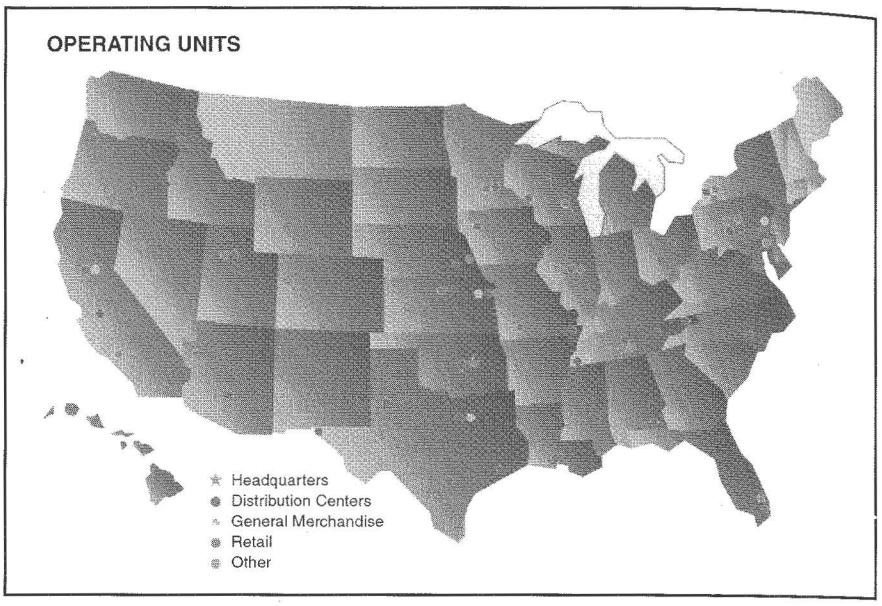


Figure 1. Fleming Operating Units, 1994 (Copyright Fleming, permission to reproduce granted from Fleming *media relations)*

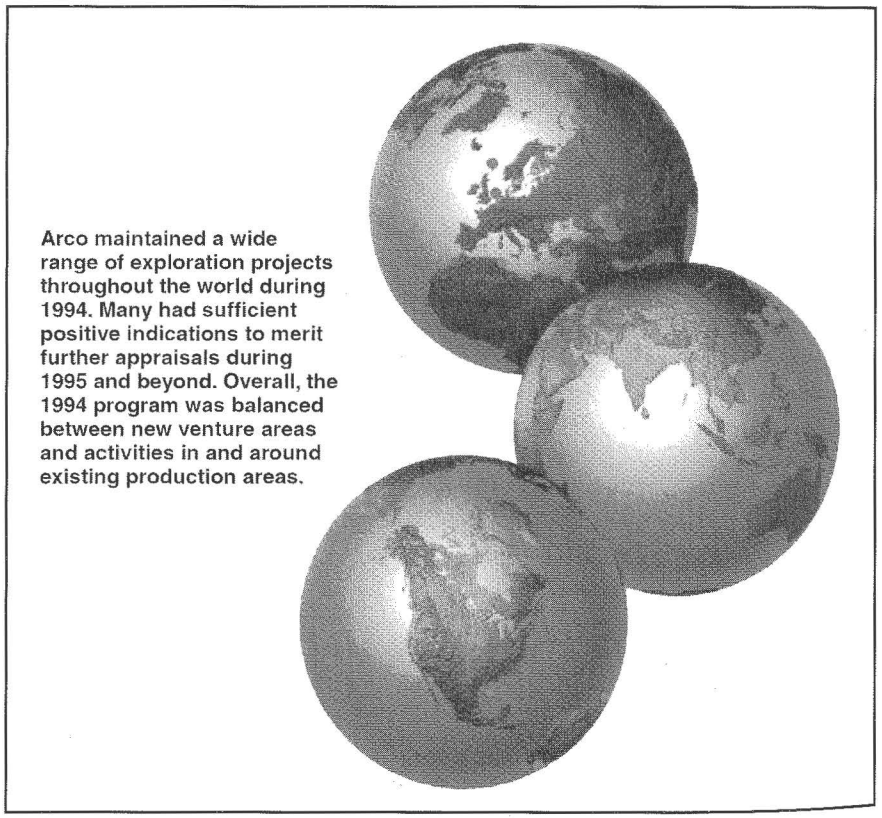


Figure 2. ARCO Exploration Sites, 1994 (Copyright ARCO, permission to reproduce granted from ARCO *media relations)*

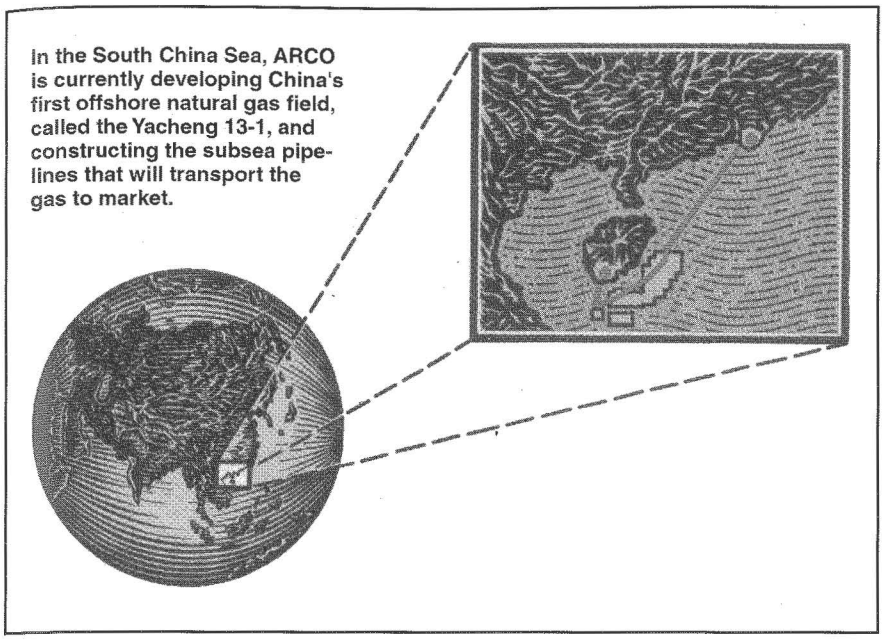


Figure 3. ARCO South China Sea Pipeline, projected 1994 (Copyright ARCO, permission to reproduce granted from ARCO *media relations)*

inside Tactical Operations Center being developed by Litton for the US Army's Theater High Altitude Area Defense (THAAD) system." The only perceptual images in the darkened photo are the operator's faint profile and the CRT screen exhibiting a relief map (perhaps of central California) whose legend or details are illegible even with a magnifying glass. The map provides no explicit information about the company although the title says much.

In the 153 reports analyzed, 1036 instances of geographic images occurred, for a mean of 6.77 images per AR, mode of 2 images, and a median of 5.5 geographic images per report. The promotional use of these reports accounts for the relatively low proportion of informational maps (131) compared to incidental maps (278) among the 1036 instances of geographic images in the reports (Figure 5). This content analysis provides a concise description of the imagery in corporate annual reports and also serves as useful input for constructing a semiotic analysis of the imagery.

"The promotional use of these reports accounts for the relatively low proportion of informational maps . . ."

Semiotic Denotative Results

The content analysis reported above provides an overview of geographic formats, the scope of the definition of geographic content of images, and a structural assessment of maps and geographic images within corporate annual reports. This section expands that analysis to build a semiotic description of the particular geographic content denoted in the AR. Semioticians distinguish between what a sign may literally stand for or denote from its cultural associations or connotations (Fiske 1990). However, to insist that denotation is merely a "literal" meaning of the images underestimates the inherently cultural basis of objects and their signs. Denotation has much to do with labeling (Sless 1986).

"Semioticians distinguish between what a sign may literally stand for or denote from its cultural associations or connotations."

Objects are often defined by their use and a particular use may be well-known in one culture and unknown in another. That is, the same object may have widely differing denotations in different cultures. For example, a book may be seen as a food source by a goat or a doorstop at an undergraduate party. Therefore, some level of interpretation is necessary even to form

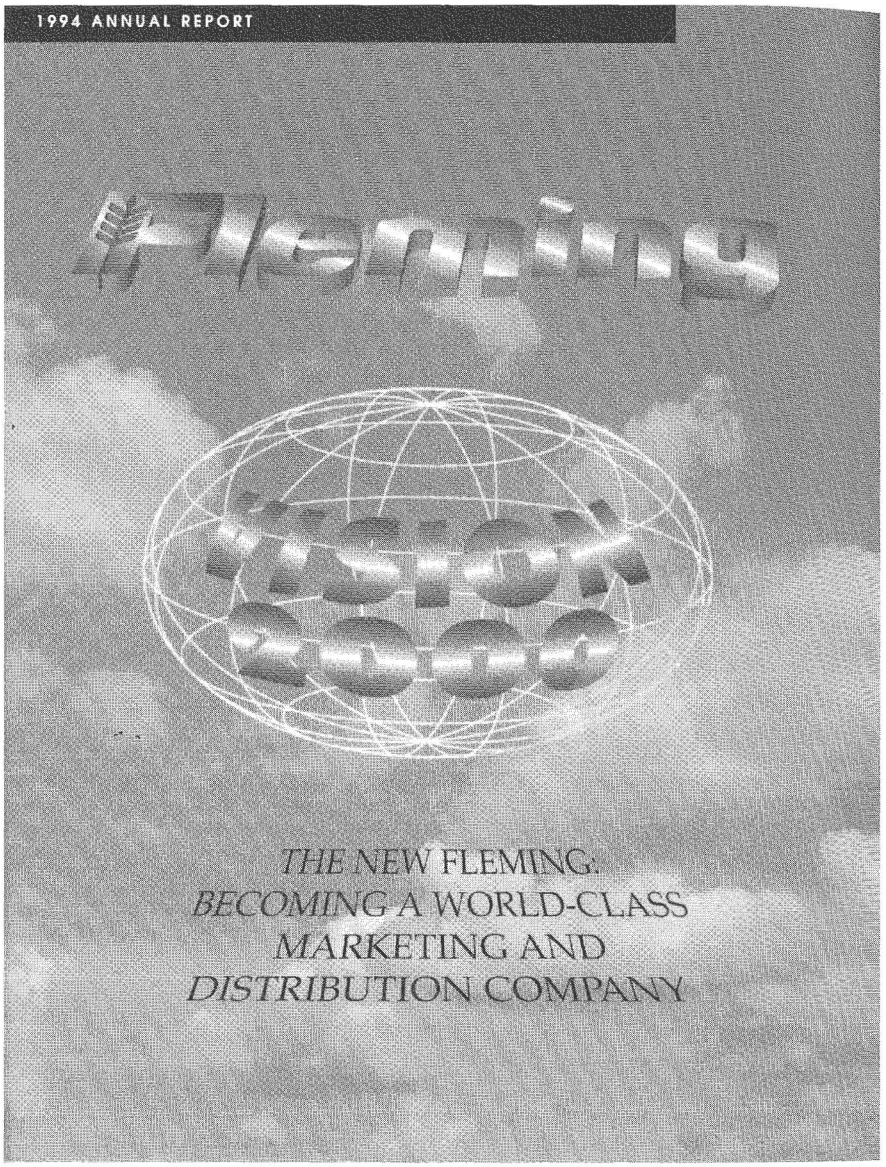


Figure 4. Fleming AR Cover, 1994: Incidental Map (Copyright Fleming, permission to reproduce granted from Fleming *media relations)*

"The goal of denotative analysis is to capture the taken-for-granted intersubjective literal meanings appreciated by a particular community or language group."

". . . denotation . . . serves as a necessary precursor to the connotative or deep interpretive semiotic associations . . ."

denotations. The goal of denotative analysis is to capture the taken-for-granted intersubjective literal meanings appreciated by a particular community or language group. As stated earlier, some would claim no signs are natural and that denotations are no more than the fixed understandings across communities for some time period. When the denotations are separated from the possible associative meanings for that same community, a richer analysis of the intersections of ideologies and discourses may be possible (Hall 1980). The analysis of denotation in ARs provides a sense of what explicit and manifest geographic content is provided in ARs. Such denotation clarifies the role of maps and other imagery in ARs and serves as a necessary precursor to the connotative or deep interpretive semiotic associations of the geographic imagery in ARs. The specific community of users for this project consists of the readers of annual reports, itself a diverse community with varying values, expectations, needs, and preferences.

A sample of 28 corporate ARs was selected from the 153 ARs used for this denotative description of geographic imagery. These 28 were chosen to

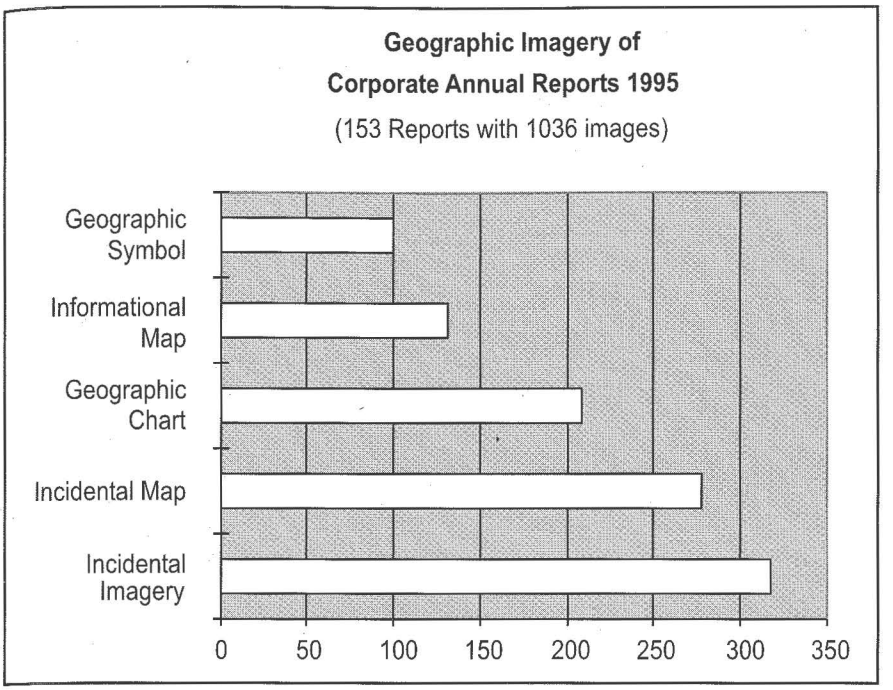


Figure 5. Distribution of Geospatial Imagery Types in Corporate Annual Reports

provide wide coverage of industries indicated by SIC codes, markets, and corporate philosophies as indicated in the body of the reports as well as coverage of the maps and geographic imagery types as presented in the content analysis scheme described previously. So what is represented in the photos, diagrams, maps, charts, icons and other graphics of ARs that is geographic in nature? That is, what are the major modes of geographic imagery as seen by expert semioticians in ARs?

"At least nine major modes of denotation appear in this set of AR geographic images."

At least nine major modes of denotation appear in this set of AR geographic images. Of these nine only one covers maps. The other eight modes (e.g., landscapes as the main focus of the graphic presentation, graphic backdrop to illustrate corporate activities or products which are manifest in the scene, and humans illustrated by industrious workers in action on the job or as corporate employees donating time to assist local communities) indicate the wider role that geographic information plays in support of resolving information needs in which maps and cartographic imagery are embedded; however, only the one covering maps is elaborated upon here.

"The principal informative use of maps is to describe the regions where the companies are actively doing business, growing, or hope for global expansion."

Maps appearing in ARs are both informative and incidental as mentioned under the content analysis. The principal informative use of maps is to describe the regions where the companies are actively doing business, growing, or hope for global expansion. For global companies, a world point map of operations is pro forma. Often country or state icons are juxtapositioned near text discussing company activity in that country or state providing a graphic relief from the intense text and as a geographic locator.

Several companies portray themselves as being global but have operations in only a limited number of countries (e.g., Quaker Oats). Several such companies exhibit global maps without country borders with or without a graticule. These representations leave the impression that the company is without borders and is more omnipresent than the list of countries of operation might indicate. This also happens with incidental maps that carry no real information per se but provide a global patina for the company.

Incidental maps are intriguing; they present no apparent data concerning the company yet they express much. For example, they often make the company appear to be present in more places and at more times than a point map of operations might indicate. In these maps a balance is struck between global presence and yet being near to consumers. For example, Quaker Oats displays a distorted "hemisphere" map centered over the Atlantic Ocean that includes North America and parts of South America, Europe, Asia, Pacific Rim, and Africa with thunderbolt icons that point to places Gatorade is consumed. Quaker states its mission for Gatorade is to "quench the hot and thirsty consumers in every corner of the world." The text discusses US, Canada, Latin America, Europe, and the Pacific Rim; however Africa and China are left unmentioned.

"In these maps a balance is struck between global presence and yet being near to consumers."

The nine denotation modes are pervasive in the ARs, both in the sample 28 studied in-depth and in the full set of 153. The modes present a literal context of the geographic images of ARs, and detail the story line or script describing the role of geography in ARs. However, they do not provide the moral or culturally imbued holistic meaning that readers make about the company, use in their stock or product purchases, or communicate about the company to others.

"The nine denotation modes . . . do not provide the moral or culturally imbued holistic meaning."

Connotative Results: Attitude-Behavior Matrix

Investigating the geographic images of ARs including maps with an attitude-behavior matrix provides one means of access to the more holistic message or associated semiotic meanings of the AR geographic images. Semiotic connotations expose a deeper sense of the whole of AR geographic imagery than denotations alone. Connotations clarify the philosophical, cultural, political, and economic role of corporations in society, and suggest the corporate wished-for beliefs and behavior of individual readers of ARs.

One approach to developing semiotic connotations employs a 2-by-2 attitude-behavior matrix. Such a matrix is composed of four cells in which each cell corresponds to an attitude-behavior category. Both the attitude and behavior variables are dichotomous (recording only the presence or absence of the trait) in which the rows indicate either an optimistic or pessimistic attitude while the columns indicate either active or passive behavior. Applying this matrix to signs of the ARs involves assigning either a whole image or a part to one or more cells. As the sign is assigned to a cell(s) aspects of its semiotic meaning within space and time for a linguistic community are exposed through the tension of the dialectic nature of the variables. The matrix (figure 6) represents an exploratory device, not a statistical tool. Examples of applying the matrix to ARs serve to illustrate the concepts that the matrix process exposes.

"As the sign is assigned to a cell(s) aspects of its semiotic meaning within space and time for a linguistic community are exposed . . ."

Abbott Laboratory's cover photo of a mother and baby daughter who are both healthy thanks to Abbott's nutritional supplement represent an entry in the *optimistic-passive* cell. That is, Abbott's cover imagery with an out-of-focus shrine in the background seems to say "Trust us. We will take care of you and yours; be happy. You don't not need to concern yourself with these issues no matter where you live, that is our business." Underscoring this interpretation of Abbott's photo is the slogan appearing on the cover pronouncing Abbott's mission as "Quality Health Care Worldwide." However, nowhere in the AR is analytic research in text or graphic to indicate the validity or reliability of the product, for whom the supplement is best, under what circumstances it is most efficacious, or what its long-term effects are upon mother or baby.

Raytheon describes its conversion of military and defense electronics to environmental monitoring while exhibiting an image of water falling

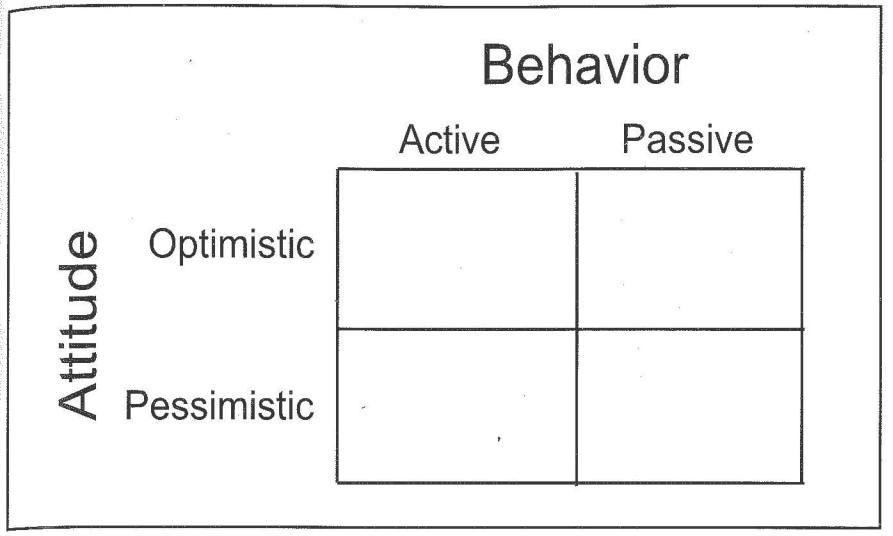


Figure 6. Attitude Behavior Matrix

hundreds of feet deep in the green Amazon rainforest region of Brazil. This image belongs at first glance to the *optimistic-active* cell. The image reflects the company's concern for the environment and the ability for others (governments, landowners, environmental groups?) to keep an eye on the environment and keep it safe. All one needs is Raytheon's products to be safe but this requires action. One can also see the *optimistic-passive* elements in this image since all one needs is Raytheon's products to monitor the environment, and somehow monitoring is equated with complete protection of the rainforest. There is also a subtle sense of *pessimistic-active* in this image of rainforest monitoring. The activity is driven by motivation to obtain the products and the pessimism is inferred from the need for the monitoring in the first place and a sense that more is needed than just monitoring for all to be well. However, the optimism and passivity are accentuated by the beauty and tranquility of the waterfall, similarly the passivity is accentuated further by the homage paid to Raytheon for being so creative in redeploying the military electronic surveillance equipment for us.

". . . homage paid to Raytheon for being so creative in redeploying the military electronic surveillance equipment for us."

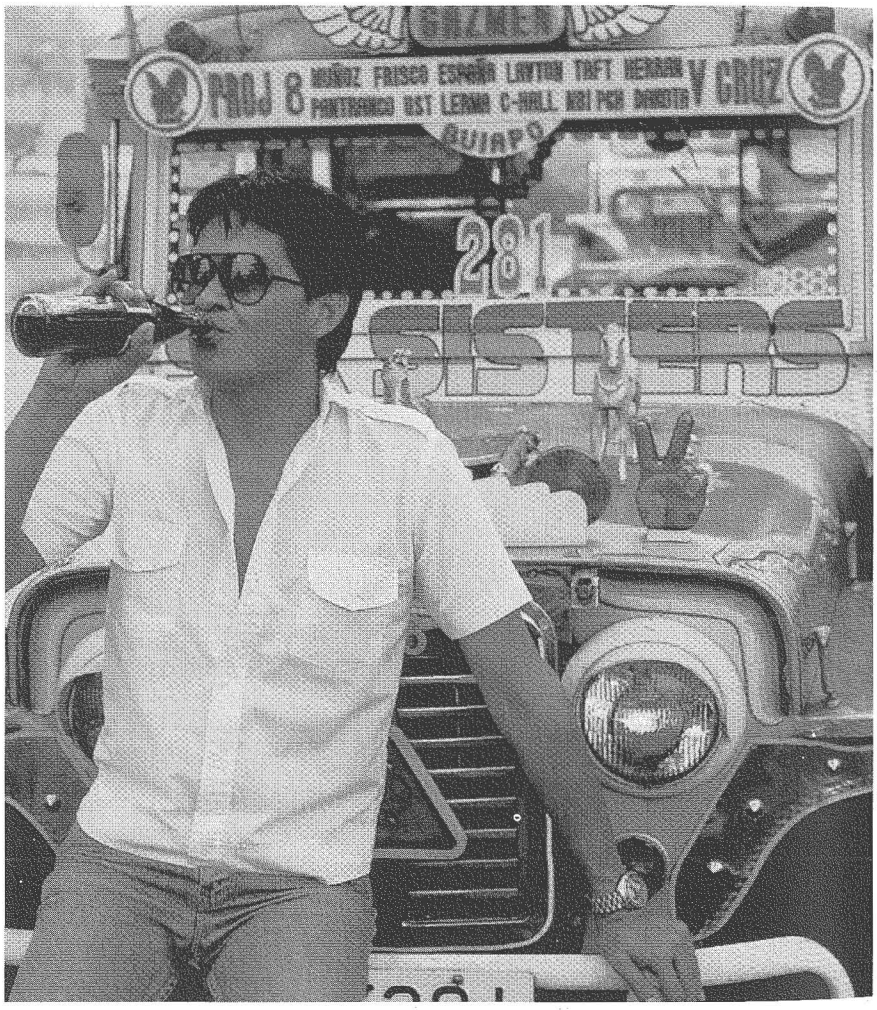
No examples could be found to reflect the *pessimism-passive* cell in the ARs geographic imagery of any mode or type. The imagery was always supportive of the corporations. The *pessimistic-passive* cell represents a fatalism antithetical to the messages corporations wish to enunciate. Images in this cell by their very nature are expressions of hopelessness and futility. Such views might be expressed by images of hedonism or solipsism. Images of rebellion against authority crushed by authoritarian regimes might also reflect such *pessimistic-passive* concepts. For example, Chinese actions in Tiananmen Square in 1989, frustration of Peruvian terrorists in taking over the Japanese embassy, the loss or accelerating loss of Brazilian rainforest, or the disillusionment of many communists or Marxists with the changes taking place in the former Soviet Union might be poignant reminders that power reflects resources and control at farther and farther distances (Giddens 1984). Yet in ARs no images appear that indicate that problems pronounced by the companies cannot be resolved or cured by their products or services. An example of a *pessimistic-passive* image ***might*** have been a chart or choropleth map reflecting the loss or accelerating loss of Brazilian rainforest because of non-sustainable harvesting of timber over the past five years; however, no such image is present in any of the ARs.

"The imagery was always supportive of the corporations."

". . . no images appear that indicate that problems pronounced by the companies cannot be resolved or cured by their products or services."

Examples of the *optimistic-passive* nature of the geographic imagery in ARs include:

- ➢ Maps indicating the expansion of the company's 'reach' through new manufacturing sites, or expanding market penetration [e.g., Quaker, Coca-Cola]
- ➢ Incidental maps that imply the globalization, regionalization, and, yet, local concern of corporations [e.g., Fleming, IBP]
- ➢ The paternal nature of Kimberly-Clark in aiding feminine hygiene in Korea
- ➢ The somber beauty at sunset of US military strength emanating from Ingalls shipbuilding division in Mississippi displayed on the cover of Litton's AR, and
- ➢ The taken-for-granted advantages gained by a Philippine bus driver quenching his thirst with a bottled carbonated soda [Grace] (see Figure 7).



Rapidly increasing consumption of carbonated soft drinks makes container sealing a growth industry in developing countries like the Philippines.

Figure 7. Complex Geospatial Imagery: Commodification of Culture (Copyright W.R. Grace & Co., permissiion to reproduce granted from Grace *Corporate Communications)*

Each of these reflect the optimism of the corporate message along with a sense that with this company all is, and will be, well. Labor strife, expropriation of foreign culture and resources, infiltration of new cultural values into old cultures, and the occasional or continual corporate lapses of responsibility for children, women and families never seem to balance the unending faith in the corporation to solve the world's problems given just a little more time and capital. In summary, the attitude-behavior matrix as a tool for semiotic analysis exposes the optimistic messages of geographic imagery and maps of corporations and of corporate responsibility and ability to maintain and improve an already wonderful world.

". . . attitude-behavior matrix as a tool for semiotic analysis exposes the optimistic messages of geographic imagery and maps of corporations."

Background

SENSE-MAKING

Postmodern semiotics calls for casual user as well as expert input in analyzing signs yet does not provide either a good conceptualization of humans or a method to collect user / viewer data (e.g., Gottdiener 1995, Sless 1986). Therefore, a richer and more robust epistemology and ontology is needed to go beyond the expert interpretations of traditional semiotic and content analyses such as those discussed above. Dervin's (e.g., 1992, 1995) sense-making framework and its associated methodologies is one such rich and robust approach. Combining sense-making with postmodern semiotic sensitivities poses a useful extension to semiotics that does privilege all users whether expert or casual. Sense-making explicitly accounts for time and space dependencies of human information needs by metaphorically representing the cognitive states of humans as continual movement along a road in time and space. The perception of a person's current position along this road depends on where the person has been (past) as well as where the person is (present) and where the person is going (future). Dervin pictures humans as intelligent, creative creatures capable of making sense by incorporating knowledge from within themselves and from the external world allowing for forward movement along their cognitive road. She notes that discontinuities or gaps that represent a need for the individual to make sense of their world often appear along their cognitive road and that humans must make sense of the barriers and gaps before movement may continue along the cognitive road. Gaps are a direct consequence of Dervin's perspective of a human view of reality as sometimes intersubjective, sometimes recursive, sometimes chaotic but constantly changing. Dervin derives her view of the human becoming in the world from her positing ontological and epistemological incompleteness. Dervin's (1995) assertion that information is designed by humans making and unmaking information has much in common with Giddens' (e.g., 1984) structuration theory. Giddens and Dervin pose an ontological philosophy of social relations in which agency and structure blend in social relations. They agree that humans often embed social relations in routinized activities of individuals who can neither be aware of all preconditions nor able to predict all the unintended consequences of their actions.

"Combining sense-making with postmodern semiotic sensitivities poses a useful extension to semiotics that does privilege all users whether expert or casual."

"Dervin derives her view of the human becoming in the world from her positing ontological and epistemological incompleteness."

Gaps are respondents' concerns that generate information needs in conjunction with respondents' expectations of how bridging the gap would be useful to continue movement along their cognitive road. Gaps are operationalized in sense-making experiments as questions respondents had as they proceed to resolve their information needs. Dervin acknowledges that these needs are not always well articulated or acknowledged by respondents. Uses are operationalized as the helps or hurts respondents express concerning the value of the responses they obtained to their questions. Dervin believes that humans have a common need to make sense of the world, an innate desire to get back on their cognitive road. Her approach

"Dervin believes that humans have a common need to make sense of the world, an innate desire to get back on their cognitive road."

allows each person to represent his or her own reality. However, Nilan (1985, 1991) suggests that this does not lead to unmanageable variability in analyzing human behavior because humans share socio-cultural experiences. Human need to make sense and the evidence for common experiences among individuals limit the range of human diversity present at a particular point in space and time.

". . . common experiences among individuals limit the range of human diversity present at a particular point in space and time."

Dervin illustrates the process of sense-making using situation, gap, and use as the three vertices of a triangle. That is, humans find themselves facing gaps they need to bridge mediated by the situation in which they find themselves. Often the actual usefulness of the bridge differs from the expected usefulness. Indeed, our cognitive movement through a situation is the accumulation of a series of steps. A triad consisting of an event of the situation, gaps at the event, and the uses obtained as responses to the event's gaps (whether helpful or impeding, actual or expected) represents each step or micro moment of the situation. Dervin often uses a time line method for respondents to map out the sequence of events of the situation, the questions (gaps) they had during the events, and the responses they obtained in making sense of their situation.

The individual is privileged in Dervin's conceptualization yet sense-making analyses go beyond an individual's view of a situation forming a social conceptualization of information needs. An individual may forget an aspect of a situation for a range of reasons, not the least of which is that the particular issue was not important to him or her or they easily resolved it. However, what one individual did not recall, another will. The sense-making methods have shown a high degree of overlap of micro moment steps among respondents in the same situation. Further, holistic impressions of triads for describing a situation require relatively few respondents (Nilan et al, 1989). To go beyond the individual, sense-making seeks out the commonalities as well as the not-so-common aspects among individuals' inputs by merging individuals to form a general view of the situation. Aligning and overlaying different respondents' sense-making triads leads to changing the essence of prediction from IF ... THEN to THEN... THEN while acknowledging the incompleteness of such a construction. Generating a prototypical sequence of gaps and support for resolving the gaps provides a design for information systems (Nilan et al, 1989) yet acknowledges ontological and epistemological incompleteness. To repeat, open systems have unacknowledged preconditions and unintended consequences. The sense-making methods accept such indeterminacy, producing flexibility and robust information systems that help people in their situation. In summary, the sense-making method is based upon collecting a series of micro moment steps in which users' state their gaps and actual and intended uses within a situation's events: the Dervin Triad. The work of Weich (1995), done independently of Dervin, provides additional perspective of sense-making for groups.

"Generating a prototypical sequence of gaps and support for resolving the gaps provides a design for information systems . . ."

For example, Nilan et al. (1989) analyzed the situation of users developing a desktop publishing product such as a poster, card, or newsletter. They analyzed the time lines of respondents with a range of experience levels, developed a model for the process of creating desktop publishing projects by overlaying time lines, and then displayed a novel online help system. The novel help system incorporated facts, task analyses, and tutorials on a menubar. The menubar reflected the situation time line rather than the standard categorical menubar items ubiquitous in desktop metaphor graphical user interfaces. In this sense-making application to information-in-use systems the individual is privileged within the collective actions of a small group leading to a meaningful design. Another example of sense-making in use is described by Dervin (Dervin & Nilan, 1986) in work with

terminally ill cancer patients. The patients, because of their experiences, were better able to support each other emotionally and informationally than were their physicians who were more centered on system rather than user support. Shields' (1994) work illustrates the use of sense-making methods in analyzing the gender issues surrounding advertising images of females. Gluck, Danley and Lahmon (1995) applied sense-making to develop an understanding of the events, gaps, and helps associated with seeking geospatial information in public libraries. Applying such a user based approach to cartographic design and interpretation and geographic imagery found in corporate annual reports is the major goal of the current project.

"Gluck, Danley, and Lahmon applied sense-making to develop an understanding of the events, gaps, and helps associated with seeking geospatial information in public libraries."

Preliminary Results of Social Semiotic Analysis of AR Geospatial Imagery

The next phase of this project uses the sense-making interview techniques to explore users' views of the maps and imagery in these ARs. The participants in the interviews will be recent purchasers of the stock of these companies, stock brokers who advise their clients to purchase these stocks, and recent purchasers of the products or services sold by these corporations. These interviews are expected to expand our understanding of how maps influence their users and how they interact with other geographic imagery to assist users in resolving their information needs. Combining the sense-making data with semiotic analyses should provide a social semiotic approach to geospatial imagery understanding.

". . . sense-making data with semiotic analyses should provide a social semiotic approach to geospatial imagery . . ."

The sense-making interview methods involve several stages of discussion with the respondents (i.e., recent stock or product purchasers) about the AR geographic images and maps. The method employed is a modification of Shields (1994). First, respondents are given 10-15 minutes to browse several (2-3) complete ARs. Respondents are then asked to select several graphic images that stand out to them most which include a geographic aspect or component with at least one that contains a map. Respondents are then asked to share their reactions, such as:

What images or ideas or thoughts did this graphic bring to mind?
What questions did it lead you to ask?
What emotional reactions did it lead you to have?

For each image / idea / thought / question / emotion respondents will be asked to describe what leads them to that response and to describe how the reaction relates to their life, now or in the past. Also, respondents are asked to indicate how such a reaction helps, facilitates, or assists them or hurts, hinders or disturbs them.

"The terms "promoting" and "appeal" are purposefully ambiguous and are probed through additional questioning . . ."

In the second and third activities respondents rank a set of 10 geospatial images selected by the researcher from ARs. The first criteria for ranking is the appeal of the image as promoting or not promoting a positive image of the corporation; a second criteria for ranking is the personal appeal of the image to the respondents. The terms "promoting" and "appeal" are purposefully ambiguous and are probed through additional questioning in a manner similar to the that employed in the first activity.

". . . those interviewed . . . indicate more scepticism and concern about the role of these services and products . . ."

Preliminary interviews applying the above activities indicate that real users do reflect some of the corporate intended messages of the optimistic-passive cell of the matrix. The US economy is doing well and the influence of the economic downturn of the Asian tigers has failed to effect the economic optimism of those interviewed. However, those interviewed to date also indicate more scepticism and concern about the role of these services and products in society at large. Participants were concerned about the

effect on children of the expanding sales of products often illustrated in cartographic images. Needless to say, much more work is needed to explore real users' connotations and denotations of the maps in ARs.

FUTURE WORK AND CONCLUSIONS

Traditional content analysis and semiotic analysis are an elitist deconstruction of geographic imagery and maps based upon experts' opinions or intuitive labels or understandings. In spite of these apparent short-comings these techniques yield interesting insights into the type and structure of geospatial imagery in ARs. Application of sense-making and semiotics to form a social semiotic analysis appears to permit a reframing and decentering of geographic imagery and map research providing researchers a less reductionist, and hopefully deeper understanding of how maps are used and the role they play in informing their users and viewers. It is further hoped that others becoming aware of social semiotics will employ it as one more tool in the process of understanding cartographic products and services.

NOTE: A preliminary version of this paper was presented by the author during a session on qualitative methods in cartography at the 1998 Association of American Geographers meeting in Boston, MA. April, 1998.

REFERENCES

Barnes, T. 1996. *Logics of Dislocation: Models, Metaphors, and Meaning of Economic Space*. New York: Guilford Press.

Barthes, Roland. 1968. *Elements of Semiology*. Translated by Annette Lavers and Colin Smith. New York: Hill and Wang.

Baudrillard, Jean. 1968. *Le Système des Objets*. Paris: Denoel-Gonthier.

Baudrillard, Jean. 1993. *Symbolic Exchange and Death*. London: Sage.

Cook, T. and Campbell, D. 1979. *Quasi-Experimentation: Design and Analysis Issues for Field Settings*. Boston: Houghton Mifflin.

Dervin, Brenda. 1992. From the mind's eye of the "user": The sense-making qualitative quantitative methodology. In Jack D. Glazier & Ronald R. Powell (Eds.), *Qualitative Research in Information Management* (pp. 61-84). Englewood Cliffs, CO:Libraries Unlimited.

Dervin, Brenda. 1995. Chaos, Order, and Sense-making: A Proposed Theory for Information Design. To appear in: Robert Jacobson, ed. Information Design, MIT Press, expected publication date 1998. World Design Inc.

Dervin, B and Nilan, M. 1986. Information Needs and Uses. *Annual Review of Information Science and Technology*. 21: 3-33.

Derrida, Jacques. 1982. *Margins of Philosophy*. Translated by Alan Bass. Chicago: University of Chicago Press.

Egenhofer, M., and Mark, D., 1995. Naive Geography. In Frank, A. and Kuhn, W., eds., *Spatial Information Theory: Theoretical Basis for GIS*, Berlin: Springer-Verlag, *Lecture Notes in Computer Sciences* No. 988, pp. 1-15.

Epstein, M. and Pava, Moses L. 1993. How Useful Are Corporate Annual reports? *Business Credit* 95(4):18-20.

Ericsson, K. A. And Simon, H. 1993. Protocol Analysis. Rev. ed. Cambridge, MA: MIT Press.

Fiske, John. 1990. *Introduction to Communication Studies*. 2nd Edition. London: Routledge.

Galant, Debbie. 1994. The Best Annual Reports. *Institutional Investor* 28(9):198-203.

Giddens, Anthony. 1984. *The Constitution of Society*. Berkeley: University of California Press.

Gilmartin, Patricia. 1992. Twenty-five Years of Cartographic Research: A Content Analysis. *Cartography and Geographic Information Systems* 19(1):37-47.

Gluck, M., Danley, E. and Lahmon, J. 1995. Views of the Public's Geospatial Information Needs. *Library Quarterly*. 66(4):408-448.

Gottdiener, Mark. 1995. *Postmodern Semiotics: Material Culture and the Forms of Postmodern Life*. Cambridge, MA: Blackwell.

Hall, Stuart. 1980. Encoding / Decoding. In *Culture, Media, and Language* London: Hutchinson.

Harley, J.B. 1989. Deconstructin the Map. *Cartographica*, 26(2):1-20.

Head, Grant. 1984. The Map as Natural Language: A Paradigm for Understanding. In Board, C. (Ed.) *New Insights Into Cartographic Communication*. Cartographica Monograph 31. Toronto, 1-32.

Hervey, S. 1982. *Semiotic Perspectives*. London: Allen and Unwin.

Hill and Knowlton, Inc. 1984. *The Annual Report: A Question of Credibility* New York: Hill and Knowlton.

Hopwood, 1996. Making Visible and The Construction of Visibilities: Shifting Agenda in the Design of the Corporate Report: Introduction (to special issue). *Accounting, Organizations, and Society* 21(1):55-57.

Innis, R. E. 1985. *Semiotics: An Introductory Anthology*. Bloomington: Indiana University Press.

Kerlinger, Fred. 1986. *Foundations of Behavioral Research*. 3rd ed. Chicago: Holt, Rinehart, and Winston, Inc.

Lakoff, G. 1987. *Women, Fire and Dangerous Things: What categories reveal about the mind*. Chicago : University of Chicago Press, c1987.

McHaffie, Patrick. 1997. Decoding the Globe: Globalism, Advertising, and Corporate Practice. *Environment and Planning. D, Society & Space*. 15 (1): 73.

Mersey, J.E. 1990. Colour and Thematic Map Design: The Role of Colour Scheme and Map Complexity in Choropleth Map Communication. (Monograph #41) *Cartographica* 27(3):1-150.

Merrill Lynch, Pierce, Fenner and Smith Inc. 1994. *How to Read a Financial Report*. New York: Merrill Lynch.

MacEachren, Alan. 1995. *How Maps Work: Representation, Visualization, and Design*. New York: Guilford.

Mervis, C. and Rosch, E. 1981. Categorization of Natural Objects. *Annual Review of Psychology*. 32:89-115.

Miles, Louella. 1988. From Annual Report to Best Seller: The Role of Annual Reports in Marketing mix. *Accountancy* 101(1136):79-81.

Monmonier, M. and Gluck, M. Focus Groups for Design Improvement in Dynamic Cartography. *Cartography and Geographic Information Systems*. 21(1):37-47.

Nilan, Michael. 1985. *Structural constraints and situational information seeking: A test of two predictors in a sense-making context*. Unpublished master's thesis, University of Washington, Seattle, WA.

Nilan, Michael, et al. 1989. User-Oriented Interfaces for Computer Systems: A User-Defined Online Help System for Desktop Publishing. *Proceedings of the 52nd Annual Meeting of the American Society for Information Science*, 26, 166-171.

Nilan, M., Newby, G. & Duvall, L. 1991. Toward a Reassessment of Individual Differences for Information Systems: The Power of User-Based Situational Predictors. *Proceedings of the 54nd Annual Meeting of the American Society for Information Science*, 28, 73-81.

Peirce, Charles S. 1931. *Collected Papers of Charles S. Peirce*. Edited by P. Weiss and C. Hartshone. Cambridge MA: Harvard University Press.

Peirce, Charles S. 1955. *The Philosophical Writings of Peirce*. New York: Dover Publications.

Saussure, Ferdinand de. 1966. *Course in General Linguistics*. New York: McGraw-Hill. [Reprinted by arrangement with The Philosophical Library, Inc. Edited by Charles Bally, Albert Sechehaye and Albert Riedlinger. Translated from the French by Wade Baskin.]

Schlichtmann, Hansgeorge. 1985. Characteristic Traits of the Semiotic System 'Map Symbol.' *Cartographic Journal* 22:23-30.

Shields, Vickie Rutledge. (1994). *The Constructing, Maintaining, and Negotiating of Gender Identities in the Process of Decoding Gender Advertisements*. Unpublished doctoral dissertation, Ohio State University, Department of Communication.

Sless, David. 1986. *In Search of Semiotics*. London: Croom Helm.

Slocum, T.A., Robeson, S. H., and Egbert, S.L. 1990. Traditional vs. Sequenced Choropleth Maps: An Experimental Investigation. *Cartographica* 27(1):67-88.

Weber, Robert Phillip. 1985. *Basic Content Analysis*. Beverly Hills, CA: Sage..

Weich, Karl E. 1995. *Sensemaking in Organizations*. Thousand Oaks, CA: Sage.

Wood, D. Fels. 1992. *The Power of Maps*. NY, NY:Guilford Press.