

ABSTRACT

LEE, JAE YOUNG. Rhetoric of Diagrams: A Study of Rhetorical Significance in the Formal Qualities of Diagrammatic Elements and Configurations in the Context of Global Warming. (Under the direction of Meredith J. Davis)

This study casts suspicion on the so-called objectivity, rationality, and neutrality that usually have been associated with diagrams. Diagrams are chosen as the focus object of this study, since the presence of rhetoric is less clear in them than in other visual representations, such as posters and advertisements. Thus, the goal of this study is to explore the rhetoric of diagrams. On the basis of the constructionist approach, assuming that readers actively construct meanings rather than passively accept what an author originated, this study aims to investigate how diagram viewers construct meanings from diagrams and what meanings they construct, focusing on what rhetorical significance they assign to diagrams on the basis of the formal qualities of diagrammatic elements or configurations.

In order to address the main research question, I first did a rhetorical analysis of the diagrams sampled from American magazines and newspapers, which deal with the issue of global warming. Through the rhetorical analysis, I not only identified diagrammatic elements and configurations to which interviewees are likely to assign rhetorical significance, but also selected some diagrams from the original collection for interview. Then, I had interviews in order to identify the diagrammatic elements or configurations to which interviewees actually assigned rhetorical significance. Then, I integrated the results from the rhetorical analysis and the interviews, and compared them in order to address the main research question.

The comparison showed that the two results are similar, which implies that the diagrammatic elements identified through the rhetorical analysis and the ones identified through the interviews significantly overlap. However, based on the findings reported in this

study, I could only answer to the main research question in somewhat qualified manner, since I could make a claim that interviewees assigned rhetorical significance only to some of the overlapping diagrammatic elements and configurations on the basis of the formal qualities of diagrammatic elements and configurations. On the other hand, I was not able to make the same claim to other overlapping diagrammatic elements and configurations, since I did not have enough data to figure out if it was purely because of the formal qualities of the diagrammatic elements and configurations that interviewees assigned rhetorical significance to them. Thus, I have learned that I should gather more data in order to be able to answer the main research question fully.

Nevertheless, as an initial attempt to explore the rhetoric of diagrams, this study is illuminating in that it clearly showed studying rhetoric of diagrams, especially studying the relationship between formal qualities of diagrammatic elements and rhetorical significance, is such a complex issue that involves multiple factors, such as contents of a diagram, unique characteristics of a target audience, context in which a diagram will be used, and visual convention grounded under a given context. In that sense, the findings of this study might serve as a useful starting point for a follow-up study of the rhetoric of diagrams.

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Rhetoric of Diagrams: A Study of Rhetorical Significance in the Formal Qualities of
Diagrammatic Elements and Configurations in the Context of Global Warming

by
Jae Young Lee

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APPROVED BY:

Meredith Davis
Committee Chair

Martha Scotford

Carolyn Miller

Victoria Gallagher

DEDICATION

This dissertation is dedicated to my loving family, my husband Seon Joo Kim and my son Ha Ram Kim. I also dedicate this dissertation to my parents, my father Kwang Sung Lee and my mother Hee Joo Park. Their understanding, patience, love, and encouragement have sustained me throughout the lows and highs of my Ph.D. journey.

BIOGRAPHY

Jae Young Lee was born and raised in Seoul, Korea. She received a Bachelor's degree in English Language and Literature from Sogang University, and a Master's degree in Visual Communication Design from Hongik University in Seoul, Korea before joining the doctoral program in Design in the College of Design at North Carolina State University. Her main area of interest is in exploring what role graphic design images or artifacts play in the construction of values, and how they influence people's views on social and political issues.

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CHAPTER 1. INTRODUCTION

In contemporary society, images are virtually everywhere. Everyday, we are surrounded by an enormous number of visual images spread by media, and asked to read and interpret them. The image-saturated environment in which we are living today increases not only the importance of our ability to read and construct meaning from those images, but also the importance of our critical perspective in viewing them. This changing environment brings the issue of “being critical” about visual images to our attention. Gillian Rose (2001) is one who emphasizes necessity of ‘critical approach’ to reading and interpreting visual images. She demonstrates that a critical approach to visual images is needed because “visual imagery is never innocent” and “it is always constructed through various practices, technologies and knowledge” (p.32). She defines the notion of “being visually critical” as thinking about the agency of the image, considering the social practices and effects of its viewing, and reflecting on the specificity of that viewing by various audiences including the academic critic (p.32). According to her view, thinking about visual images through the lens of social practices, cultural meaning, and power relations is the core concept of “being critical” about visual images.

Among various kinds of design artifacts, diagrams play an important role in human visual communication. Under the overarching genre of “information design” in graphic design, they communicate quantitative or statistical information necessary for people to understand social, political, economic, and cultural issues in our society. They are intermediary visual media through which we read and interpret information, and ultimately, interact with other members in our society. With explosively increasing amounts of

information that we are asked to process within a single day, our visual criticality about such visual representations is more necessary than ever.

The issue of visual criticality is especially important in reading diagrams because it is generally assumed that they are objective, neutral, and rational representations. They are data-driven representations based on the features, such as geometric and logical forms, abstraction of concepts, and numbers. The unique visual style shaped by those common features causes the objectivity, rationality, and neutrality we generally associate with them. The seeming objectivity, rationality, and neutrality define the visual nature of data-driven representations, while they conceal possible social practices, cultural meaning, and power relations under the surface of rational form and neutral-looking style. In other words, the combination of rational form, style, and the general assumption about data-driven representation give viewers the impression that visual representations, such as diagrams, communicate factual and truthful information, encouraging viewers to take them as they are. Consequently, such forms are considered as a channel for factual information, which does not allow infiltration of emotion, opinion, or perspective.

The objectivity, rationality, and neutrality that we attribute to visual representations, such as diagrams, are also found in photographic representation. As Barthes (1977) depicts the photographic image as a “mechanical analogue of reality” (p.18), we tend to assume that a camera mechanically records what is out there in the world as it is, and therefore, photographic images reflect reality as it is. The objectivity, rationality, and neutrality that we attribute to diagrams are applicable not only to photographic representation but also to journalism in a broader sense, since journalism asserts its domain as objective description of

reality. Although the myth of objective journalism has been undermined by some scholars, there is still tacit agreement that encourages us to see journalism more as documentation of what it is than as commentary. In short, it is generally assumed that data-driven practices, such as information design, photography, and journalism, have no room for editing, coloring, or slanting, and therefore, they do not involve emotion, opinion, and perspective.

Consequently, these forms of communication share a common ground in the sense that they are assumed to be objective, rational, and neutral representations of reality, and thus, factual and trustworthy.

This study casts suspicion on the so-called objectivity, rationality, and neutrality of diagrams, one representative instance of various information design artifacts, photographic images, and journalism. I chose diagrams as the main focus object of this study for the following reasons. First, diagrams are areas of design in which “the presence of rhetoric is less clear than in areas such as advertising and poster design” (Emanuel, 2010, p.5). Thus, it was interesting to investigate if there is any rhetoric in diagrams, and, if yes, what kind of rhetoric works in what ways. Second, diagrams are diverse in terms of form. By selecting them as the main object of this study, I can explore the ways in which rhetoric works in diverse forms of diagrams, the ways viewers construct meanings from them, and respond to their seeming objectivity, neutrality, and rationality.

The main figure who provides a central theoretical framework for this study is Roland Barthes, who was a French literary critic as well as a literary and social theorist, philosopher, and semiotician. Barthes (1977) professes in his essay, *The Photographic Message*, that the purely denotative status of photographic image is always accompanied by supplementary

connotative message which refers to the style or treatment of the image. (p.17, 19) Hence, the seeming objectivity, rationality and neutrality of photographic image are always undermined by the second level of message. The connotative level that includes style and treatment brings the issue of rhetoric to the center of focus. Through the lens of rhetoric, we can discuss the issue of intention, opinion, perspective, ideologies, and interests that penetrate visual representations. In other words, with the disguise of the seeming objectivity, rationality, and neutrality, visual representations, such as diagrams, can be used as a tool for disseminating a particular perspective, ideology, or interests that serve a particular group of people as well as for affecting or shaping other people's opinion or perspective on a particular issue.

To address the rhetoric of diagrams, I developed two separate, but closely related, clusters of theoretical concepts, relevant to the central issue of this study, of the rhetorical dimension in seemingly objective, rational, and neutral visual representations, such as diagrams. One centers on the notion of the "rhetoric of image" adopted from Barthes¹, and the other on the notion of "rhetoric of neutrality"² adopted from Robin Kinross, a graphic designer and design historian. Here, I briefly describe how the theoretical concepts in each

¹ I adopt the term, "rhetoric of image," from Barthes' essay, *Rhetoric of Image*, in his book, *Image-Music-Text* (1977), and his discussion of rhetorical aspect of image in the essay. In the first part of the literature review, I will discuss my concept of "rhetoric of image" by identifying several relevant theoretical concepts from Baudrillard and Gottdiener, and then, by building on Barthes' "rhetoric of image," drawing from the relevant sources. Then, I will use it as a theoretical framework to look at the rhetoric of diagram.

² I also adopt the term, "rhetoric of neutrality," from Kinross' essay, "The Rhetoric of Neutrality" in *Design Discourse: History / Theory / Criticism* (1984). In the second part of the literature , I will identify theoretical concepts or discussions from other disciplines (rhetoric, linguistics, graphic design, etc.), relevant to Kinross' "rhetoric of neutrality," and build on the notion, using the relevant concepts. Then, I will use the cluster of the concepts as a theoretical framework to look at the rhetoric of diagram.

cluster relate to one another, and, in the literature review, I discuss each author with the theoretical concepts that one provides and how the concepts can be interconnected.

Barthes starts the lineage of the rhetoric of image, the keyword in the first cluster of theoretical concepts. Especially, his notion of *naturalization* and *myth* are two closely interrelated theoretical concepts that play a central role in discussing visual images. Jean Baudrillard also provides helpful ideas for me to build the lineage of the rhetoric of image with the theoretical concepts such as *code*, *system*, and *simulation*. Especially, as applied to the rhetoric of diagrams, code can be considered as a kind of rule or principle that governs visual images including diagrams, and system as an overarching structure under which the code works. Mark Gottdiener's social semiotic theory emphasizes the importance of social context and codified ideologies engineered into material forms such as diagrams. Barthes, Baudrillard, and Gottdiener provide the concepts helpful for building up the rhetoric of image.

Centering on the notion of the rhetoric of neutrality, the second cluster of theoretical concepts integrates different concepts from various disciplines; transparency vs. opacity, look through vs. look at, style vs. substance, fluff vs. stuff, and conduit metaphor. Among the concepts, *transparency* and *opacity* refer to contrasting qualities or effects that we perceive, depending on whether we *look through* or *look at* media such as texts, symbols, images or diagrams. In other words, when we pay attention to form or style of a medium, we look at the medium, and the style of the medium is foregrounded. On the other hand, when the form or style does not draw our attention, we directly focus on substance of the medium. In such a case, we look through the medium, and pay attention to the substance of the medium, bypassing its style. Hence, transparency and opacity, look through and look at, and substance

and style are paired counterparts that have intimate relationships with one another. James Jasinski and Donald S. Lee discuss the notion of transparency and opacity. Richard Lanham is one who discusses all the three counterparts together, building an integrated discussion of them. Lanham also extends his discussion with additional concepts, such as *stuff* and *fluff* and “economics of stuff” and “economics of attention.” Andrew Blauvelt adds some more discussions of substance and style from a graphic designer’s perspective. In addition, Michael Reddy, a linguist, argues against the notion of “conduit metaphor” as an adequate representation of language. He criticizes it because it conceives language as a mere conduit containing our meanings and thoughts, and then, proposes an alternative notion. The notion of conduit metaphor shares similarity with the rhetoric of neutrality in the sense that both point to the transparent quality of language (or image if we apply the concept to design). The difference is that the rhetoric of neutrality recognizes and reveals the illusion of the transparent quality while the conduit metaphor believes in the transparent quality.

As mentioned earlier, this study casts suspicion on the alleged objectivity, rationality, and neutrality of diagrams. As a theoretical basis of my critical stance in the study of diagrams, I take a mixed theoretical perspective that combines rhetoric, post-structuralism, and social semiotics. In this study, rhetoric serves as an overarching theoretical framework to investigate how diagrams persuade or affect viewers in particular ways and shape our attitudes, belief, values, knowledge, and even behavior. Post-structuralism also grounds this study as another theoretical perspective. Post-structuralist school of thought considers meaning as social construction, emphasizing readers’ active participation in meaning making processes. It also concerns issues of ideology and power in communication. These

assumptions underpin this study as well. Lastly, social semiotics also serves as another theoretical perspective of this study. Its emphasis on social context in communication and ideologies codified in material forms theoretically underpins this study as well.

CHAPTER 2. COMPARISON BETWEEN MODERNISM AND POSTMODERNISM

2.1. The Rationale for the Comparison

Paradoxically, the rhetoric of the seeming objectivity, neutrality, and rationality of diagrams is composed of two contradictory ideas or philosophies. On one hand, geometric, numerical, and abstract form of diagrams has its root in modernism, and the concepts, such as objectivity, neutrality, and rationality, also stem from modernist ideas. On the other hand, rhetoric is aligned with the poststructuralist or postmodern assumption that visual representations and communication involve value, intention, opinion, perspective, ideology and power. Therefore, the paradoxical nature of the central theme of this study demands exploration of the fundamental assumptions of modernism and postmodernism. By examining the foundational assumptions of the two contradictory philosophical grounds, I can situate the rhetoric of the seeming objectivity, neutrality, and rationality in the context of the two different philosophical or theoretical traditions. The theoretical backgrounds relevant to the theme of this study require exploration of modernism, postmodernism, and post-structuralism. Hence, I examine their fundamental assumptions and characteristics.

In general, it is difficult to define isms in a few words or single out common characteristics that apply to all theoreticians or practitioners involved in a particular ism. Among those isms, post-structuralism is one of the most slippery ones. David Macey (2001)

indicates that “the term ‘post-structuralism’ is used very loosely, and it is difficult to identify it with any specific school of thought. “DERRIDA, BAUDRILLARD, DELEUZE, LYOTARD, RORTY (capitalized by Macey) and the later Barthes could all be described as poststructuralists” (p.309). Post-structuralism is closely associated with postmodernism and deconstruction, and sometimes, they are used interchangeably. Regarding their close interrelationships, Macey claims that “poststructuralism is often equated with deconstruction, also with POSTMODERNISM in general” (p.309). Macey continues to state that postmodernism, “together with DECONSTRUCTION, has become one of the main themes of POSTSTRUCTURALISM (capitalized by Macey)” (p.305-306). Ellen Lupton (1996) also discusses their interrelationships; deconstruction “belongs to the broader critical field known as “post-structuralism,” whose key figures include Roland Barthes, Michel Foucault, and Jean Baudrillard” (p.7); post-structuralism “provided a critical avenue into “post-modernism,” posing an alternative to the period’s nostalgic returns to figurative painting and neo-classical architecture.” (p.7) As Macey and Lupton discuss, post-structuralism is usually regarded as an inclusive term that covers postmodernism and deconstruction as its two central strands.

“Post-structuralism both shares and rejects some of the basic propositions of structuralism” (Casey et al., 2007, p.274), and thus, comparing the two helps us understand basis premises of post-structuralism. Post-structuralism is still based on the basic assumption of structuralism advocated by Saussure that meaning is “structural and relational rather than referential” (Chandler, 2005, p.18). In other words, “primacy is given to relationships rather than to things (the meaning of signs was seen as lying in their systematic relation to each

other rather than deriving from any inherent features of signifiers or any reference to material things)” (p.18). Accordingly, from structuralist and post-structuralist point of view, meaning is not in the thing itself, but generated from the relationship among elements.

In addition, both structuralism and post-structuralism assume that “structures are privileged over and above individual purposeful action. The unobservable but detectable underlying structural relations underpinning the surface appearance of social reality are seen as determining social relations and social life” (Casey et al., 2007, p.273). Thus, from structural and post-structural perspective, “what at first appears to be ‘natural’ is in fact socially constructed” (p.273). The notion of socially constructed nature of reality, an essential premise of post-structuralism, is originated from the structuralists’ recognition that “language as a system does not reflect reality but rather, because we conceptualise social life through language, constructs our sense of reality” (p.273). “For writers such as Roland Barthes this is vital, because it points to the way in which meanings are constituted in society so that language is not a neutral and ‘innocent’ reflection of reality but the source of what he calls ‘myths’ or *ideology*” (p.273). Another basic premise of structuralism that derives from the previous discussion and shared by post-structuralism is that “social actors are not the authors of their intentions but are the products of structures, discourses and social relationships” (p.273).

On the other hand, what distinguishes post-structuralism from structuralism is that it rejects the existence of “universal and transcendent structures” (Drucker, 1994, p.5). Pointing out the structural linguistics’ inability to address the issue of “subjectivity” and “historical specificity,” Drucker (1994) criticizes structural linguistics’ “belief in universal and

transcendent structures” (p.5). Post-structuralists also refuse to accept the structuralist idea that meaning is stable within an underlying structure. “Following Derrida, post-structuralists see meaning as always being in a constant state of flux, rather than being final or fixed. For Derrida, texts are contradictory and the meanings they produce are both plural and fluid” (Casey et al., 2007, p.274).

In terms of the overall tendency, post-structuralism, postmodernism, and deconstruction stand in opposition to modernism. To understand the three associated terms, we should compare modernism and postmodernism first, since the philosophical and theoretical counterpart of modernism is postmodernism. Thus, I discuss central themes that characterize modernism and postmodernism through identifying five main characteristics of postmodernism, and also how the two opposing isms have been embodied in architecture and graphic design history, using some specific examples.

2.2. The Basic Relationship between Modernism and Postmodernism

There are different perspectives regarding what the “post” means, depending on how we interpret the “post.” The first interpretation is that the post signifies “linear periodization,” and therefore, it simply suggests that postmodernism is “a cultural era ‘after’ modernism. However, indicating the naivety of this temporal interpretation, Tim Woods (1999) argues that “the relationship between the two is clearly more complex than a simple linear model of historical development” (p.8). Paying attention to the modern aspects in postmodernism, he argues that postmodernism is “a *knowing* modernism, a *self-reflexive* modernism, a modernism that does not agonize about itself. Postmodernism does what

modernism does, only in a celebratory rather than repentant way. Thus, instead of lamenting the loss of the past, the fragmentation of existence and the collapse of selfhood, postmodernism embraces these characteristics as a new form of social existence and behavior” (p.8-9). Woods then concludes that the difference between modernism and postmodernism is “a difference in mood or attitude, rather than a chronological difference, or a different set of aesthetic practices” (p.9).

Hebdige (1988) also admits that the word, “post,” encourages us to see the relationship between modernism and postmodernism as linear periodization, arguing that to “say “post” is to say “past”, hence questions of periodisation are inevitably raised whenever the term “postmodernism” is invoked. However, he argues that “There is, however, little agreement as to what it is we are alleged to have surpassed, when that passage is supposed to have occurred, and what effects it is supposed to have had” (p.183). After pointing out “two artistic modernisms articulating different politico-aesthetic aspirations which remain broadly incompatible and non-synchronous” (p.183), the first one derived from Kant and the second that traces back to Hegel, he continues to discuss that if “the unity, the boundaries and the timing of modernism itself remain contentious issues, then postmodernism seems to defy any kind of critical consensus” (p.183). He then introduces how scholars, such as Lyotard and Merquior, define postmodernism. ³

³ According to Hebdige (1999), Lyotard points out three overarching tendencies in postmodernism, (i) a trend within architecture away from the Modern Movement’s project “of a last rebuilding of the whole space occupied by humanity, (ii) a decay in confidence in the idea of progress and modernisation, (iii) a recognition that it is no longer appropriate to employ the metaphor of the “avant garde” as if modern artists were soldiers fighting on the borders of knowledge and the visible, prefiguring in their art some kind of collective global future. On the other hand, Merquior defines postmodernism as (i) a style of mood of exhaustion of/dissatisfaction with modernism in art and literature, (ii) a trend in poststructuralist philosophy and (iii) a new cultural age in the West.

Woods' clarification of the relationship between modernism and postmodernism shares a common ground with Charles Jencks's notion of "double-coding." Jencks, an architectural critic, argues that his theory of postmodernism is a double-coding of modernism with other codes. With this notion, he discusses how postmodern architecture addresses "other architects and a concerned minority who care specifically about architectural meanings," and at the same time, "the public at large, or the local inhabitants, who care about issues of comfort and a way of life" (p.99). Serving as Jencks' key notion to summarize the gist of postmodern architecture, "double-coding" implies "*the combination of Modern techniques with something else (usually traditional building) in order for architecture to communicate with the public and a concerned minority, usually other architects*" (Jencks, 1987, p.14). As a result, postmodernism both incorporates and transforms modernism at the same time (Rose, 1991, p.176).

2.3. Main Characteristics of Postmodernism

To address central themes that characterize modernism and postmodernism, I identify five main characteristics of postmodernism; pluralism and eclecticism, anti-essentialism and incredulity toward metanarratives, skepticism about the stable and unified subject, anti-teleological tendency and the shift from center (author) to margin (reader), and anti-utopianism.

2.3.1. Pluralism and Eclecticism

Through the notion of “double-coding,” Jencks argues that postmodernism has “the essential double meaning: the continuation of Modernism and its transcendence” (Jencks, 1987, p.14). Because postmodernism simultaneously inherits from and surpasses modernism, it is in an ambivalent state. Postmodernism is “fundamentally the eclectic mixture of any tradition with that of the immediate past...” (Jencks, 1987, p.7). Jencks claims that this eclectic nature of postmodernism captures *pluralism* that is prevalent in postmodern society (p.7). He indicates that we are “entering a new period of world communications where literally hundreds of styles and ways of life will thrive simultaneously, cheek-by-jowl. They may not appreciate or understand each other. But tolerance, a respect for difference, an enjoyment of variety are *the* attitudes suited to the information age, and pluralism is its philosophy” (Jencks, 1991, p.19). Jencks (1987) builds on this argument; “I would even argue that ‘the true and proper style’ is not as they said Gothic, but some form of eclecticism, because only this can adequately encompass the pluralism that is our social and metaphysical reality” (p.20).

Pluralism is an essential term for describing postmodern philosophy, and it brings about eclectic and heterogeneous solution of postmodernism. “The characteristics of the Post-Modern come from its attempt to cut across the spectrum of tastes with a variety of styles: thus it seeks a *radical eclecticism*, or a multiple-coding, as well as the double logic I have already mentioned” (Jencks, 1991, p.13). A postmodern semiotician, Mark Gottdiener (1995), argues for the same nature of postmodernism; in sum, “while there is a general consensus that the “Modern Movement in architecture is dead,” the present represents a

disconnected *mélange* of different anti-modern styles. Clearly, it is the sheer nature of the present eclecticism that perhaps can be pointed to as the singular characteristic of postmodernism, rather than some articulated transcendent ideology. In place of some unified ideology we have, instead, a series of anti-modernist ideologies and anti-modernist design practices that celebrate eclecticism and the synthesis of styles (p.127).

Jencks' double-coding illustrates how postmodern architecture responds to pluralism in postmodern society. It is echoed by a postmodern architect, Robert Venturi, with the phenomenon of "both-and" and "complexity and contradiction" in postmodern architecture. As shown in Figure 1, 2, 3, and 4, giving examples of contradictory levels of meaning and use in postmodern architecture, Venturi argues for the inclusion of "both-and" over the exclusion of "either-or"; architects "can no longer afford to be intimidated by the puritanically moral language of orthodox Modern architecture." Venturi further mentions that "I like elements which are hybrid rather than "pure," "compromising rather than "clean," distorted rather than "straightforward," ambiguous rather than "articulated," perverse as well as impersonal, boring as well as "interesting," conventional rather than "designed," accommodating rather than excluding, redundant rather than simple, vestigial as well as innovating, inconsistent and equivocal rather than direct and clear. I am for messy vitality over obvious unity. I include the non sequitur and proclaim the duality. I am for richness of meaning rather than clarity of meaning; for the implicit function as well as the explicit function. I prefer "both-and" to "either-or"... But an architecture of complexity and contradiction has a special obligation toward the whole: its truth must be in its totality or its

implications of totality. It must embody the difficult unity of inclusion rather than the easy unity of exclusion. More is not less “(Venturi, 1966, p.22-23).

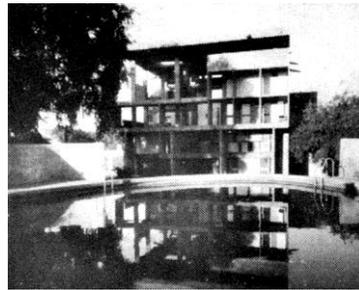


Figure 1. “Le Corbusier’s *Shodan House*”

It is “closed yet open – a cube, precisely closed by its corners, yet randomly opened on its surfaces (Venturi, 1966, p.30).”

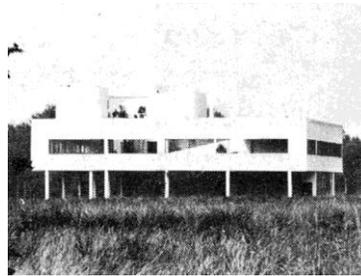


Figure 2. “Le Corbusier’s *Villa Savoye*”

It is “simple outside yet complex inside (p.30).”

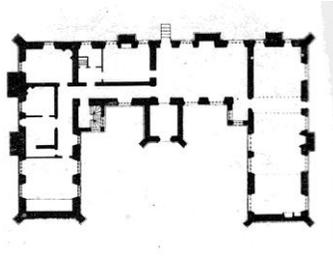


Figure 3. “The Tudor plan of Barrington Court”
It is “symmetrical yet asymmetrical (p.30).”

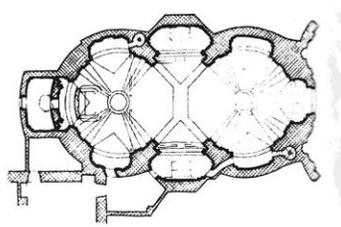


Figure 4. “Guarini’s *Church of the Immaculate Conception* in Turin”
It is “a duality in plan and yet a unity (Venturi, 1966, p.30).”

2.3.2. Anti-essentialism⁴ and Incredulity toward Metanarratives

Pluralism that characterizes postmodern society and eclectic responses to it, such as “double-coding” and “both-and,” reflect how modernism’s belief in the universal and totalizing principle has been shattered by the attack of postmodernism. A British writer on

⁴ Burr (1995) defines essentialism as “a way of understanding the world that sees things (including human beings) as having their own particular essence or nature, something which can be said to belong to them and which explains how they behave” (p.19). On the contrary, anti-essentialism believes that “there cannot be any given, determined nature to the world or people” (p.5). Thus, there are “no ‘essence’ inside things or people that make them what they are” (p.5). Anti-essentialism considers the world as “the product of social processes” (p.5), and is a key feature that describes postmodern, post-structuralist, and social constructionist line of thoughts.

graphic design, Rick Poynor, describes this nature of postmodernism in the following; for “postmodern thinkers, it is no longer possible to believe in absolutes, in ‘totalizing’ systems, in universally applicable values or solutions. They view with incredulity the claims of grand or metanarratives (2003, p.11). Hence, as Woods (1999) clarifies, “postmodernism seeks local or provisional, rather than universal and absolute, forms of legitimation” (p.11).

Jencks also argues that “all beliefs, or master narratives, become impossible in a scientific age, especially the role and ultimate legitimacy of science itself” (1987, p.36). “Hence the nihilism, anarchism and pluralism of ‘language games’ fight each other,” and “postmodern culture entails a ‘sensitivity to differences’ and a ‘war on totality’”⁵ (p.36). “Post-Modern is then defined as ‘a period of slackening’, a period in which everything is ‘delegitimised’” (p.36). A British media theorist and sociologist, Dick Hebdige’s (1988) argument about “antagonism to the “generalizing” aspirations“ also points to the anti-essentialist nature of postmodernism, a key feature distinguishing itself from modernism (p.186).

2.3.3. Skepticism about the Stable and Unified Subject⁶

“Pluralism and eclecticism” and “anti-essentialism and incredulity toward metanarratives” that I discussed as postmodern characteristics have an impact on how we view the issue of *a subject*. Modernism and postmodernism have two contrasting attitudes toward the issue of the subject. Woods (1999) discusses how postmodernism undermines the

⁵ “War on totality” is cited from Jean-Francois Lyotard’s *The Postmodern Condition: A Report on Knowledge* published by Manchester University Press in 1984.

⁶ I refer to Cartesian subject by the term “subject” here. The subject means an innate sense of ‘self’ that can provide a stable personal identity or be the focus of experience. (Macey, 2000, p.368)

unity and stability of the modern subject as follows; postmodernism “pits *reasons* in the plural – fragmented and incommensurable – against the universality of modernism and the longstanding conception of the human self as a subject with a single, unified reason” (p.9). In the tradition of modernism, the “subject is the space demarcated by the ‘I’, understood as a sense of identity, a selfhood which is coherent, stable, rational and unified. Based upon this sense of individuality, it is believed that people possess agency and can use their capacities to alter, shape and change the world in which they live” (p.9-10). Postmodernism has a skeptical attitude toward the so-called “unified subject,” arguing that postmodern theory is “suspicious of the notion of humans possessing an undivided and coherent self which acts as the standard of rationality, and guarantees all knowledge claims irrespective of time and space. It no longer believes that reasoning subjects act as vehicles for historically progressive change” (Woods, 1999, p.10). Hebdige (1988) summarizes this shift as “the “de-centering” of the subject” (p.182).

Along with the disbelief in the universal and totalizing principle that modernism firmly believes in, postmodernism casts suspicion on the viability of the modern subject as a unified and stable source of meaning and identity. Postmodernism does this by revisiting the core underpinnings of modernism as well as by undermining its authority and power. The skepticism about the stable and unified modern subject is a byproduct of the undermining process.

Not only the notion of subject but also the notion of author as a center of meaning is undermined by postmodern way of thinking. Under postmodernism, while the author’s authority is degraded, readers gain more power than before as active producers of meaning.

Barthes discusses this change through making his famous distinction between “work” and “text,” and between “the readerly” and “the writerly.” “Work” and “text” are synonyms of “the readerly” and “the writerly” respectively. “Whereas the work is a finished object, consisting of a body of writing enclosed within the covers of a book” (Young, 1991, p.31), the text “is a methodological field ... experienced only in an activity of production” (Barthes, 1977, p.157). Barthes defines “the readerly” as “a product consumed by the reader,” and “the writerly” as “a process of production in which the reader becomes a producer: it is ‘ourselves writing’” (Young, 1991, p.167). What Barthes puts more emphasis on is “text” and “the writerly.” Barthes (1974) mentions that “Why is the writerly our value? Because the goal of literary work (of literature as work) is to make the reader no longer a consumer, but a producer of the text.” (p.4) Barthes (1977) argues that the “author is a modern figure, a product of our society insofar as, emerging from the Middle Ages with English empiricism, French rationalism and the personal faith of the Reformation, it discovered the prestige of the individual, of, as it is more nobly put, the ‘human person’ (p.143). As a contrasting notion to the author, Barthes connects the notion of reader to the concept of text, arguing that “a text is made of multiple writings, drawn from many cultures and entering into mutual relations of dialogue, parody, contestation, but there is one place where this multiplicity is focused and that place is the reader, not, as was hitherto said, the author. The reader is the space on which all the quotations that make up a writing are inscribed without any of them being lost; a text’s unity lies not in its origin but in its destination” (p.148).

Hall’s (1997) notion of constructionist approach to meaning shares similarities with Barthes’s “text” and “the writerly.” While the other two approaches discussed by Hall,

“reflective” and “intentional,” back up a modern way of thinking, the constructionist approach underpins a postmodern way of thinking, positing that “neither things in themselves nor the individual users of language can fix meaning in language. Things don’t *mean*: we *construct* meaning, using representational systems – concepts and signs” (p.25).

Barthes’s notions of “text” and “the writerly” and Hall’s constructionist approach are all important for my study of rhetorical of diagrams, since this study is basically grounded in an assumption that the meaning of a diagram is not originated from the maker, but constructed by diagram readers. In order to build up a foundation for this assumption, we need such concepts as “text” and “the writerly” and the constructionist approach, since they enable us to assign an active role and power to readers who were not thought to have those in the past under modernism. In this study, I assume that diagram viewers are active participants in meaning making process and actually “write” diagrams.

2.3.4. Anti-teleological Tendency and the Shift from Center (Author) to Margin (Reader)

Hebdige (1988) indicates that postmodernism also holds skepticism about “the idea of decidable origins/causes,” describing this as “anti-teleological tendency” (p.190). According to him, the “rhetorical tropes which form the literary-artistic-critical means for effacing the traces of teleology are parody, simulation, pastiche and allegory” and all “those tropes tend to deny the primacy or originary power of the “author” as sole source of meaning ... and confine the critic/artist instead to an endless “reworking of the antecedent” in such a way that the purity of the text gives way to the promiscuity of the inter-text and the distinction

between originals and copies, hosts and parasites, “creative” texts and “critical” ones is eroded” (p.191).

Hebdige (1988) describes this shift in postmodernism as “the replacement of unitary power axes by a plurality of power/discourse formations” (p.182). Postmodern pluralism and conversion to marginality incapacitates the centralizing power of modernism grounded in grand narratives. This parallels the shift from author to reader, as discussed Barthes’ essay on *The Death of the Author* in his book *Image-Music-Text* (1977). Barthes indicates that the “author is a modern figure, a product of our society insofar as, emerging from the Middle Ages with English empiricism, French rationalism and the personal faith of the Reformation, it discovered the prestige of the individual, of, as it is more nobly put, the ‘human person’” (p.142-143). He also argues that thus “is revealed the total existence of writing: a text is made of multiple writings, drawn from many cultures and entering into mutual relations of dialogue, parody, contestation, but there is one place where this multiplicity is focused and that place is the reader, not, as was hitherto said, the author. The reader is the space on which all the quotations that make up a writing are inscribed without any of them being lost” (p.148). Then, he refocuses on his main point, the shift from author to reader, arguing that “we know that to give writing its future, it is necessary to overthrow the myth: the birth of the reader must be at the cost of the death of the Author” (p.148).

2.3.5. Anti-utopianism

Among three descriptors for postmodernism mentioned by Hebdige (1988), the last one is “anti-utopianism” (p.196). He criticizes modernism’s “blind faith in progress,

evolution, race struggle, class struggle, etc., which is itself a product of the deep metaphysical residue which lies at the root of Western thought and culture” (p.196).

Originally, modernism is based on “the eighteenth-century Enlightenment’s belief in the possibility of continuous human progress through reason and science” (Poynor, 2003, p.11).

This belief has played a centripetal role for supporting the modern grand narrative mentioned earlier. For example, the Pruitt-Igoe housing project ⁷ illustrates how modern architecture seeks to promote people’s good behavior through the good forms of modern architecture.

Jencks indicates that modernism’s “Purist style, its clean, salubrious hospital metaphor, was meant to instill, by good example, corresponding virtues in the inhabitants. Good form was to lead to good content, or at least good conduct; the intelligent planning of abstract space was to promote healthy behavior” (p.24). What lies under this project is the faith in utopian aspirations that human society can make progress and constantly evolve. Modern architects take an active role as “doctors, leaders, prophets, or at least midwives” to create a new social order (Jencks, 1991, p.34).

On the other hand, “where postmodernism differs ... is in its loss of faith in the progressive ideals that sustained the modernists” (Poynor, 2003, p.11). Postmodernism “represents a decline of faith in the keystones of the Enlightenment – belief in the infinite progress of knowledge, belief in infinite moral and social advancement, belief in teleology –

⁷ Pruitt-Igoe project is a famous example of why and how modern architecture ended in failure. “It consisted of elegant slab blocks fourteen storeys high with rational ‘streets in the air’; ‘sun, space and greenery’, which Le Corbusier called the ‘three essential joys of urbanism. It had a separation of pedestrian and vehicular traffic, the provision of play space, and local amenities such as laundries, crèches and gossip centres – all rational substitutes for traditional patterns“ (Jencks, 1991, p.23-24). In spite of its utopian ideal, buildings were “vandalized, mutilated and defaced by its black inhabitants,” and the crime rate was high. Finally, the project was blown up in 1972 since the attempts to fix those problems did not work out.

and its rigorous definition of the standards of intelligibility, coherence and legitimacy” (Woods, 1999, p.11).

So far, I have discussed some key differences between modernism and postmodernism by pointing out the five main characteristics of postmodernism. Although I pointed out the five characteristics as generic descriptors for postmodernism in general, which function as a common theoretical or philosophical ground for any kind of postmodern movement and practice, different disciplines have developed slightly different versions of postmodernism, depending on their particular situations and practices. Among many disciplines, my focus is on graphic design. Hence, I will discuss modern and postmodern graphic design with some specific visual examples.

2.4. Modern Graphic Design

In terms of central tenets, the faith in universality and objectivity underpins modern graphic design. As Lorraine Wild (1990), a graphic designer and design historian, describes, modern graphic design assumes that design is “*value-free, universal, obliged to reveal elemental truths...*” (p.30). In terms of formal characteristics, modern graphic design shows similar features as modern architecture does. As Harper (1999) describes, the International Style in graphic design “prescribes refined, uncluttered, grid-driven arrangements, an orderly sense of balance to the composition, clean white space, and clearly legible typefaces (predominantly Helvetica). The main objective of this school of thought is to present information in a structured, rational manner” (p.15). Hence, the formal characteristics of the highly organized modern design are to embody the belief that designers can achieve

universal and objective communication through the structured and rational forms. The spirit of the Enlightenment project based on the faith in universality and objectivity through reason and science had profound influence on shaping modern graphic design.

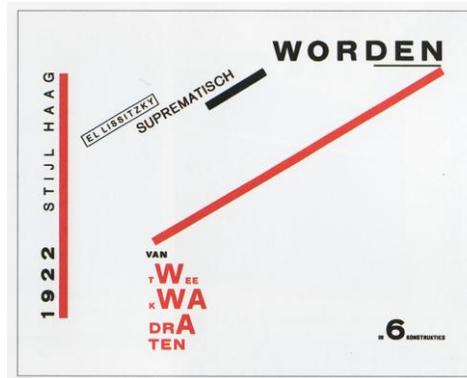


Figure 5. El Lissitzky's page design for *De Stijl* (1922)

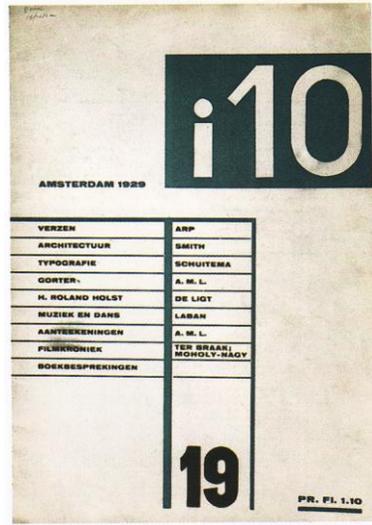


Figure 6. Laszlo Moholy-Nagy's cover design for *i10* (1927)



Figure 7. Jan Tschichold's cover for "Elementare Typographie" insert (1925)



Figure 8. Piet Zwart's advertisement for the Laga Company (1923)

The style of modern graphic design is philosophically influenced by De Stijl, a movement that “sought to create a universal language in the visual arts” that goes beyond any particular style (Hendrix, 2013, p.131). The reason for eliminating style and pursuing universality is that proponents of De Stijl thought that they could construct a utopian future through eliminating conflicts between interests, which are represented by styles (p.131). The elements chosen to embody a universal language are reduced and purified forms, such as horizontal and vertical lines, and primary colors. The notion of universality, not only in De Stijl but also in the modern graphic design, is also discussed by Padova (2002) who identifies “Humanity’s need to transcend the individual in order to evolve towards the universal” as a “constant theme of Mondrian’s writings” (p.4). He then contrasts the individual (i.e. the particular) identified with the natural to the universal with the abstract, mentioning that the

“most evident characteristics of De Stijl as style are a direct consequence of this opposition of the universal-abstract to the individual-natural: the straight line replaced the curve, the rectangular plane replaced the solid form, and the six ‘abstract’ colours (red, blue, yellow, white, grey and black) replaced ‘natural’ colour (p.4).

The notion of universality in modern graphic design and De Stijl is especially important in the study of diagrams, since diagrams also employ similar kinds of forms based on geometric shapes and limited colors, encouraging viewers to assume that they can be universally interpreted, and not subject to the cultural specificity and artifice of ornament or style.

In terms of typography, all the examples employ sans serif typefaces that take a mechanical and geometrical look. Lupton (1989) discusses that in “the twentieth century, sans serif typefaces have expressed the machine age: Traditional references to handicraft are stripped from the essential, geometric core of the alphabet” (p.153). Agreeing with Lupton’s argument, Diffrient asserts that sans serif is another medium to visualize the “barest and pristine essentials” (1990, p.10). As analyzed, the examples visualize the minimalist and reductivist vocabulary of forms employed by modern graphic design through their shapes, colors, typefaces, and compositions. Although four examples have been discussed here, they represent general features of modern graphic design artifacts. Accordingly, the discussions covered here apply to other modern graphic design artifacts as well. The reductivist and purified vocabulary of forms shows how modern graphic design seeks to accomplish universal and objective communication through employing essential components.

As modern architecture eliminates historicism, individualism, style, and decoration, so does modern graphic design in the process of distilling essentials from inessentials. By employing only the core essentials, modern graphic design strives to gain transparency and neutrality. In other words, modern graphic design does not call viewers' attention to its form, but to the message by employing the essentials only. Consequently, the form itself becomes transparent, and therefore, form functions as a transparent window through which readers read the message.

As mentioned earlier, in a modern framework, authors play a dominant role as a source of meaning. Communication is driven by authors, while readers passively receive the authors' message. If we bring this author-dominated framework of modernism to graphic design, clients whom designers serve are authors, and designers are translators or facilitators at best, who visualize their client's message on their behalf. Thus, a designer's role is to function as a transparent channel of the communication between their clients and readers.

With the author in the center of communication, modern graphic design assumes a singular reading of a graphic design artifact. Hence, designers' role is to clearly communicate the single message to readers, and in order to do that, they use purified and minimalist vocabulary of form. As a design critic, Poyner (2003), describes modern graphic designers' role as imposing "a single closed and restrictive reading," communication in the modern sense is a mechanical and one-way message delivery process from authors to readers. Through the communication process, authors and readers are assumed to share the same singular meaning of artifacts. Therefore, meaning is considered stable in this modern model of communication.

2.5. Postmodern Graphic Design

Postmodernism in graphic design has been described using various terms such as “deconstruction,”⁸ “Radical,”⁹ and “the new discourse.” In spite of the variety of terms, they all point to the same anti-modern aesthetic or philosophy in graphic design. In this study, I label the anti-modern aesthetic/philosophy as postmodern graphic design, and discuss its main characteristics.

First of all, postmodern graphic design casts suspicion upon the modern design’s faith in universality and objectivity in communication. Resisting “the faith in the scientifically predictable transmission of meaning” through one-way communication from author to reader, postmodern graphic designers assume that meaning is *constructed* between graphic design artifacts and readers (McCoy & McCoy, 1990, p.16). The constructed nature of meaning is closely related with the previously discussed notions such as “text” and “writerly,” since they enable us to assign an active role to readers in meaning making process by allowing them to “write” texts. As Harper (1999) indicates, postmodern graphic designers “reject the notion that it is possible for everyone, regardless of age, gender, culture, and background, to respond to and understand the same design vernacular in the same manner” (p.14). Since the notion of a singular reading is destabilized, there can be multiple interpretations of a singular design artifact by readers. As a result, while author’s authority is weakened, readers participate in

⁸ Ellen Lupton (1996) discusses post-structuralism and graphic design, focusing on the notion of deconstruction.

⁹ Naming designers such as David Carson, Zuzana Licko, Rudy Vanderlans, and Rick Valicenti, Laurel Harper (1999) talks about a controversial design genre that ignores or undermines the establishment’s view of good design, foregoing the traditional rules of legibility, orderly grids and columns, and logical information flow. She labels this design genre as “Radical” (p.12).

the meaning construction process as active agents. As a result, reader's role becomes more significant than before.

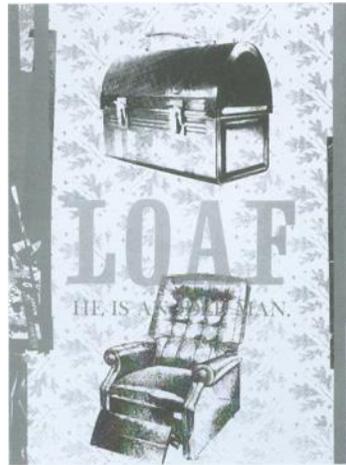


Figure 9. Scott Zukowski's *Loaf* Concept Poster (1986)

Scott Zukowski's *Loaf* Concept Poster in Figure 9 is a good example of multiple readings and readers' active interpretation. The lunchbox in the poster is a particular type of lunchbox that working class people used to carry. The reclining chair at the bottom reminds us of a working man who takes a rest, watching TV on the chair at the end of his day. The word "LOAF" means either "bread" in relation to the lunchbox or "being idle" in relation to the chair. Hence, the word "LOAF" interacts with the two visual images. Depending on what image it interacts with, the word is interpreted in two different ways. The poster not only has the verbal pun, but also a visual pun; the shape of the lunchbox looks like that of a loaf of

bread. Thus, the lunchbox can be also read as a loaf of bread. In addition, the two text-image relationships make a statement about social class distinction because the lunchbox and the chair point to working class people, raising the class distinction issue.

Therefore, each element in this poster carries a variety of possible meanings, and thus, this poster presents multiple interpretations. Furthermore, the possibility of multiple interpretations has significant implications for readers' roles. If there is no single meaning imposed by an author, readers are welcomed to explore multiple possible meanings of design artifacts. Accordingly, readers can play an active role in constructing meanings of design artifacts. In addition, the possibility of multiple interpretations has another significant implications in terms of destabilization of meaning, since multiple readings prevent us from finalizing the meaning of design artifacts.

While designers play a neutral role as a translator of clients' messages in modern graphic design, they gain their own voices, increasing their presence in postmodern graphic design. Rick Poyner (2003) discusses that the "emergence of the 'designer as author' is one of the key ideas in graphic design of the postmodern period" (p.118). In postmodern graphic design, designers gain a controlling position, and play a vital role as a generator of visual messages rather than merely serve clients. Due to diverse experimentation in postmodern graphic design, design draws attention to itself, and consequently, designers who create design works come to take the central stage. As a result, the line between art and design is blurred, and designers' artistic self-expression becomes an acceptable genre in graphic design.

As discussed earlier, postmodern graphic design recognizes the instability of meaning in communication as well as pluralism that comes from "the essential messiness and

ambiguity of the human condition” (Diffrient, 1990, p.11). Therefore, the notion of universal and objective communication becomes untenable under postmodern graphic design. With the new understanding of the nature of meaning and communication and the new recognition of human condition and reality, postmodern graphic design rejects the prescribed formal vocabulary of modern graphic design with limited range of expression. As Wild (1990) indicates, “notions of ‘correctness’ are negated, and a way of generating imagery without rules suddenly becomes viable” (p.35). For example, grid system that has been central to modern graphic design is criticized, and violated by many postmodern graphic designers. David Carson, a famous postmodern graphic designer, argues that “the rationalism of grid systems of other kinds of typographic formatting is ‘horribly irrational’ as a response to the complexity of the contemporary world” (Poynor, 2003, p.62). The emphasis on legibility and clarity of modern typography is undermined by layering, low legibility, and syntactical playfulness of postmodern typography.

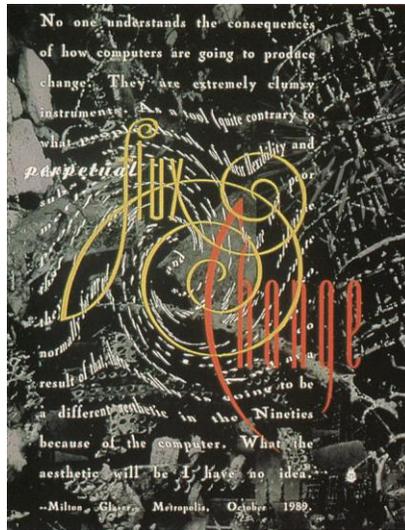


Figure 10. Margo Chase's *Perceptual Flux and Change* (1990)

In Margo Chase's *Perceptual Flux and Change* (Figure 10), legibility is sacrificed to visualize the dynamism of perceptual flux and change. The typography in Max Kisman's *Stay Tuned* (Figure 11) is illegible to the extent that it loses its status as a text to be read. The text looks more like an image than a text because of its low legibility and heavy layering. As the two examples illustrate, postmodern graphic design employs a rule-breaking graphic language by departing from ascetic reductionism and forced unity of the International Typographic Style.

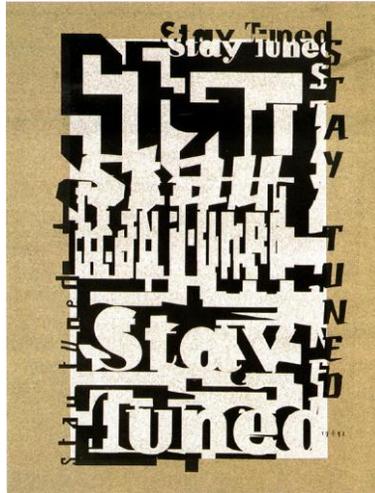


Figure 11. Max Kisman's *Stay Tuned* (1992)

In the pages from a scholarly design journal, *Visible Language* (Figure 12), designed by Richard Kerr and other designers, the conventional syntax of typography is deconstructed. The deconstructed typographic syntax is a maximized form of deviation from the modern typography, and approximately parallels the use of “irrational spaces” employed in postmodern architecture.

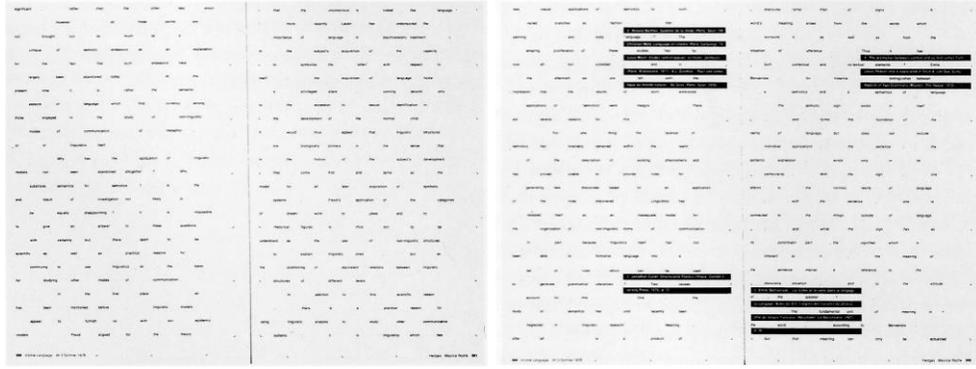


Figure 12. Journal, *Visible Language*, “French Currents of the Letter” (1978)

Another main characteristic of postmodern graphic design is the use of *vernacular images*. Departing from the International Typographic Style, postmodern graphic designers pay attention to vernacular images from our everyday lives. Wild (1990) argues that postmodern graphic design is characterized by “the use of material outside the realm of ‘correct’ graphic design, such as the vernacular” (p.35). For graphic designers in postmodern period, formal “refinement and elegance are no longer primary objectives” (McCoy & McCoy, 1990, p.16). As McCoy and McCoy (1990) describe, much of the postmodern work is “‘aformal’ and sometimes defiantly antiformal, perhaps in reaction to the technical perfection and stylistic mannerism of the professional mainstream of graphic design” (p.16-17). Hence, refinement and mastery are frequently rejected in favor of the directness of unmannered, hand-drawn, or vernacular forms (McCoy & McCoy, 1990, p.16-17). The inclusion of vernacular forms into graphic design leads to the synthesis of the high and low

visual culture (Wild, 1990, p.35), and breaks down the distinctions between designed and nondesigned typography (p.34).

Modern Dog Design's poster for *Syracuse University Presents* (Figure 13) adopts the vernacular images from circus broadsides to visualize their presentation style. Modern Dog Design's poster for the *Third Annual Rainy States Film Festival* (Figure 14) deliberately expresses the "rough" look through the handcrafted illustration in order to visualize the independent filmmakers who participate in this festival (Harper, 1999, p.109). In his poster *Stick* (Figure 15), Scott Clum intentionally breaks down and blurs the hand image and makes text illegible in a deconstructed way. Charles. S. Anderson's *Seinfeld*, a poster for *Entertainment Weekly* (Figure 16), is an intricate collage of vernacular images, mixed with product logos, packaging and other types of graphic ephemera (Poynor, 2003, p.89).

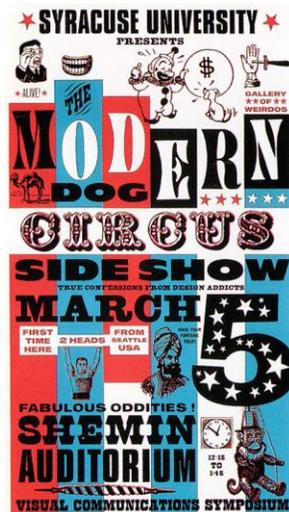


Figure 13. Modern Dog Design's *Syracuse University Presents* (1997)



Figure 14. Modern Dog Design's *Third Annual Rainy States Film Festival* (1997)

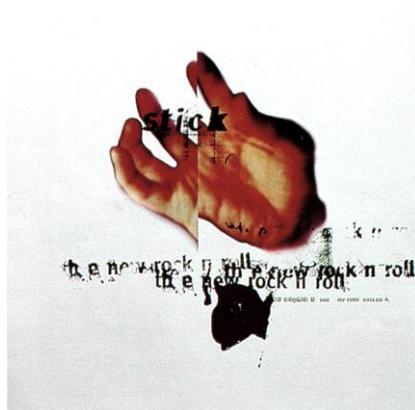


Figure 15. Scott Clum's *Stick* (1996)



Figure 16. Charles S. Anderson's *Seinfeld* (1998)

Postmodern graphic designers were influenced by critical theory and literary theory. For example, the Cranbrook Academy of Art is famous for its adoption of the post-structuralist theory and applying it to design practice. “The Cranbrook theorists’ aim, derived from French philosophy and literary theory, is to deconstruct, to break apart and expose, the manipulative visual language and different levels of meaning embodied in a design” (Poynor, 1991, p.9). Jeff Keedy is one of the students at the Cranbrook Academy of Art, who is credited with introducing fellow course members to post-structural and postmodern books, which flooded American art schools at the time (<http://www.eyemagazine.com/feature/article/the-academy-of-deconstructed-design>, accessed on Jul, 6 2013). Following Keedy’s lead, the Cranbrook graphic design students “began reading communications theories voraciously and focused on post-structuralist

language theory, literary theory and deconstruction” and “analyzed and debated how these ideas could be applied to graphic design in many critique sessions,” and they “gradually found ways to incorporate post-structuralist concepts into design strategies” that they all realized in design projects. (Vit & Gomez-Palacio, 2008, p.25)

As discussed so far, modernism and postmodernism have contrasting tendencies and assumptions about the nature of reality and how to understand reality as well as the nature of communication and meaning-making processes. Being located at the intersection of modernism and postmodernism, the issue of rhetoric of seeming objectivity, neutrality, and rationality in diagrams raises the fundamental question of this study. What happens when rhetorical dimension resides in the seemingly objective, neutral, and rational visual forms of diagrams? In other words, what happens when the seemingly objective and neutral visual forms of diagrams, crystallized from modern ideology, hide postmodern rhetorical infiltration? This paradox is the main point of this study to be investigated.

Taking the previously mentioned postmodern assumptions about the changed perception of readers as active producers of meaning and the constructed nature of meaning making as its ground, this study aims to see how viewers construct meaning from diagrams, especially focusing on what rhetorical significance they assign to diagrams on the basis of the formal qualities of diagrammatic elements or configurations. Based on the mixed theoretical framework previously declared as my critical stance, this study aims to examine what rhetorical significance they assign to diagrams on the basis of the formal qualities of diagrammatic elements or configurations.

CHAPTER 3. LITERATURE REVIEW

3.1. Introduction

This study is initial in the sense that there is little precedent that investigates a similar topic. Therefore, I draw theories and ideas from relevant intellectual traditions that can provide underlying assumptions for the research topic, the rhetoric of diagrams. There is no source available that particularly deals with diagrams. Nevertheless, since diagrams are a type of visual image, intellectual works relevant to the rhetoric of visual image in general can provide useful concepts and discussions. Thus, I examine them in order to theoretically ground this study. As noted earlier, the literature review is composed of two parts. I discuss theoretical concepts that constitute the lineage of the rhetoric of image first, and then, theoretical concepts that center on the rhetoric of neutrality.

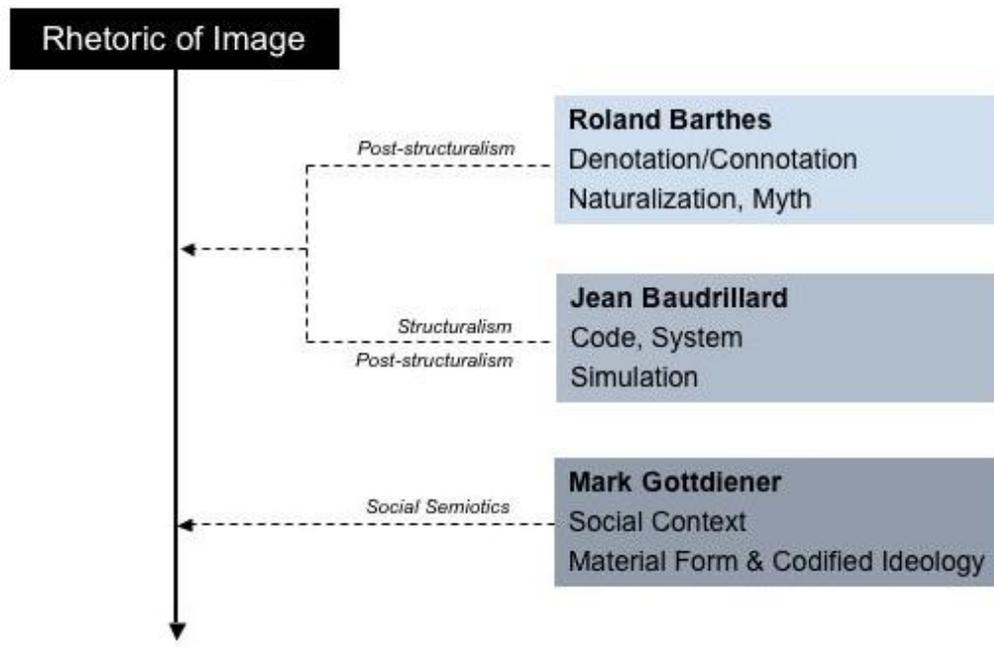


Figure 17. Diagram for the Lineage of the Rhetoric of Image

The first part of the literature review is a linear examination of scholars who provide key theoretical concepts or assumptions for the rhetoric of image. As diagrammed in Figure 17, the lineage of the rhetoric of image starts with Roland Barthes. He is the pioneer theoretician who opens the discussion of rhetorical and ideological dimension of visual images. As a theoretician and critic who went through a transition from a structuralist to a post-structuralist, he applied his methods of inquiry to studying visual images, such as photographs, magazine covers, and advertisements. With Barthes as a starting point, the theoretical lineage of the rhetoric of image can be drawn. Barthes' post-structuralist ideas

centering on the rhetoric of image are followed and further developed by Jean Baudrillard who mainly discussed code and system as core theoretical concepts, applying them to the description of interiors in a capitalist consumer culture. As theoreticians who belong to the genealogy of French post-structuralism, Barthes and Baudrillard are two central figures who provide theoretical frameworks for the rhetoric of image. Lastly, Mark Gottdiener, a semiotician, continued the lineage of the rhetoric of image, providing a social semiotic framework that mainly focuses on the analysis of the articulation between codified ideology and material forms. The progressive lineage of the rhetoric of image that starts from Barthes through Baudrillard to Gottdiener constitutes the first part of the literature review.

The second part of the literature review focuses on theoretical concepts from various disciplines, such as rhetoric, linguistics and graphic design, which can provide underlying assumptions for building up the “rhetoric of diagrams.” The key theoretical concepts from rhetoric are transparency and opacity,¹⁰ and looking through and looking at.¹¹ In a close relationship to the contrasting pairs of concepts, style and substance¹² is another useful pair of concepts that helps us build up the rhetoric of diagrams. Another theoretical concept is Michael Reddy’s “conduit metaphor”¹³ that comes from linguistics. A theoretical concept

¹⁰ *Transparency* refers to the quality of symbols (including language) that makes people who view a symbol to see the content of the symbol “through” the form of a symbol. In this case, the viewer is discouraged from viewing the form of the symbol because of its transparent quality. On the other hand, *opacity* refers to the quality of symbols that makes people who view a symbol to see the form of a symbol. Therefore, the viewer is encouraged to pay attention to the formal elements of the symbol in this case.

¹¹ *Looking through* refers to the way people treat symbols with an assumption that they are transparent. *Looking at* refers to the way people treat symbols with an assumption that they are opaque.

¹² By *style*, I mean formal elements of a symbol, and by *substance*, I mean content, meaning, or message of the symbol.

¹³ “Conduit metaphor” is a coined term by linguist, Michael Reddy, to refer to the role of language as a transparent channel for communication. This metaphor assumes that to communicate each other, people insert thoughts, meanings, and ideas into words, transfer the words to other people, and then, other people understand

from graphic design is Robin Kinross' rhetoric of neutrality, which serves as a focal point of the second cluster of the relevant theoretical concepts. In the following section, I discuss all these concepts together in the second part of the literature review, focusing on their closely related relationships.

3.2. The Lineage of the Rhetoric of Image

3.2.1. Roland Barthes

Barthes was the pioneer who explicitly used the term, rhetoric of image, as a title of his essay (1977), and initiated the discussion of rhetoric that resides in visual images. In other words, he provided a theoretical framework in which the rhetoric of diagram can be grounded. Barthes' main theoretical concepts that help us establish the rhetoric of diagram are naturalization and myth. As a basis of the theoretical concepts, he discussed two levels of meaning in images; denotative and connotative meaning. Barthes' distinction between denotation and connotation plays a critical role, not only in his own theory, but also in semiotics in general. The two terms describe different aspects of the meaning of an image; an image denotes a primary or dictionary meaning but also connotes a whole set of associated meanings (Macey, 2001). For Barthes, systems of signs articulate with cultural values or ideology as connotative codes. These produce richer structures of meaning than were assumed by Saussure (Gottdiener, 1995, p.15). Using photograph as an example, in his essay, *The Photographic Message*, he discussed that photographic images develop a supplementary message in addition to the analogical content itself, which is what is commonly called the

the thoughts, meanings, and ideas by extracting them from the words. In this model of communication, words are only a container of thoughts, meanings, and ideas.

“style” of the reproduction; a second meaning which consists of a certain “treatment” of the image (result of the action of the creator) as its signifier and a certain “culture” of the society – whether aesthetic or ideological – receiving the message as its signified (Barthes, 1977, p.17).

In short, photographic images comprise two messages: “a denoted message, which is the analogon itself, and a connoted message, which is the manner in which the society to a certain extent communicates what it thinks of it” (p.17). Barthes continued to argue that this duality of messages is “evident in all reproductions other than photographic ones: there is no drawing, no matter how exact, whose very exactitude is not turned into a style (the style of ‘verism’); no filmed scene whose objectivity is not finally read as the very sign of objectivity” (p.17). Hence, the discussion of denotation and connotation is not limited to photographic representation only, but can be applied to visual representations in general.

Barthes regarded this duality in images as the “photographic paradox” which creates “co-existence of two messages, the one without a code (the photographic analogue), the other with a code (the ‘art’, or the treatment, or the ‘writing’, or the rhetoric, of the photograph)” (p.19). He used the term, “paradox,” because the connoted (or coded) message develops on the basis of a message without a code. Accordingly, the connoted message can be “innocented”¹⁴ through the photograph’s denotation so that the connotation can assume so completely the ‘objective’ mask of denotation (p.21). This is how the typical process of

¹⁴ This term is originally from Barthes. By “innocent (an adjective or a verb),” I mean the state in which connotative message is masked by the objectivity and neutrality of denoted message (adjective), or the process of masking connotative message by the objectivity and neutrality of denoted message (verb). In other words, it is the process of hiding rhetorical or ideological dimension of something by objective and neutral mask of denotation, or the state accomplished by the process. The basic assumption under the term, “innocent,” is that the process of making something innocent is not possible.

“naturalization of the cultural” occurs (p.26). “*Naturalization*” means making the connotative message innocent through the objective and neutral mask of the denoted message. In other words, the rhetorical or ideological aspects that reside in the connotative message can become natural through this naturalizing process, and consequently, this prevents viewers from critically viewing rhetorical content embedded in images.

Through the naturalizing process, “the denoted image naturalizes the symbolic message, innocents the semantic artifice of connotation” (p.45). As Barthes himself argued, the duality of messages is evident, not only in a photograph, but also in all representations, and the naturalization process can occur in all representations more or less. Thus, it is possible to discuss naturalization in diagrams as well, since diagrams are a kind of reproduction that Barthes discusses.

Barthes’ other central concept, *myth*, was discussed in *Mythologies* (1977) through the example of a 1955 cover from the Paris Match magazine shown in Figure 18.



Figure 18. Cover Image of *Paris Match* (1955)

The image depicts a young, black soldier in French army uniform, saluting the French flag which is outside the frame of the picture. In addition to the first level of denotative meaning, Barthes argued that the image has a wider and cultural meaning. At this second level of meaning, the completed message in the first level is linked to a second set of signifieds – a broad, ideological theme about French colonialism, particularly in Africa. In other words, the first and completed meaning functions as the signifier in the second stage of the representation process, and yields a second, more elaborate and ideologically framed meaning (Hall, 1997, p.39). This is the process of how myth is created. In *Mythologies* (1972), Barthes claimed that myth is constructed from a semiological chain which existed before it, and therefore, it is a second-order semiological system (p.114). A sign in the first system becomes a mere signifier in the second (p.114).

Myth is closely related to naturalization. Barthes indicated that the “purely ‘denotative’ status of the photograph, the perfection and plenitude of its analogy, in short its ‘objectivity’, has every chance of being mythical” (p.19). In other words, through a naturalizing process, “denotative signs can be manipulated to hide connotative meanings by obscuring their historical origin and making them seem natural” (Macey, 2001, p.92). The continuous naturalizing process creates myth, and “myth has the task of giving an historical intention a natural justification, and making contingency appear eternal” (Barthes, 1957, p.142). “Society constantly uses the first system of human language to produce systems of secondary meanings, and the resultant accumulation of connoted signifiers solidifies into ideology” (Macey, 2001, p.91). Therefore, we can see how the previous discussion of naturalization develops into the discussion of myth, bringing up the issue of ideology. Barthes’ naturalization and myth shaped by naturalization that manipulate the seeming objectivity of denotative level of meaning are critical concepts that are applicable when we talk about the objectivity and neutrality of diagram and its potentiality as a medium that hides ideologies and manipulation. Although Barthes mainly focused his discussion of naturalization and myth on photographic images, he clarified that the concepts are applicable to visual representations in general. Thus, naturalization and myth are useful theoretical concepts that ground the issue of rhetoric of diagrams.

In addition, Barthes discussed the “important historical reversal” in the relationship between image and text (1977, p.25). In the traditional modes of illustration, “the image functioned as an episodic return to denotation from a principal message (the text)” (p.25). However, because of the reversal, “the image no longer *illustrates* the words; it is now the

words which, structurally, are parasitic on the image” (p.25). Barthes continued to discuss that “Formerly, the image illustrated the text (made it clearer); today, the text loads the image, burdening it with a culture, a moral, an imagination” (p.26). This shift is worth noting in studying the rhetoric of diagrams, since image, text, and the relationship between the two are related to reading diagrams.

3.2.2. Jean Baudrillard

Baudrillard also offered some useful concepts that provide theoretical ground for the rhetoric of image, and for the rhetoric of diagrams, the ultimate focus area of this study. Baudrillard began his academic career as a Marxist sociologist, but he gradually transformed himself into a neo-Marxist after realizing that Marxian theories fell short of explaining social changes happening in his time in France. Baudrillard’s earlier writings, *The System of Objects* (1968), *The Consumer Society* (1970), and *For a Critique of the Political Economy of the Sign* (1972)¹⁵, basically reflect his original position as a Marxist thinker, but, more importantly, show his efforts to overcome the limitations of classical Marxism.

In his first published book, *The System of Objects* (2005), Baudrillard described “the contours and dominant structures of the new system of objects,” and at the same time, indicates “how they condition and structure needs, fantasies and behavior” (Kellner, 1989, p.8). To do so, Baudrillard basically presupposed “the theory of the commodification of everyday life under capitalism advanced by Marxists like Lukacs and semiological theories in which objects are interpreted as signs which are organized into systems of signification”

¹⁵ The years in the parentheses, 1968, 1970, and 1972, indicates the years when each of them was published. What I actually cited from in the following are newer versions of them, 2005, 1998, and 1981.

(Kellner, 1989, p.8). Kellner (1989), one of the “third generation” critical theorists in the tradition of the Frankfurt School, indicates that “Baudrillard combines structuralist analysis of systems of objects with Freudian analysis of the hidden meanings in the life of objects and Marxist ideology critiques of dominant ideological legitimations of the consumer society” (p.9). In short, Baudrillard’s analysis in *The System of Objects* is based on the integration of Marxist theories such as commodification, semiological theories, structuralist theories, and Freudian analysis.

As Gottdiener (2003) indicates, in *The System of Objects*, Baudrillard “concerns himself with the way home furnishings and interior decoration have passed from an ersatz, subjective, and personalized activity to one that is highly regulated by a code of design and appearance based on the commodification of household interiors” (Gottdiener, p.39-40). In the beginning of the book, Baudrillard discussed the traditional furniture as having an emotional value, personifying human relationships, and being freighted with moral convention (Baudrillard, 2005, p.14-15). Then, he talked about the transition from the traditional furniture system to modern system, arguing as follows; in “their anthropomorphism the objects that furnish it become household gods, spatial incarnations of the emotional bonds and the permanence of the family group. These gods enjoyed a gentle immortality until the advent of a modern generation which has cast them aside, dispersed them – even, on occasion, reinstated them in an up-to-date nostalgia for whatever is old” (p.14).

While the traditional objects spatially incarnates cultural meanings such as emotional values, the permanence of the family group, and moral convention of the bourgeois, the

modern objects are stripped down to their most primitive essence, leaving nothing but one core element, function itself (p.16). Arguing the centrality of function in the modern objects, Baudrillard said, it “will be clear from the foregoing discussion of the values of interior design and atmosphere that the entire system is founded on the concept of FUNCTIONALITY. Colours, forms, materials, design, space – all are functional. Every object claims to be functional, just as every regime claims to be democratic. The term evokes all the virtues of modernity, yet it is perfectly ambiguous” (p.67).

To summarize, Baudrillard’s discussion of the traditional and modern furniture system provides a set of contrasts as shown on the left two columns in Table 1.

Table 1. Analogy between Modern Furniture System and Diagram System

		Furniture System		Diagram System
		Traditional	Modern	
Core Element		Sentimentality Cultural Connotations	Function	Function
	It embodies core element through	Style, Ornament, Illustrative Form	Pure and Basic Form	Simplified Form Based on Geometry

While traditional furniture incarnates sentimentality and cultural connotations through style, ornament, and illustrative form, modern furniture strips everything down to function through its pure and basic form. Function and pure form emphasized in the modern furniture system are similar to function and simplified form based on geometry in diagram system.

To further elaborate the notion of function central to the modern objects, Baudrillard compared how colors are conceived differently in the traditional system and the modern system. “In the traditional system colours have psychological and moral overtones” (p.30). Hence, “they are simply metaphors for fixed cultural meanings” (p.31). While colors have fixed meanings and value in the traditional system, in the modern system, they “lose their unique value, and become relative to each other and to the whole. This is what is meant by describing them as ‘functional’” (p.35). This relativity in the system is well explained with Baudrillard’s example of hot and cold colors. According to Baudrillard, both warm and cold tones are determined in their contrast between the two poles in the modern system. (p.37) “Functional warmth is thus a warmth that no longer issues forth from a warm substance, nor from a harmonious juxtaposition of particular objects, but instead arises from the systematic oscillation or abstract synchrony of a perpetual ‘warm-and-cold’ which in reality continually defers any real ‘warm’ feeling” (p.37).

As discussed above, the modern objects liberated from the traditionalism with its focus on the sentimentality, the emotional and subjective context of daily family life (Gottdiener, 2003, p.42), and fixed cultural meanings or values, are put in the *system of objects* through the emphasis on *function*. Therefore, functionality is a key notion that integrates the modern objects into a system of objects. As Baudrillard indicated, “‘functional’ in no way qualifies

what is adapted to a goal, merely what is adapted to an order or system: functionality is the ability to become integrated into an overall scheme” (p.67). In addition, Baudrillard applied structural theories to his discussion of the system of objects. Objects in the system are interpreted as signs which are organized into systems of signification. Through this application, Baudrillard added semiological and structural dimension to the Marxist theory of commodification in his discussion of the system of objects. As Baudrillard stated, “the coherence of the functional system of objects depends on the fact that these objects – along with their various properties such as colour, form, and so on – no longer have any value of their own, but merely a universal value as signs” (p.67-68).

In the conclusion of *The System of Objects*, Baudrillard connected the objects as signs in a system with his other important concept, *consumption*, which is the central notion of his second book, *The Consumer Society* (1998). Defining consumption as “an activity consisting of the systematic manipulation of signs” (p.218), he argued that consumption is not a material practice but defined, rather, by the organization of all these things into a signifying fabric (p.218). “So what is consummated and consumed is never the object but the relationship itself, signified yet absent, simultaneously included and excluded; it is the idea of the relationship that is consumed in the series of objects that displays it” (p.219).

As the title implies, Baudrillard’s second book, *The Consumer Society* (1998), focuses on the notion of *consumption* as an underlying “mode of social activity” (Kellner, 1989, p.15) that replaces *production* (the central notion of the classical Marxism), on the basis of “the conviction that a deeper understanding of consumption is needed to comprehend the fundamental dynamics of neo-capitalist societies” (p.12). Baudrillard described that in the

consumer society consumers are “induced to buy into an entire system of objects and needs through which one differentiates oneself socially, yet integrates oneself into the consumer society” (p.15). As Keller (1989) indicates, “Baudrillard suggests that this activity can best be conceptualized by seeing the objects of consumption as signs and the consumer society as a system of signs” (p.15). Thus, the notion of modern objects and the system that are mainly discussed in *The System of Objects* can be integrated with the notion of consumption in *The Consumer Society*. By integrating the concepts from the two books, the continuous purchasing behavior of consumers in the capitalist society can be attributed to their desire to complete the system of objects. In spite of the desire for completion, consumers can never complete the system of objects because capitalist society induces the consumers to continuously want to buy more and more objects by constantly changing color or design of the objects.

As Kellner (1989) points out, in *For a Critique of the Political Economy of the Sign* (1972), Baudrillard started distancing himself from Marxism, incorporating semiological theories as his main framework. Regarding this shift, Kellner (1989) discusses that whereas “in his first two books Baudrillard resisted interpreting the consumer society as a linguistic system, as a language, in his collection of essays *For a Critique of the Political Economy of the Sign*, he appropriates Saussure’s semiological theory of language, which conceptualizes language as a differential system of signs, for his analysis of the system of commodities” (p.21). As Poster (2001) argues, just “as Marx exposed the strategy behind the theory of the commodity in political economy, Baudrillard did the same for the theory of the sign by undermining the formalism of the theory of the sign” in this work (Poster, 2001, p.3).

Baudrillard added the notion of *sign value* to *use value* and *exchange value* that Marxists focus on in their commodity analysis. In “The Ideological Genesis of Needs,” Baudrillard described “development of 1. A functional logic of use value; 2. An economic logic of exchange value; 3. A logic of symbolic exchange; 4. A logic of sign value ... Organized in accordance with one of the above groupings, the object assumes respectively the status of an *instrument, a commodity, a symbol, or a sign*” (Baudrillard, 1981, p.66). Through this development process, Baudrillard revealed that “Marx’s analysis of commodity fails to address ‘sign value’,” which is the key concept in *For a Critique of the Political Economy of the Sign* (Kellner, 1989, p.22). The emphasis on sign value “provides answers to “why commodities become such objects of desire, and fascination, why certain types of consumption take place (as, for example, conspicuous consumption), why certain commodities are preferred to others, and why consumption can take on such an important function in contemporary capitalist societies. The theory of sign value, Baudrillard argued, combined with what he called a ‘political economy of the sign,’ explain these phenomena by pointing out that socially constructed prestige values (sign values) are appropriated and displayed in consumption” (Kellner, 1989, p.24-25).

Barthes (1983), in his book *The Fashion System*, separated clothing into three entities, image-clothing (the garment presented to us as photographed or drawn), written-clothing (the same garment described and transformed into language), and real clothing (p.3-4).¹⁶ His distinction between functions of image-clothing and written clothing within representation is worth noting, since discussion of image and text in fashion photographs is useful for our

¹⁶ They are also described as the iconic structure, the verbal structure, and the technological structure, respectively.

understanding the image and text in diagrams. “Image-clothing provides the potential user with a ‘stencil’ of the real garment and, at the same time, inflects these traces of the real garment in an aesthetic direction. The image performs a mimetic function as well as making the garment into a pleasing sight, or pleasant arrangement” (Carter, 2003, p.150). For those reasons, “the image makes the purchase unnecessary, it replaces it; we can intoxicate ourselves on images, identify ourselves oneirically with the model, and, in reality, follow Fashion merely by purchasing a few boutique accessories” (Barthes, 1983, p.17).

On the other hand, according to Carter (2003), “Barthes argues that the presence of language ‘immobilizes perception’, and so ‘imposes on the reading of the image a fixity of meaning’ which the image, by itself, cannot achieve. It is language that brings about a closure to the meaning of the image and it is the task of written clothing to finally urge the represented garment of the ‘ghost’ of any lingering materiality” (p.150). Barthes (1983) also argued that speech “rids the garment of all corporal actuality; being no more than a system of impersonal objects whose mere assemblage creates Fashion, the described garment encourages the purchase” (p.17).

Barthes further argued that “the described dress and the photographed dress are united in the actual dress they both refer to” (p.4), but they are not identical to the actual dress, since there is difference of structure between the two garments and the real one, requiring a “transition to other substances and other relations” (p.4). Barthes argued that “the real garment forms a third structure, different from the first two” (p.4). Barthes (1983) discussed that the two garments in fashion magazines, image-clothing and written clothing, “which enable and articulate fashion’s symbolic value, are most easily and widely consumed than the

real thing ... they are also generating objects of consumption, a fashion commodity that coexists with but also exceeds the material object” (Tu, 2011, p.106). In other words, what are actually consumed by people are the two garments rather than the real clothing itself.

One of the most important theoretical concepts discussed by Baudrillard is *code*. Although he did not clearly or systematically define the meaning of code, it is worth looking at how he described the term and what it means in relation to diagram. According to Kellner (1989), code in Baudrillardian sense usually “refers to the structure of the entire system of political economy in which all commodities are assigned certain sign values through the system as a whole” (p.29). In his earlier writings, Baudrillard generally used the term, code, to “stand for the system of political economy as a whole and the rules and the hierarchies through which differences and sign values of commodities are produced and regulated” (p.29). In other words, “the code manages the exchange of values just as language manages the interplay of signifier and signified” (p.23). In short, Baudrillard viewed the code as “an overarching regulative principle or system that determines the relative prestige or sign value of commodities” (p.30). The argument that code is a regulative rule or system, and attaches a certain value to a certain commodity should be noted in Baudrillard’s definition of code.

Originally, code is a widely discussed concept, especially in linguistics and communication. A communication theorist, David Berlo (1960), defines code as “any group of symbols that can be structured in a way that is meaningful to some person” (p.57). He claims that languages are codes because they have “a group of elements (a vocabulary) and a set of procedures for combining those elements meaningfully (a syntax)” (p.57). Daniel Chandler (2002), a semiotician, defines code as “a set of practices familiar to users of the

medium operating within a broad cultural framework,” arguing that the “conventions of codes represent a social dimension in semiotics” (p.147-148). A communication and media theorist, John Fiske (1987) defines code as “a rule-governed system of signs, whose rules and conventions are shared amongst members of a culture, and which is used to generate and circulate meanings in and for that culture” (p.4). In addition to the definition, Fiske presents an interesting argument about code in relation with our understanding of reality. He argues that “‘reality’ is already encoded, or rather the only way we can perceive and make sense of reality is by the codes of our culture. There may be an objective, empiricist reality out there, but there is no universal, objective way of perceiving and making sense of it. What passes for reality in any culture is the product of the culture’s codes, so “reality” is always already encoded, it is never “raw” (p.4-5).

Synthetically, in spite of the various contexts in which code is situated, the definitions of code that have been discussed so far have a common assumption that code is a kind of rule or principle that integrates individual components in a system so that people can communicate through the shared rule or principle. Baudrillard argued that code attaches a certain value to a certain component in the system, and Fiske discusses ideological dimension of code, claiming that reality is only perceived and understood through code which is produced under culture of a society.

The notion and role of code discussed so far have a significant implication for understanding diagrams. Experiencing the reductionist visual vocabulary and excessive attachment to function under Modernism, people have constructed the code of what visual form should look like. In addition, under the notion of system, people have learned that

everything should have similar attributes, since they are all parts of a unified system.

Through the modern visual form stripped down to the most basic elements for universality and objectivity, people have learned that the form is neutral and value-free. Thus, whenever we look at geometric form of diagrams, we associate it with the code of modern visual form, and consider it as neutral and value-free. Because the code of the reductivist form was created in our mind under modernism, modernism has associated meanings, and we attach all the meanings of universality, objectivity, and neutrality that we used to encode to modern visual form in the past to diagrams. In other words, meanings have been transferred through codes.

Another important aspect of code in relation to graphic forms is that it triggers our expectations and guides our behavior. Because we are used to the modern visual form and have already created a code of it in our mind, we bring up the code whenever we encounter a similar form like diagrams, and have a certain expectation about the form. In addition, code guides our behavior in the sense that the code of modern interior system induces us to complete the system by purchasing furniture that we need to complete the system. Thus, a certain code of graphic form can have some associated meanings in it, and the meanings can be attached to other diagrams by sharing the code. Also, the code of the graphic form can trigger certain expectations and guide our behavior. For example, we attach the code of seriousness and trustworthiness more to The New York Times than to the USA Today, and therefore, readers who pursue high intellectuality and in-depth discussions of issues read The New York Times.

Charles Kostelnick (2003), a professor of English, discusses the notion of “conventional codes,” which is synonymous with code. He argues that design forms “operate within a universe of conventional codes that, with continual exposure, profoundly mediate our interpretation of visual language” (p.12). Therefore, “we interpret design with our accumulated knowledge of conventional forms – libraries, malls, churches, skyscrapers, computers, TVs, clothes, cars – and we draw on these experiences to interpret new forms that we encounter” (p.12). He also talks about several characteristics of the conventional codes. He indicates that “we can’t easily escape the presence of these codes (conventional codes) – or their power to enculturate us” (p.12), but the conventional codes “constantly change - emerging, evolving, mutating, metamorphosing, receding...” (p.119). Hence, code is ingrained to us, but it is not a fixed thing but changes over time.

In *Simulacra and Simulation* (1994), one of his later writings, Baudrillard took his key notions such as sign and code to the extreme by describing a society governed by signs and codes (Kellner, 1989, p.63). According to Baudrillard, in “the new postindustrial, postmodern era, the model or code structures social reality, and erodes distinctions between the model and the real. Baudrillard (1994) discussed that “nothing separates one pole from another anymore, the beginning from the end; there is a kind of contraction of one over the other, a fantastic telescoping, a collapse of the two traditional poles into each other: implosion – an absorption of the radiating mode of causality, of the differential mode of determination, with its positive and negative charge – an implosion of meaning. That is where simulation begins” (p.31). Using McLuhan’s cybernetic concept of implosion, Baudrillard claimed that in the contemporary world “the boundary between representation

and reality implodes, and that, as a result, the very experience and ground of ‘the real’ disappears” (p.31).

Hence, simulation comes from where representation and reality implode. Simulations create self-referential signs which have no reality to refer to, and this self-referentiality of signs is an important feature of post-structuralism. As Kellner (1989) indicates, Baudrillard’s theory of simulations is parallel in some ways to post-structuralist critiques of referentiality, in that for Baudrillard there is nothing outside the play of simulations, no ‘real’ in which theory can be grounded or radical politics reconstructed” (p.90). In short, his theory of simulation takes to the extreme of certain poststructuralist positions about language, reference and the absence of ‘the real’” (p.90).

3.2.3. Mark Gottdiener

Mark Gottdiener (1995), a semiotician, continued the lineage of the rhetoric of image with social semiotic theoretical framework. Borrowing from the work of a semiotician, Umberto Eco, who extended the ideas of Peirce, and the decomposition of the sign devised by the Danish linguist, Louis Hjelmslev, Gottdiener developed a socio-semiotic model of a sign for the purpose of illustrating how ideology articulates with material forms (p.27). As Baudrillard focused on capturing the fundamental relation between ideology and materiality in *The System of Objects*, “the main goal of social semiotics is to examine how ideologies, like modern styles of furniture, are engineered into material forms. Social semiotics takes this as its fundamental analytical understanding of social life” (Gottdiener, 1995, p.49).

Overcoming limitations of the traditional semiotics, social semiotics suggests some underlying assumptions that help us build up the rhetoric of image. First, it emphasizes material form of signs by drawing from the Peircian semiotics that assumes the existence of a material world. Hence, the social semiotic model of a sign provides a framework to analyze or critique design artifacts that always involves material forms. Second, social semiotics considers social context in which a sign is situated. “The social context includes exo-semiotic processes of economics and politics which are often neglected by both semiotics and symbolic interaction” (p.67). Third, the main goal of social semiotic investigation is to see how ideologies are codified into material forms. Gottdiener summarized the advantages of social semiotics as follows; only socio-semiotics tries to account for the entire three-way complex of material forms, the articulation of codified ideology (the form of the content), social context (the substance of the content and its “pre-signifiers”), and material forms (the substance and form of the expression) (p.74). Since the goal of this study is to examine what rhetorical significance viewers assign to diagrams on the basis of the formal qualities of diagrammatic elements or configurations, the entire three-way complex of material forms, codified ideology, and social context is a useful theoretical framework to be applied in studying the rhetoric of diagrams.

3.3. Rhetoric of Neutrality and Relevant Theoretical Concepts

The second part of the literature review moves its focus on theoretical concepts from various areas such as rhetoric, linguistics, and graphic design that can build up the notion of rhetoric of diagrams. The theoretical concepts that I will discuss in this section have a close

relationship with one another, centering on the notion of the “rhetoric of neutrality” proposed by Robin Kinross. I will first discuss what his notion of the rhetoric of neutrality means, and discuss other similar concepts centering on it. Then, I will build up the notion of the rhetoric of neutrality as a theoretical framework to investigate diagrams by integrating all the relevant theoretical concepts.

3.3.1. Rhetoric of Neutrality

The notion of *rhetoric of neutrality* is proposed by a graphic designer, Robin Kinross (1984). Discussing the rhetorical aspects in British and Dutch train timetables as a representative example of information design in general, he demonstrates that the belief of modern design in neutrality is untenable. He argues that nothing is free of rhetoric, since “visual manifestations emerge from particular historical circumstances,” and therefore, “ideological vacuums do not exist” (p.143). Borrowing the term, “interlarding,” from Gui Bonsiepe (1999), a graphic designer and design theoretician, who also talks about the issue of rhetoric in graphic design, Kinross indicates how information is “interlarded with rhetoric to a greater or lesser degree” (p.131). Hence, pure information “exists for the designer only in arid abstraction. As soon as he begins to give it concrete shape, to bring it within the range of experience, the process of rhetorical infiltration begins” (Bonsiepe, 1999, p.170).

Kinross uses the phrase, rhetoric of neutrality, not only as the title for his essay, but also the core concept to develop his argument. Concluding his essay, he states that so “one arrives again at the rhetoric of neutrality. If nothing can be free of rhetoric, what can be done

to *seem* free of rhetoric? The style (for such it was) of the HfG Ulm¹⁷ was one response” (Kinross, 1984, p.143). By this, he means that the style of the HfG Ulm, one of the representative centers of modern design, embodies what seemingly looks free of rhetoric, in other words, the rhetoric of neutrality. Yet, his argument is that not only information design but the entire area of graphic design is always infiltrated by rhetoric, making the goal of modern design, the possibility of universal, objective and neutral communication, something unattainable. Indeed, he uncovers the rhetoric of neutrality underlying the mask of universality in information design and modern design.

3.3.2. Transparency/Opacity and Looking through/Looking at

James Jasinski (2001), a rhetorician, discusses that the concept of *transparency* comes from critics’ persistent tendency to “*look through* the text rather than fix their analytic gaze on it” (p.591). In other words, our habitual inclination to look through the text, overlooking the surface of the text to be looked at, treats the text as though it were transparent, and therefore, invisible to us. As a result of this, we concentrate on the content of the text. Although Jasinski’s definition of the term mainly deals with the case of text, transparency is a widely applicable notion that goes beyond the realm of text. He confirms this applicability by emphasizing that “the idea of the transparent text is not unique to the field of rhetorical studies; it has deep roots in American thinking about political discourse and rhetorical style” (p.591).

¹⁷ “HfG Ulm” stands for the “Hochschule fur Gestaltung Ulm” which was a design institution set up in the early 1950s to continue the Bauhaus tradition.

Donald S. Lee (1982), a professor in philosophy, also discusses the notion of transparency, broadening the range of application to symbols in general. Pointing out the transparent quality of a symbol, he also says that “transparency is a matter of seeing “through” the symbol to something else” (p.126). He then regards transparency as a medium that exists between the seer and the seen object, separating them from each other. At a glance, his comparison of the transparency to the medium seems contradictory to the very notion of transparency itself. Nevertheless, the comparison makes sense, since text and symbol are media between the reader and meaning of the text, or the seer and the seen object. This becomes more obvious with the notion of *opacity* which is the counterpart of transparency. Lee continues to discuss that as “*purely* transparent its physical presence has no important effect on that which is seen. If the medium creates an effect by distortion or opacity, then to that extent it falls short of transparency” (p.126). In short, transparency and opacity are the inverses of each other.

Lee’s discussion of transparency and opacity is further developed by Richard Lanham (2003), a rhetorician, who discusses the two notions in conjunction with the notion of *looking through* and *looking at*, and the issue of *style*. He opens his own discussion with Aristotle’s notion of *clarity*. Aristotle (1984) claims that style “to be good must be clear, as is proved by the, fact that speech which fails to convey a plain meaning will fail to do just what speech has to do” (1404b). Lanham (2003) indicates that the “long-standing argument for styles that don’t show, that are not noticed” (p.189) originated from Aristotle’s concept of clarity. On the basis of clarity, the ideal role of style is to convey a meaning or content naturally, minimizing verbal distortion. Thus, clarity becomes “synonymous with “transparency”” (Lee,

1982, p.413). Emphasizing the concept of clarity, according to Lanham, Aristotle advocates “the transparent and neutral theory of language” (Lanham, 2003, p.191; p.206). For Aristotle, the language should be transparent or invisible, and subsequently, make the contents as clear as possible. According to Lanham (2003), Aristotle reduces the issue of style to “a simplistic on-off switch” of “at” and “through” (p.205). As a result, Aristotle’s theory has produced and disseminated a dichotomized set of concepts – at/through, style/content, medium/message – that still dominate our way of thinking today. According to Lanham (2003), Aristotle even raises the set of concepts to the ethical dimension by equating unnoticeable style and noticeable style with virtue and vice (p.191).

Aristotle’s discussion of style has something to do with the modern assumption about style. The modern notion that style has suspicious origins, and therefore, should be avoided, is an extension of the Aristotelian theory of style that imposes virtue on the unnoticeable style. As mentioned earlier in the discussion of modernism and postmodernism, modernists try to get rid of all historical references and decoration that create a particular style. In doing so, they think that they can accomplish neutrality. The modern visual vocabulary that strips everything down to the most basic elements, function, and a core structure, succeeds to the anti-stylistic philosophy that starts with Aristotle.

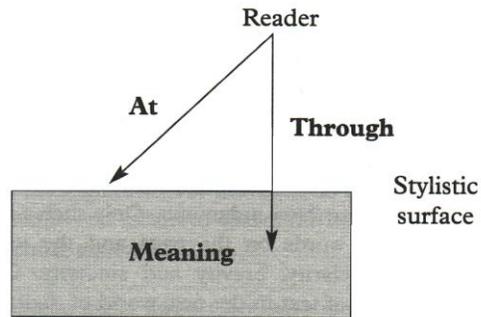


Figure 19. Lanham's Diagram for Looking At/Through from *Analyzing Prose* (2003), 192

Lanham adopts the notion of looking Through and looking At, which is an age-old distinction made by many other theorists, including Aristotle (Figure 19). However, he rejects the Aristotelian dualistic approach to the concepts. Lanham questions Aristotle's moralized dichotomy of transparency/opacity, and looking Through/looking At with nothing in between. He argues that the "harsh simplicity of the At/Through choice reveals a fundamental truth about how we read. Yet it is not the whole truth. Our response to a verbal surface varies in self-consciousness by degree, too; it does not simply click on or off" (Lanham, 2003, p.193). He finds a way to resolve the problem of Aristotle's simplified model, suggesting "a spectrum of self-consciousness for verbal styles which measures the whole ranges from transparent to opaque" (p.193) as shown in Figure 20.

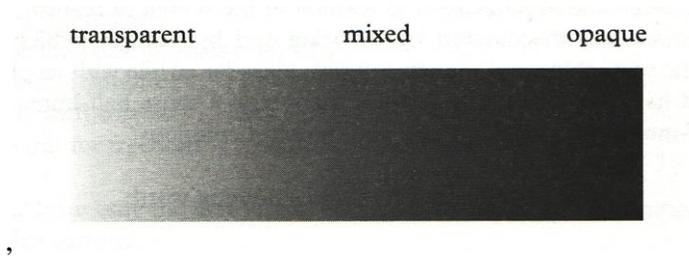


Figure 20. Lanham's Spectrum of Self-awareness for Verbal Styles from *Analyzing Prose* (2003), 193

Based on the spectrum in Figure 21, Lanham builds up a more complex matrix that consists of the level of “text” and “perceiver” as shown in Figure 21.

	Transparent	Opaque
Text	(prose; nonfiction)	(poetry; fiction)
	Through	At
Perceiver	(common reader)	(critic)

Figure 21. Lanham's Matrix of Transparency/Opacity and Through/At from *Analyzing Prose* (2003), 209

Lanham states that the “matrix provides a framework for plotting both of these form/content definitions and reconciling them. At the transparent side of the matrix, form and content are

totally discrete” (Lanham, 2003, p.217). So, for example, literary genres, such as prose or nonfiction, illustrate transparency. “At the opaque extreme, form and content are one. Since the perceiver is looking At the verbal surface and not Through it, that surface is the content” (p.217) This is why the formal surface level in poetry plays a critical role. “On the text spectrum, an opaque, style is the subject, the thing imitated and gazed at, the referent reality. Language has become its own subject, maximized its self-conscious self-reference” (p.217). Regarding the perceiver spectrum, we can choose to look at a style, thus become literary critics rather than common readers, and vice versa (Lanham, 2003, p.209).

3.3.3. Style/Substance

As noted so far, the discussion of transparency/opacity, and looking through/at ultimately bring us to a more fundamental issue of *style* and *substance*. On top of the two pairs of concepts that have been discussed so far, Blauvelt indicates that the dualistic position is embedded in the pair of style and substance as well. He discusses that debates “about style usually invoke dualisms such as form/content and style/substance” (Blauvelt, 1995, p.64). As Lanham replaces Aristotle’s dichotomous model with the spectrum of transparency and opacity, Blauvelt also criticizes the dualism between style and substance. He argues that these “artificial dichotomies divorce the terms from one another, giving the mistaken impression that there is form independent of content, or style in lieu of substance. In fact, since each term is married to the other, a relationship must be established and the terms negotiated” (p.64). In other words, he emphasizes this inseparability of form and content, and

style and substance, claiming that “form is legitimized on the basis of content – form is truthful or aesthetically valid when it faithfully represents content” (p.64).

He further explains that “the distrust of style as false, shallow and meaningless” goes back to modern functionalism (p.64). The modern notion of “style that diverts us from the truth with its seductive surface” has indoctrinated us. Arguing that the “Modernist notion of deceptive forms (style) on the surface and essential contents (substance) at the core is outmoded for contemporary graphic design” (p.64), he asserts that the dichotomy based on modernism needs to be reconsidered and our prejudice about the concept of style, form and content needs to be reconfigured. Refusing the modern antipathy against style, he argues that style is “not governed by functionalism’s desire to reflect an internal truth. Style engages us on the surface – it is about appearance – but this surface is neither the glossy reflection of adoring consumers seduced by their own image nor a layer of camouflage hiding the truth. Rather, style is an outward sign of difference that gains its uniqueness in relation to other styles” (p.66). Hence, his definition of style as “a code of communication, not for the transparent reflection of content but as a signifier of taste” (Blauvelt, 1995, p.68) rehabilitates the long-ignored importance of style by breaking down the dichotomy between style and substance.

Lanham also discusses the issue of style and substance in *The Economics of Attention: Style and Substance in the Age of Information* (2006). First, borrowing from an economic framework of allocating scarce resources,¹⁸ Lanham argues that our society is shifting from “an economics of stuff to an economics of attention” (p.13). In the past, economics was all

¹⁸ Lanham defines economics as “the study of how human beings allocate scarce resources to produce various commodities and how those commodities are distributed for consumption among the people in society” (p.6).

about how we produce and distribute physical commodities, which are stuffs in Lanham's term. However, in the current information society, the scarce resource is information rather than commodities. Thus, the shift of focus from commodities to information has driven the shift from "the economics of stuff" to "the economics of information." However, information is not in short supply in the current information-driven society, but rather, is overloaded. According to the economic principle of demand and supply, the information oversupply causes a decrease in our attention that needs to be paid to the information. Consequently, the information has to compete for grabbing our attention to be perceived and interpreted. Therefore, in the information society, *attention* rather than information is a commodity. This is what Lanham means by "an economics of attention." Therefore, "the economics of information" that has replaced "the economics of stuff" is again superseded by "the economics of attention."

If attention is considered as a commodity, this has an important implication for diagrams. While the traditional information design considers information as a commodity, Lanham's emphasis on attention puts diagrams in "the economics of attention," encouraging us to see them as commodities competing for our attention. In other words, we can think of diagrams as competing to grab our attention just as we think of commodities as competing to be purchased by consumers. In a sense, this discussion is connected to Baudrillard's discussion of the furniture system. As shown in Table 2, an analogy between furniture system and diagram system can be drawn. As Baudrillard indicates, objects in the furniture system compete to be selected and purchased by consumers through slightly changing designs or colors every season. To increase consumers' purchase, the capitalist society takes advantage

of consumers' desire to complete the system of objects. Likewise, diagrams in the diagram system compete for our attention by changing their styles. For example, an information graphic designer, Nigel Holmes' diagrams in the *Time Magazine*, show different formal characteristics and styles than the stripped-down geometry which is typical form of diagrams. His diagrams manifest "attention as commodity" as opposed to "information as commodity."

Table 2. Analogy between Furniture System and Diagram System
in Terms of Lanham's *Economies of Attention* (2006)

Furniture System	Diagram System
Various Designs and Colors to Induce Consumers' Desire to Complete the System of Objects (Owning objects that fit the system)	Various Styles of Diagram
Buying	Attention

Lanham further develops his discussion of "the economics of stuff" and "the economics of attention" with a paired concept of *stuff* and *fluff*. According to Lanham, stuff means the real and physical objects. When we consider stuff as a basic unit of economy, we are in "the economics of stuff." On the other hand, fluff refers to what we think about the physical objects. To be more specific, Marcel Duchamp's installation, *Fountain*, is a good

example of what Lanham means by fluff. In the *Fountain*, art is not the object itself, but “whatever the artist wishes to call to our attention. Art is an act of attention the artist wishes to invoke in the beholder” (p.43). In other words, art is the “attention that makes that stuff meaningful” (p.43). Thus, when we conceive fluff as a basic unit of economy, we are in “the economics of attention.” In parallel with the fundamental shift from “the economics of stuff” to “the economics of attention,” Lanham argues that style and fluff are more important than substance and stuff. As Blauvelt frees style from the repression of substance, Lanham also sets style and fluff free from substance and stuff. This has a significant implication for the rhetoric of diagrams, since the fluff and style are the levels where rhetoric and persuasion can infiltrate. In that sense, Lanham’s discussion of “the economics of attention,” fluff, and style provide an underlying assumption for the rhetoric of diagrams.

3.3.4. Conduit Metaphor

The “conduit metaphor,” coined by a linguist, Michael J. Reddy, has influenced information studies in “modeling what we believe the terms ‘information,’ ‘communication,’ and even what we consider ‘language’ mean and signify” (Day, 2000, 806). Reddy (1979) explains how the conduit metaphor works in everyday language by giving some examples like the following; “Try to *get* your thoughts *across* better”; “None of Mary’s *feelings came through to me* with any clarity”; “You still haven’t *given me any idea* of what you mean” (p.286-287). He argues that “none of these expressions is to be taken completely at face value” since “no one receives anyone else’s thoughts directly in their minds when they are using language (p.286-287)”. “Mary’s feelings can be perceived directly only by Mary but

they do not really “come through to us” when she talks” (p.286-287). Nevertheless, this is the way English speakers speak the language. As Reddy claims, these examples illustrate that “humans place their internal thoughts and feelings within the external signals of the language” (p.288).

Reddy defines the “conduit metaphor” by describing “four categories which constitute the major framework” of the notion. First, “language functions like a conduit, transferring thoughts bodily from one person to another.” Second, “in writing and speaking, people insert their thoughts or feelings in the words.” Third, “words accomplish the transfer by containing the thoughts or feelings and conveying them to others.” Fourth, “in listening or reading, people extract the thoughts and feelings once again from the words” (p.290). In other words, the conduit metaphor assumes that words have insides and outsides. Accordingly, thoughts, meanings and ideas can be inserted to the words, transferred to other people, and then other people can extract the thoughts from the words.

Reddy contrasts the conduit metaphor-based model of communication with the “toolmakers paradigm” based on “radical subjectivity.” In terms of the toolmakers paradigm, there is no such thing as a transparent conduit in communication. Such an ideal communication under the conduit metaphor model is not possible since the internal thoughts, feelings and perceptions cannot be sent to anyone by any means that we know of (p.293). The two frameworks take totally different positions about human communication. While the conduit metaphor model assumes that receiver can make an exact duplication of sender’s message in his/her mind through language as a conduit, the radical subjectivism paradigm denies the existence of that kind of communication.

Reddy argues that the conduit metaphor model of communication “objectifies meaning in a misleading and dehumanizing fashion” (p.308). He continues to argue that the conduit metaphor model of communication “influences us to talk and think about thoughts as if they had the same kind of external, intersubjective reality as lamps and tables” (p.308). Another problem of the conduit metaphor is that the “function of the reader or listener is trivialized” because they become passive message receivers based on the model’s assumption. On the other hand, the radical subjectivist paradigm assumes that readers and listeners are active participants who reconstruct the meaning of the message. Comparing the two conflicting models, Reddy emphasizes that we have neglected the “crucial human ability to reconstruct thought patterns on the basis of signals and this ability founders” (p.310), adhering to the mechanistic view of language and communication, the conduit metaphor.

Reddy’s conduit metaphor shares some similarities with the previously discussed notions such as transparency and looking through. If language is considered as a mere conduit as the conduit metaphor suggests, language is a transparent channel through which thoughts and meanings are exchanged, and therefore, becomes something that we look through to extract thoughts and meanings from. Accordingly, the conduit metaphor is grounded in the assumption that language serves to communicate substance and there is nothing but substance in language. In other words, the issue of style completely loses its ground in this linguistic metaphor. Thus, the conduit metaphor is aligned with the modern belief in universal and objective communication. Through eliminating style and creating visual language of neutrality, meanings are transmitted in a predictable way, and sender and receiver share the same meaning transmitted through the conduit. Therefore, the modern

vocabulary of neutral visual form can be conceived as a kind of conduit metaphor that serves for universal and objective communication.

3.3.5. Integration of the Theoretical Concepts and “Rhetoric of Neutrality” as a Framework

So far, I have discussed several theoretical concepts from different disciplines that converge on the notion of rhetoric of neutrality. Although there are minor differences, it has been noted that transparency, looking through, substance, and conduit metaphor share similar ideas in conjunction with Barthes’ notion of naturalization and myth. On the other hand, opacity, looking at, style, and radical subjectivist paradigm share a common ground as well. The first group of concepts illustrates our constant effort to shift something cultural to natural, while the second group of concepts exhibits the counteraction to the effort. The two ends of the spectrum shaped by the two contrasting groups of concepts create this conflict between concealment and revelation.

As discussed so far, each pair of the concepts has been considered in a dichotomized or dualistic way. In addition, value judgments have been attached to the pairs of concepts. Looking back upon the past, we can see that our dominant way of thinking based on Plato-Aristotelian system and modernism has demanded us to choose one over the other; transparency over opacity, looking through over looking at, substance over style, and conduit metaphor over radical subjectivist paradigm. The reason that we strive to accomplish transparency in language by encouraging people to look through the verbal surface, and that we emphasize substance, resisting becoming self-conscious about style, is because the

cultural heritage originated from Plato-Aristotelian system of thinking urges us to protect its specific conception of the self and of the world's reality (Lanham, 2003, p.205). Rejecting this, Reddy criticizes the mechanistic nature of the conduit metaphor, which fails to explain human agency that plays a critical role in communication. In addition, Lanham's modification of Aristotle's simplified either/or shift between through and at to a full spectrum with degrees of self-consciousness is also the same kind of gesture against the Plato-Aristotelian system embedded in us.

To sum up, the notion of the rhetoric of neutrality shares a common ground with transparency, looking through, substance, conduit metaphor, naturalization, and myth, and can serve as a solid theoretical concept through integrating those similar concepts. Examination of such concepts encourages us to see a kind of paradox that resides in the concepts; the naturalizing process never reaches an end, but only reveals that they cannot be fully naturalized, and therefore, are not transparent. The unattainable dream of transparency and looking through is unveiled by the constant operation of their counterparts, opacity and looking at, which brings about rhetorical infiltration. Integrating these ideas, the rhetoric of neutrality can serve as a robust theoretical concept, functioning as a tool for us to break down the myth of diagrams, photographic images, and journalism. Especially, the paradoxical quality that we have captured from the two contrasting clusters of concepts is the essential aspect that lies at the heart of the rhetoric of neutrality. Thus, the rhetoric of neutrality is a useful concept that I can apply to the rhetoric of diagrams.

In a sense, the paradoxical quality is inherent in the rhetoric of neutrality itself. The rhetoric of neutrality can be defined as a strategy that a rhetor employs to make something

look objective and neutral. However, as the juxtaposition of the two incompatible words implies, the strategy is doomed to fail. Rhetoric and neutrality cannot coexist. Hence, the rhetor cannot achieve neutrality, since the rhetoric of neutrality is just a kind of rhetoric in which the rhetor's striving for neutrality ends up revealing unattainableness of the dream. Therefore, the belief in objectivity and neutrality that resides in diagrams, photographic images, journalism, and modern design can be refuted by the very paradoxical nature of the rhetoric of neutrality. This is why the rhetoric of neutrality can become a tool to break down the myth of objectivity, rationality and neutrality of diagrams. On the other hand, from another perspective, we can see it as a code that is not fully at the control of the rhetor.

3.4. Conclusion

To summarize, the basic framework of the visual communication through diagrams can be diagrammed as shown in Figure 22. Among the two contrasting processes described in Figure 22, the focus of this study is the upper one.

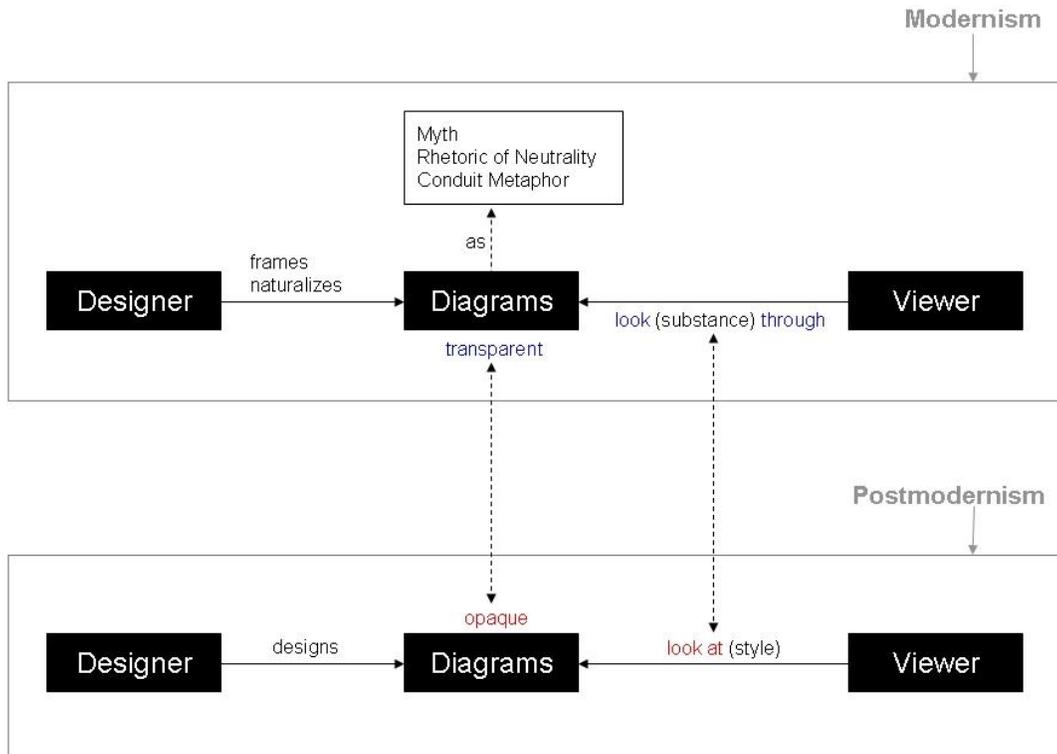


Figure 22. A Basic Framework of the Diagram Communication

On the template of the basic framework of the diagram communication in Figure 22, I have drawn a literature map. Figure 23 is a literature map that visualizes where all the relevant authors and their theoretical concepts are located in the basic framework and how they are related.

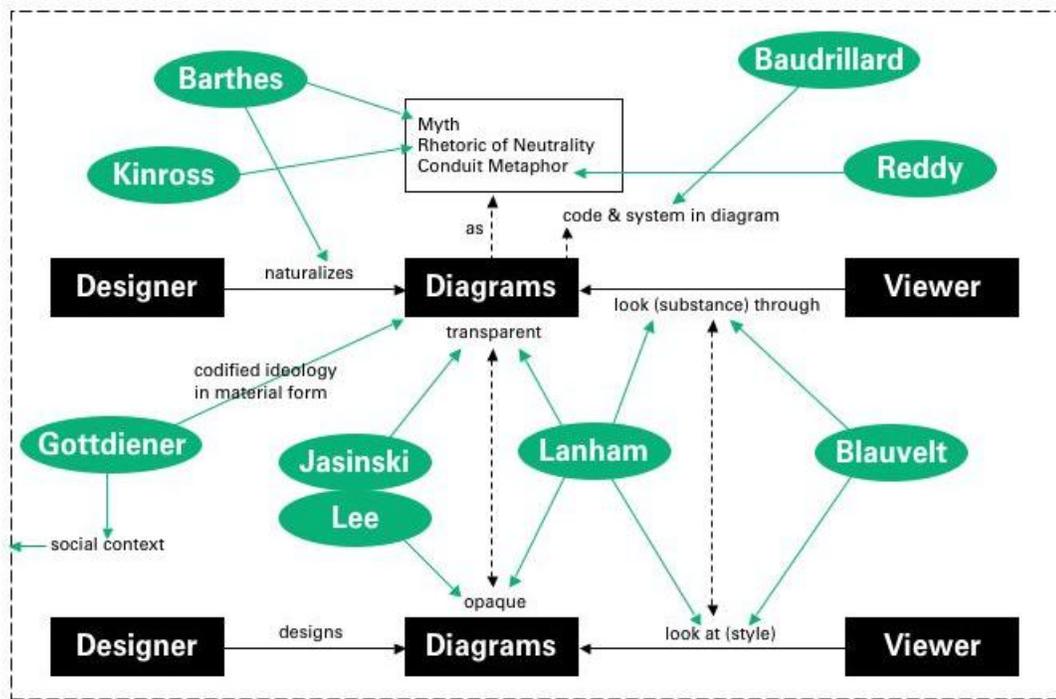


Figure 23. A Literature Review Map

CHAPTER 4. OBJECT REVIEW

4.1. Significance of Object Review

Over the two semesters of Fall 2006 and Spring 2007, I collected a number of diagrams from *The New York Times* online newspaper¹⁹ (published from August to December in 2006), and also from magazines such as *Scientific American*, *Newsweek*, and *Mother Jones* (published between 2006 and February 2007). Through the analysis of the

¹⁹ I selected The New York Times online newspaper at the beginning stage of the object review because I was interested in both printed-based diagrams and dynamic diagrams at that time, and wanted to examine both phenomena. Although I decided to focus on print-based diagrams only later, reviewing dynamic diagrams that employ timeline, animation, and progression has broadened my understanding of diagrams.

diagrams collected through my visual research, I came up with categories to classify diagrams; the degree to which images in diagrams are abstract (or real), style of image, timeline, comparison, animation, zooming, and progression. In the process of analyzing and classifying the collected diagrams into the categories, I happened to become more interested in some categories than others, and this process helped me decide what aspects of diagrams I should focus on in my research. In the following section, I discuss the particular categories of diagrams I decided to focus on with specific diagram examples that I collected, and show how the object review helped me with shaping up my research question.

4.2. Diagrams from the New York Times

Through the visual research of diagrams in *The New York Times* online newspaper, I came up with categories, such as the degree to which images in diagrams are abstract (or real), style of image, timeline, comparison, animation, zooming, and progression. Among them, I focus on the first two categories, the degree to which images in diagrams are abstract (or real) and style of image, since they are relevant to the formal qualities of diagrammatic elements, which is a keyword of the main question of this study, “what rhetorical significance do viewers assign to diagrams on the basis of the formal qualities of diagrammatic elements or configurations.

Degree of abstraction in images employed in diagrams refers to the degree to which images are separated or disassociated from the original real object in terms of physical resemblance. Hence, if an image has a high degree of abstraction, it takes a highly abstract mode of representation detached from the appearance of the real object. The diagram in

Figure 24 employs a highly abstract mode of representation to illustrate the range of geographical areas in the Middle East that can be destroyed by various types of military weapons. ²⁰ As shown, the images of the weapons are simplified by eliminating detailed description of the actual objects, and therefore, disassociated from what actual weapons look like.

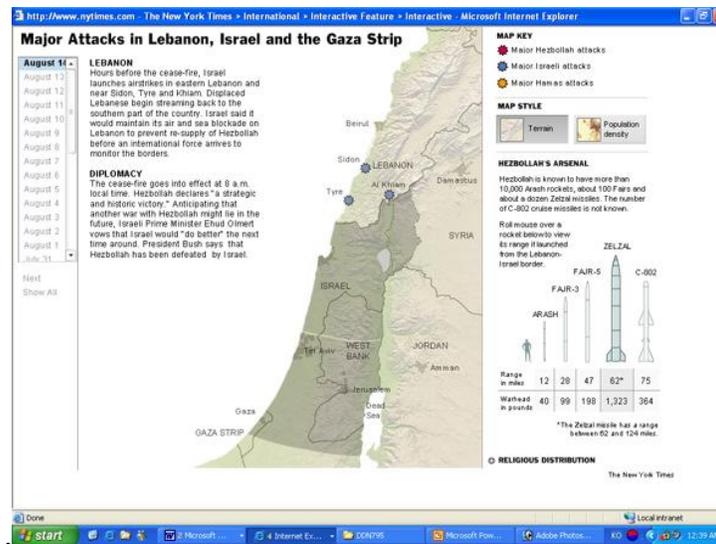


Figure 24. A Diagram from Online *New York Times*

<http://topics.nytimes.com/top/reference/timestopics/organizations/h/hezbollah/index.html?query=HAMAS&field=org&match=exact>

²⁰ When viewers roll mouse over each weapon, the range of area that can be destroyed by the weapon is shaded on the map.

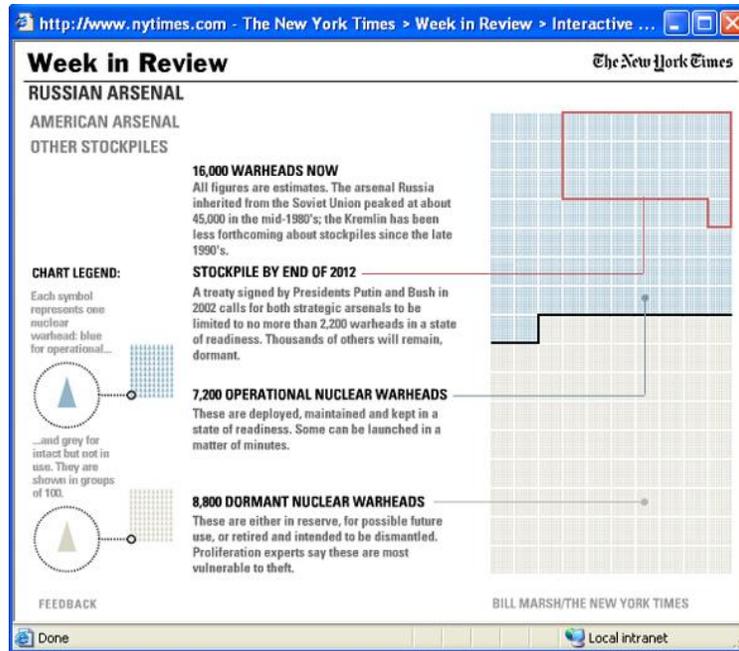


Figure 25. A Diagram from Online *New York Times*

<http://query.nytimes.com/search/query?query=%22Interactive+Graphic%22&srchst=m&d=&o=&v=&c=&sort=newest&n=10&dp=0&daterange=full&frow=80>

Nonetheless, the weapon images in Figure 24 are still in the concrete mode of representation in comparison with the triangular shapes representing weapons in Figure 25. The triangular shapes do not have physical resemblance with real weapons at all. Thus, the weapon images in Figure 25 have a higher degree of abstraction than those in Figure 24. Without the additional information provided by text, viewers can hardly identify the triangular shapes as weapons, although there is greater affiliation with weaponry in triangles than circles so the form is not entirely arbitrary.

Abstraction in images creates distancing effect. *Distancing* is an effect produced when the degree of separation between the representing image and the represented object increases. In other words, a high degree of abstraction between the representing image and the original object increases distancing effect. Thus, the abstract symbol for weapons in Figure 25 distances us further from the original object than the weapon images in Figure 24 does.

On the other hand, *degree of realism* refers to the degree to which images used in diagrams are associated with the original real object, and therefore, has a physical resemblance to it. Thus, if an image has a high degree of realness, it looks identical to the original object in reality. Thus, degree of realness and degree of abstraction are the inverses to each other.

Diagrams in Figure 26 and 27 deal with the issue of degree of abstractness, distancing, and degree of realness. The diagram in Figure 26 uses two photographic images of *The World Trade Center*, having a high degree of realness, in contrast to the geometric representation of the same architecture, employing a high degree of abstraction in the center of the Figure 26. On the other hand, the series of *The World Trade Center* images in Figure 27 have a high degree of abstraction as well, but employs somewhat different abstract mode of representation from the geometric image in the center of the Figure 26.

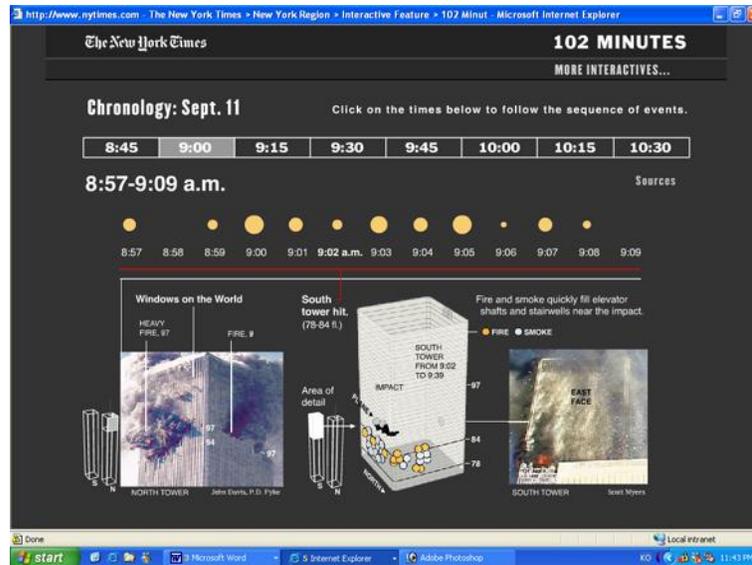


Figure 26. A Diagram from Online *New York Times*

<http://www.nytimes.com/2005/06/24/nyregion/24towers.html?ex=1277265600&en=9d6498ded58870d3&ei=5088&partner=rssnyt&emc=rss>

,

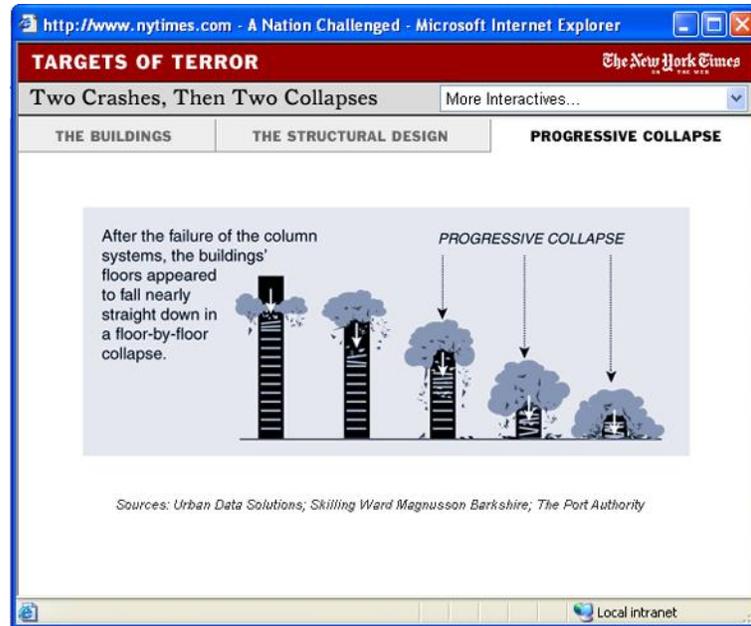


Figure 27. A Diagram from Online *New York Times*

<http://query.nytimes.com/search/query?query=%22Interactive+Graphic%22&srchst=m&d=&o=&v=&c=&sort=newest&n=10&dp=0&daterange=full&frow=330>

One thing to note in this set of comparisons is that the two different types of images in Figure 26 and 27 – photographic images and abstract images – make viewers have different feelings and attitudes toward the images and the subject matter being described in the diagrams. While the photographic images in Figure 26 give a sense of presence to viewers, the geometric image in the center of Figure 26 and the series of abstract images in Figure 27 distance viewers from the presence or realness of the event. The geometric image and abstract images encourage viewers to see *The World Trade Center* and the accident of 9.11. as something to analyze rather than to empathize with.

To summarize, images in diagrams have different degrees of resemblance to the original object or source being represented, and we can put images somewhere on a spectrum with abstractedness and concreteness at either end. Therefore, if an image is closer to the abstract side of the spectrum, the degree of abstraction and distancing effect increases. On the other hand, if an image is closer to the concrete side of the spectrum, the degree of realness increases, and viewers are more likely to empathize with the image than to analyze it.

Style of image is another viable category for diagram classification. Style generally means the way in which something is presented. Thus, style of images used in diagrams can be defined as a particular manner or technique by which something is created or presented. Thus, abstract images might employ different styles. For example, the images of *The World Trade Center* in the center of Figure 26 and in Figure 27 are abstract, but they employ different styles of representation. While *The World Trade Center* image in Figure 26 looks geometric and rational, the other one in Figure 27 looks cartoonish. The cartoonish style more or less decreases the degree of seriousness of the subject matter.



Figure 28. A Diagram from Online *New York Times*

<http://query.nytimes.com/search/query?query=%22Interactive+Graphic%22&srchst=m&d=&o=&v=&c=&sort=newest&n=10&dp=0&daterange=full&frow=10>

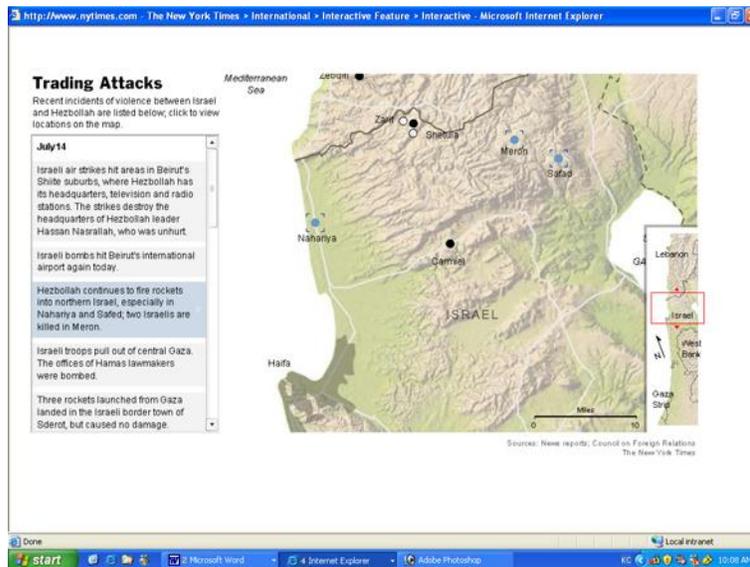


Figure 29. A Diagram from Online *New York Times*

<http://query.nytimes.com/search/query?query=%22Interactive+Graphic%22&srchst=m&d=&o=&v=&c=&sort=newest&n=10&dp=0&daterange=full&frow=20>

Figure 28 and 29 also illustrate different styles of image. The satellite photograph in Figure 28 is a more direct representation of the real hospital than the map in Figure 29 because photographs have less room for editing or treatment than other modes of representation, such as drawings or maps. Thus, although we are aware that photographs, in some degree, can embed photographer's intention, perspective, or point of view through his/her editing or treatment, they allow for relatively less editing or treatment than drawings or maps. Accordingly, photographs have a high degree of realness, and viewers consider them as an accurate description of reality. Another level of connotation in Figure 28 is based on the fact that an imaging technology that produces satellite photographs has been present in the space shown in Figure 28. The satellite photo in Figure 28 gives viewers impression that someone was there in the given space, even if only through a satellite. To put it another way, the satellite is a particular type of imagemaking technology that extends human presence.

On the other hand, the map-based diagram in Figure 29 reduces detailed information of a certain area to a simplified form with minimal geographical information. Thus, with a high degree of abstraction, the diagram distances viewers from the presence or realness of the area. Unlike photographs, map-based diagrams select certain features of the area, while excluding others, relying on the principle of simplification and elimination. Therefore, original properties of the represented objects or areas are reduced to some limited features. Accordingly, makers' intention, perspective, or points of view are more likely to be involved in map making process than in photograph taking process.

Donald Norman's (2004) three different aspects of design provide useful concepts to explain different kinds of effect created by different representational styles. In terms of

Norman's three aspects of design, the satellite photograph in Figure 28 has a visceral aspect, while the map in Figure 29 has a reflective aspect. The satellite photograph causes an immediate visceral reaction from viewers, since it represents a sense of presence and that someone who photographed the image was also present as in the discussion above, and encourages viewers to feel like they are physically present in the setting. On the other hand, the map in Figure 29 distances viewers from the presence of the attack, encouraging them to rationally think about it or to analyze the geographical information in the map. The two different styles of image appeal to us in different ways, serving different purposes. In other words, photographic images with a high degree of realness promote a visceral reaction from viewers, while drawings and maps encourage viewers to reflect on them.

4.3. Diagrams from Magazines

After the visual research of diagrams collected from *The New York Times*, the scope of diagram collection has been narrowed, since I decided to focus on how viewers construct meanings from diagrams that employ different kinds of images. Thus, at the second stage of the object review, I collected diagrams from magazines, *Scientific American*, *Newsweek*, and *Mother Jones*, based on what kinds of image are employed in these publications. At the second stage of the object review, I tried to classify diagrams according to types of images used in diagrams, and came up with categories of images: geometric, pictorial, photographic, and silhouette images. I discuss them later with specific diagram examples.

The diagram in Figure 30 collected from *Scientific American* mainly uses geometric images, such, as circles and lines, in order to visualize how social networks are built up.

Concepts, such as home, work, car, and day care, are visualized with the circles, and their relationships are formed through the lines.

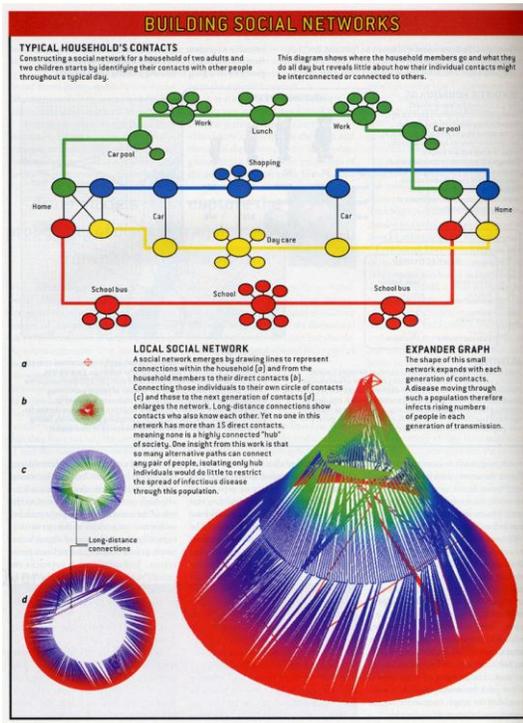


Figure 30. A Diagram from *Scientific American*

The diagram in Figure 31 also adopts geometric images, different sizes of squares, in order to visualize radio-frequency spectrum and its allocations in the United States.

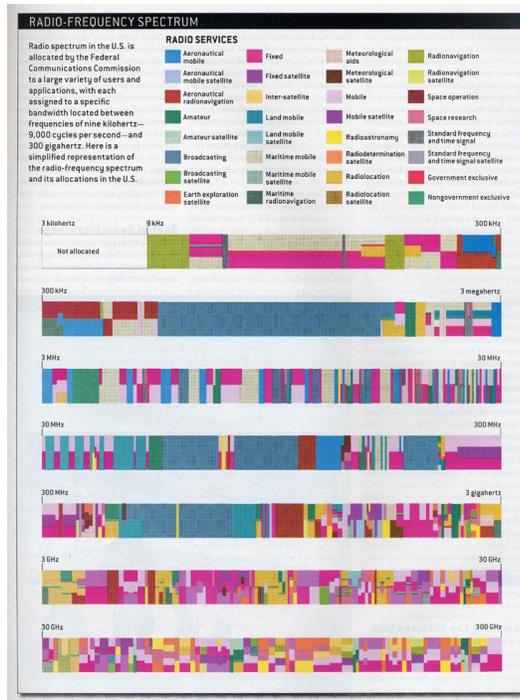


Figure 31. A Diagram from *Scientific American*

Figure 32 transforms a pictorial image into a diagram in order to illustrate how greenhouse effect negatively affects our environment. While the geometric images in the two previous diagrams are employed to visualize abstract concepts and the relationships among them, the pictorial images of the land and the ocean are adopted here in order to describe greenhouse effect in a catastrophic way, emotionally arousing viewers' attention to the issue of greenhouse effect.



Figure 32. A Diagram from Scientific American

The diagram in Figure 33 also employs pictorial images of trees, bears, fish, and natural environment in order to visually explain the flow of nutrients in ecosystem. The pictorial description in this diagram is less real than the one in Figure 32, since the images here are more simplified than those in Figure 32. Thus, the pictorial image in Figure 32 has a higher degree of presence than the one in Figure 33.

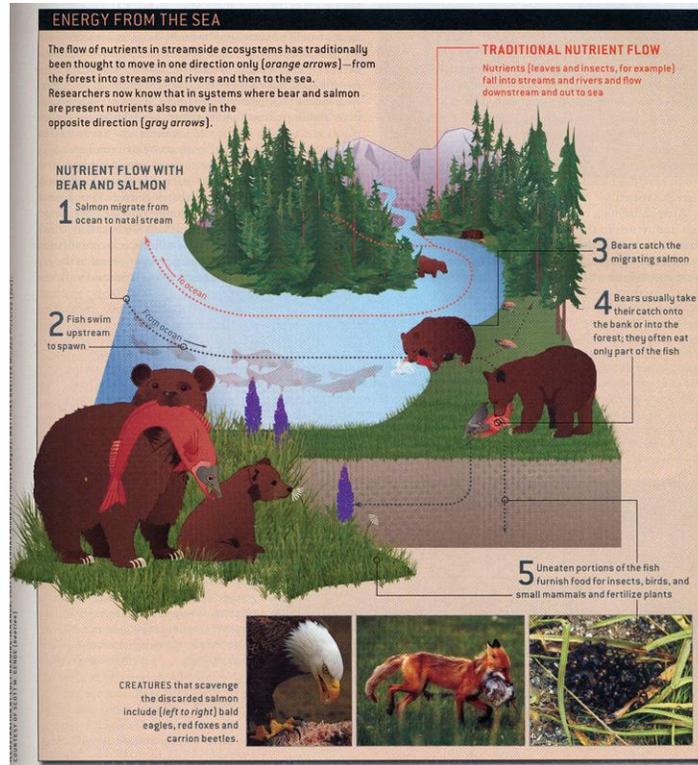


Figure 33. A Diagram from *Scientific American*

The diagram in Figure 34 also uses pictorial images of marine products to visualize aquaculture production in different states of the United States. The pictorial images here are also simplified, but have a different style from the pictorial images in Figure 33.

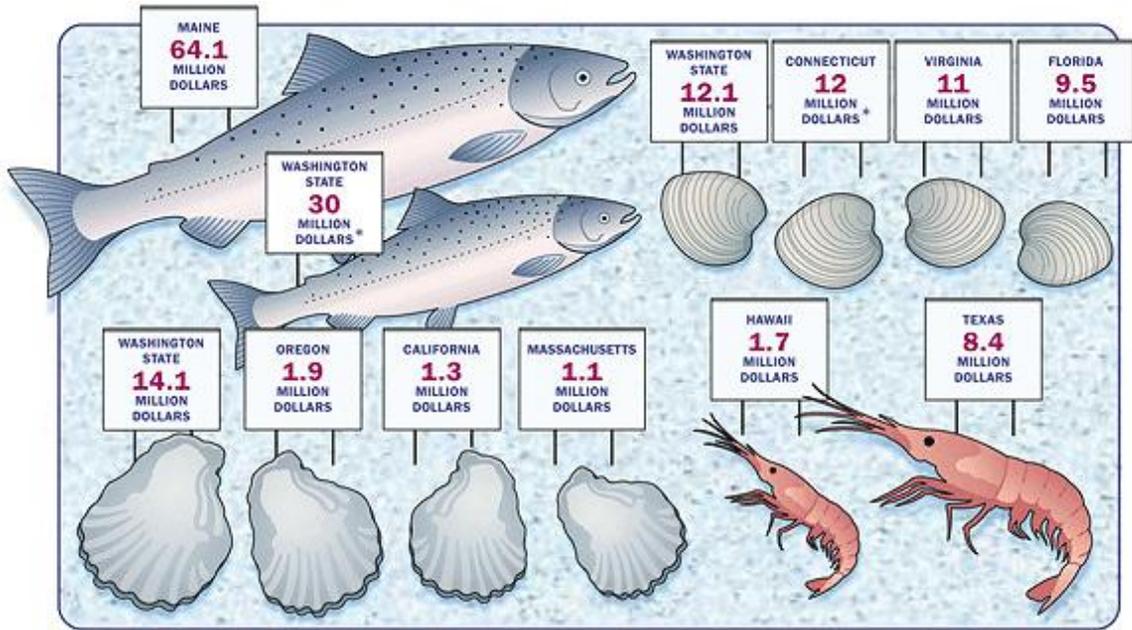


Figure 34. A Diagram from *Mother Jones*

The diagram in Figure 35 uses photographic images of planets in the universe in order to visualize their relationships and a new order of the universe that conceives Pluto as a dwarf planet. The diagram in Figure 36 also uses photographic images of a skiing person in order to visualize how to ski. However, under the photographic images, this diagram employs geometric images as well, which schematize proper postures that a skier needs to take at a certain moment. This diagram is an interesting case because it takes advantages of the two different modes of representation; photographic and geometric mode of representation. While the photographs provide detailed visual information of what a skier looks like at each step of skiing, evoking a sense of presence and realness, the geometric images visually summarize detailed information regarding how to align parts of a body and how much a skier needs to

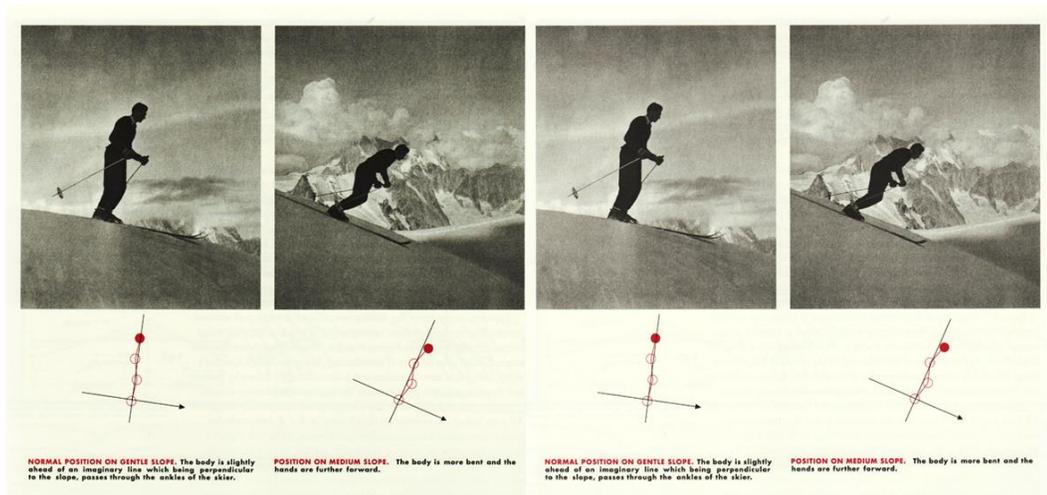


Figure 36. A Diagram from Edward Tufte's *Beautiful Evidence*

The diagram in Figure 37 uses silhouette images of fish in order to visually communicate the negative effect of overfishing. Fish take a highly abstract form, since they are simply represented by their outline and color. The diagram simplifies complexity of things by eliminating detailed information in the interior part. The goal of this diagram is not to describe the type or exact numerical quantity of particular fish, but to visualize a general trend, decline in the number of fish. It reduces complexity, pursuing clarity.

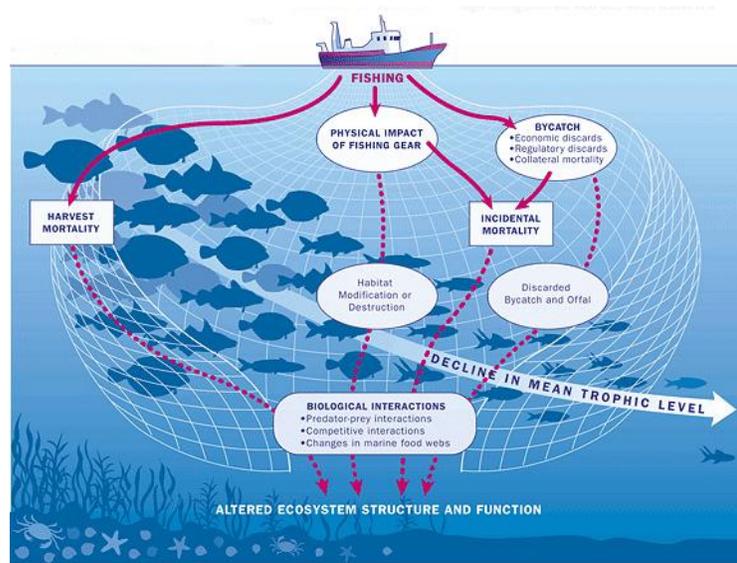


Figure 37. A Diagram from *Mother Jones*

4.4. Jay Doblin’s Model of Visual Information Messages

Doblin (1980) proposes a model of visual information messages that can systematize the categories of visual images that have been discussed through the object review. Doblin’s model classifies visual images according to their levels of abstraction. In his *Matrix of Information Messages*²¹ in Figure 38, Doblin proposes three kinds of visual information messages; *nominal*, *noumenal*, and *phenomenal*. *Visual nominal information (ideogrammatic)* means “visual ‘words’ that convey a single meaning” (p.91). For example, trademarks, ideographs (Chinese characters are one form), roadway signs, and flags belong to this. *Visual noumenal information (diagrammatic)* means “charts and graphs used for

²¹ The matrix proposes three columns – verbal, numerical, and visual column – but I will focus on the visual column only, since the focus of this study is on visual images.

visualizing processes that are otherwise difficult to comprehend” (p.91). Lastly, *visual phenomenal information (isogrammatic)* means “visual representation of reality” (p.91). Isogrammatic techniques include “drawing, drafting, model making, sketching, photography, portraiture, illustration, and so forth” (p.91). “The column of visual information messages can be conceived of as three levels of abstraction” (p.91). Doblin claims that phenomenal messages are the most realistic, nominal messages are the most abstract, and noumenal messages are in the middle (p.91).

	VERBAL	NUMERICAL	VISUAL
NOMINAL	lexic	numeric	ideogrammatic
NOUMENAL	logic	mathematic	diagrammatic
PHENOMENAL	prosaic	arithmetic	isogrammatic

Figure 38. Jay Doblin’s *Original Matrix of Information Messages*

Doblin restructures the matrix in Figure 38 to Figure 39, since the three levels in the original matrix are “too esoteric and encompassing” (p.91-92). He subdivides the three levels

into finer increments and gives them practical names (p.92). Isograms are divided into four sub-categories: models, photographs, drawings, and drafting. Diagrams (usually called charts and graphs) are considered as one level, and marks are also considered as one level. As a result, the six levels form the column of visual information messages. The six levels also form a scale from abstract to real, from the top to the bottom.

	VERBAL	NUMERICAL	VISUAL
NOMINAL	names	numbers	marks
NOUMENAL	theories	formulas	charts & graphs
PHENOMENAL	descriptions	measurements	drafting & maps
			drawings
			photographs
	signals	counting	models

Figure 39. Jay Doblin’s *Restructured Matrix of Information Messages*

The restructured matrix of information messages is again refined to the final version of matrix as shown in Figure 40. Doblin takes the ladder of six levels of visual abstraction from the matrix in Figure 39, and allocates even space to them to give equal emphasis to the six types of visual messages. The six types of visual messages are now arranged from the very abstract (marks) to the very realistic (models).

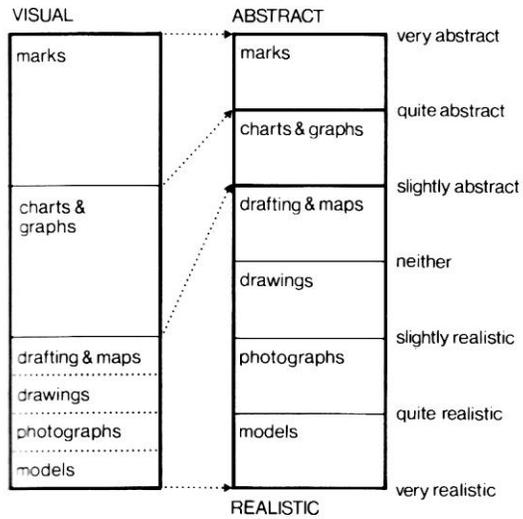


Figure 40. Jay Doblin's *The Ladder of Abstraction*

Shifting on the ladder, objects, animals, and persons can be translated into all eight types of visual messages. Figure 41 illustrates how the photograph of a person is abstracted to the drawing, through the ladder of abstraction.

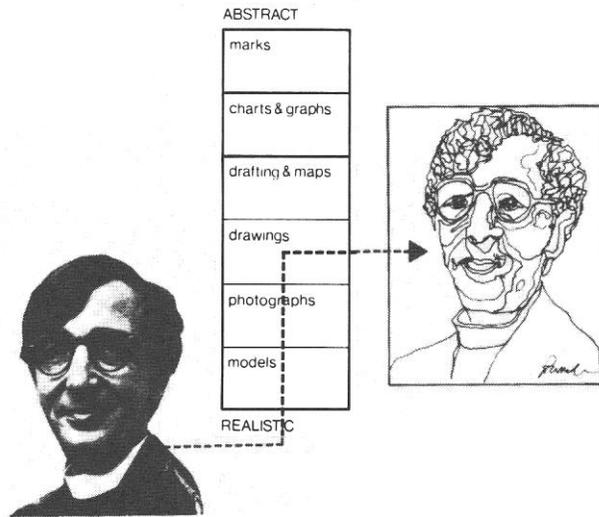


Figure 41. Increase of Abstraction of Visual Messages

Doblin's ladder of abstraction provides a useful theoretical framework for systematizing the categories of images used in diagrams. The categories of images that I discussed in the object review or that might be used in diagrams, geometric, pictorial, photographic, and cartographic images, can be rearranged in Doblin's ladder as shown in Figure 42.

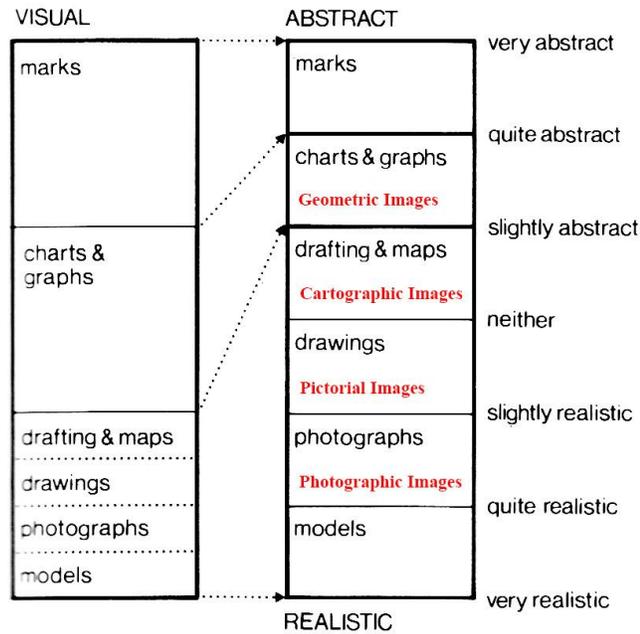


Figure 42. Categories of Images arranged in Doblin's Ladder of Abstraction

Photographic images correspond to the level of photographs, and pictorial images to the level of drawings in the ladder. I put cartographic images in the level of drafting and maps.

Cartographic images are images that are more abstract than pictorial images and less abstract than geometric images. They approximately correspond to the level of drafting and maps.²²

Lastly, geometric images belong to the level of charts and graphs, since line graphs, bar graphs, and pie charts are composed of geometric images.

²² Some of the diagrams sampled for the interviews in this study, which will be discussed later, are based on maps. The map-based diagrams sampled for this study correspond to cartographic image. I see cartographic images as equivalent to the level of drafting and maps, since they are more abstract than pictorial images in that they reduce and simplify detailed visual information in pictorial images, and less abstract than geometric images.

4.5. Implications of the Object Review

This research aims to focus on what rhetorical significance viewers assign to diagrams on the basis of the formal qualities of diagrammatic elements or configurations. To investigate this, I first need to identify what diagrammatic elements or configurations are in diagrams. The four types of images categorized by their degree of abstraction (Figure 42), can serve as useful categories that help me with identifying various formal qualities of diagrammatic elements, informing me of the ways we can divide images into different types according to their representational style.

Varying diagrammatic forms determined by various categories of images used in diagrams, such as photographic, pictorial, cartographic, and geometric images, can have implications for the way diagrams have rhetorical significance, since formal features carry meanings. For example, simplified forms, abstract images, such as geometric images, might encourage viewers to believe that the contents in diagrams are objective and trustworthy truth. Thus, seemingly objective diagrams based on abstract images might serve as a medium to hide or disseminate a particular perspective or ideology under the mask of objective truth through rhetoric. On the other hand, photographic images have a high degree of realness, which might encourage viewers to believe them as objective and neutral representations of reality, free of editing, coloring or bias. Thus, I can use the four categories of image as a useful source, not only when I identify diagrammatic elements or configurations that have rhetorical significance, but also when I examine whether a diagram belongs to a particular category among the four has any relationship with whether viewers are more likely to assign rhetorical significance to the diagram.

CHAPTER 5. CONCEPTUAL FRAMEWORK AND RESEARCH QUESTION

5.1. Theoretical Perspective

Stuart Hall's (2006) theories of representation and Charles Kostelnick's (1995) models for visual communication lay a ground for talking about the theoretical perspective of this study. Hall (2006) discusses three fundamentally different theories of representation, reflective, intentional, and constructionist approach, demonstrating that the constructionist approach best describes representation. According to his definition, in the *reflective* approach, "meaning is thought to lie in the object, person, idea or event in the real world, and language functions like a mirror, to *reflect* the true meaning as it already exists in the world" (p.24). The *intentional* approach assumes that "it is the speaker, the author, who imposes his or her unique meaning on the world through language" (p.25). Hence, words "mean what the author intends they should mean" (p.25). Hall criticizes the first two approaches, arguing that "neither things in themselves nor the individual users of language can fix meaning in language" (p.25). Instead, "we construct meaning, using representational systems – concepts and signs" (p.25). This is the way in which the constructionist approach defines meaning-making and representation. The core assumption of this approach is that meaning is conveyed by the "rules, codes, and conventions of language to be shared and understood" (p.25).

Similarly, Charles Kostelnick (1995) presents two contrasting theoretical views to visual communication; "a global (or universal) model" and "a culture-focused model of visual communication". The global/universal model aims to "create a rational, objective, and culture-free design language," assuming that "regardless of cultural background or other in-group identity, the perceptual responses of the eye and brain can be measured and predicted"

(p.183-184). On the other hand, the culture-focused model, rejecting the universal design, emphasizes that “visual communication is intimately bound to experience” and “it can function only within a limited range of cultural contexts” (p.183-184).

The approaches to representation and visual communication by Hall and Kostelnick roughly overlap. While Hall’s reflective approach roughly parallels Kostelnick’s global model, the constructionist approach approximately parallels the culture-focused model. Whereas the reflective approach and the global model believe in objective and universal communication, the constructionist approach and the culture-focused model emphasize cultural or conventional aspect of communication. Among the two contrasting pairs, this study takes the constructionist and the culture-focused line of thought as an overarching theoretical orientation to study the rhetoric of diagrams.

As briefly mentioned earlier, I take a mixed theoretical perspective that combines rhetoric, post-structuralism, and social semiotics as a theoretical basis of my critical stance to study the rhetoric of diagrams. Although rhetoric, post-structuralism, and social semiotics are slightly different from one another, they share a lot in common, being underpinned by a more inclusive theoretical orientation, social constructionism. Social constructionism is identified more as a group of different approaches that share similarities than as a unified paradigm. As Burr (1995) indicates, there are diverse approaches that can be loosely grouped as social constructionism, such as critical psychology, discourse analysis, deconstruction and post-structuralism (p.1-2).

In spite of diversity in social constructionism, Burr (1995) identifies four common key features shared by all social constructionist approaches. First, social constructionism takes a

“critical stance towards taken-for-granted knowledge” (p.3). Thus, it “invites us to be critical of the idea that our observations of the world unproblematically yield its nature to us, to challenge the view that conventional knowledge is based upon objective, unbiased observation of the world” (p.3). Second, social constructionism assumes that the “ways in which we commonly understand the world, the categories and concepts we use, are historically and culturally specific” (p.3). In other words, not only all ways of understanding are “specific to particular cultures of periods of history” (p.4), but also “they are seen as products of that culture and history, and are dependent upon the particular social and economic arrangements prevailing in the culture at that time” (p.4). Third, social constructionism presumes that our knowledge of the world “is not derived from the nature of the world as it really is” (p.4) but is “sustained by social processes” (p.4). Hence, knowledge is derived from “the daily interactions between people in the course of social life” (p.4). Fourth, “each different construction also brings with it, or invites, a different kind of action from human beings” so that descriptions or “constructions of the world sustain some patterns of social action and exclude others (p.5).

Rhetoric, post-structuralism, and social semiotics share the four major features of social constructionism in common. Combining the three theoretical frameworks grounded in social constructionism, I create a mixed theoretical perspective for my study. In addition to the four common features shared by the three frameworks, I will discuss fundamental ideas and assumptions of the three frameworks one by one in the next section.

5.1.1. Rhetoric

Rhetoric, as a discipline, is basically grounded in the assumption that “human social life depends on our ability to use various symbol systems to communicate meanings to one another” (Herrick, 2005, p.6). Without communication through symbol systems, human social life cannot be sustained, and in that sense, “our lives as members of human communities are inherently and inescapably rhetorical” (Herrick, 2005, p.6). Based on this assumption, Herrick (2005) defines rhetoric as “the systematic study and intentional practice of effective symbolic expression” (p.7). “*Effective* here will mean achieving the purposes of the symbol-user, whether that purpose is persuasion, clarity, beauty, or mutual understanding” (p.7).²³ In contrast to the narrow definition of traditional rhetoric that was exclusively interested in persuasion through verbal language, contemporary definitions of rhetoric including Herrick’s have been dramatically expanded in two prominent ways. The range of interest has shifted from persuasion to a broader realm of communication, and the exclusive focus on verbal language broadened into symbols in general that include not only visual language, but also musical notion and performance. Sonja K. Foss (1994), a rhetorical scholar who pioneered the area of visual rhetoric, argues that rhetorical critics are “recognizing that to confine their study of symbols to speech making is to miss a great many of the symbols that affect us daily,” and therefore, they are “responding to changes in rhetorical practice by expanding the data they analyze to include visual symbols” (p.213). As a result, rhetoric itself has broadened to “become a major theory informing not only the study

²³ Herrick points out that “for most of its history the art of rhetoric has focused on *persuasion* employing the symbol system of *language*” rather than other aspects mentioned here.

of literature and speech, but of culture, art, and even science” today (Kenney & Scott, 2003, p.18).

In the proliferation of rhetoric, the expansion of rhetoric to visual language has generated a new area called *visual rhetoric*, which provides a theoretical framework for this study, since the focus of this study is on diagrams. Kenney and Scott (2003) discuss several key characteristics or assumptions of rhetoric in general that are applicable to visual rhetoric as well. First, rhetoric fundamentally aims to study “the impact of persuasive materials upon human attitudes, cognition, or memory” (p.18). One of the most prominent characteristics of rhetoric (or visual rhetoric) is that it fundamentally concerns how symbols, such as verbal and visual language, musical notes, and performance, affect or shape people’s attitudes, belief, values, knowledge, and even behavior. Hill and Helmers (2004) also mention this dimension of rhetoric, arguing that visual rhetoric explores “the many ways in which visual elements are used to influence people’s attitudes, opinions, and beliefs” (p.2). Making a distinction between aesthetic perspective and rhetorical perspective, Foss (1994) argues that the former aims to “identify artistic merit or aesthetic excellence,” while the latter concerns “the influence of images on audiences and the way images are constructed to affect such influence” (p.214). Foss’s view is reinforced by Kenney and Scott (2003) who claim that the “basic distinction between a rhetorical approach and a traditional formalist one is probably the attention given to intent and effect” (p.32). Since this study mainly aims to explore the constitutive function of visual images, especially diagrams, as a tool for shaping people’s attitudes, belief, values, knowledge, and behavior, a rhetorical framework is useful for theoretically grounding this study.

On top of its focus on intent and effect, a rhetorical framework provides several other assumptions that ground this study. As Kenney and Scott indicate, a “truly rhetorical approach to visual communications includes the firm premise that the making and viewing of pictures is fundamentally a culture-based practice” (Kenney & Scott, 2003, p.20). Under the overarching theoretical orientation of the constructionist approach and the culture-focused model discussed earlier, a rhetorical framework takes a situational, provisional, contextual, and contingent approach to language and communication (p.22). Kenney and Scott demonstrate that this is so because “the meaning of a particular figure of speech, narrative, or example derive(s) from the particular experiences of a particular audience addressed by a particular speaker at a particular moment” (p.22). Because of this “antifoundationalist” orientation, “rhetoric is more clearly aligned with reader response theory and poststructuralism rather than with New Criticism or structuralism or any other essentialist (or formalist) view” (p.22).

In addition to the emphasis on cultural and contextual aspect, a rhetorical framework focuses on “the principle of ‘selection’” (p.20). To persuade someone to have a certain perspective or to take a certain action, “the one producing any rhetorical text will select from among a range of options the word, tone, color, view, or tune that he or she feels is most likely to have the desired effect among the intended audience” (p.21). Hence, all visual images are “unavoidably selective and, therefore, irretrievably rhetorical” (p.21). Concerning this selective aspect in rhetoric, Kostelnick (2004) discusses the “rules of inclusion and exclusion,” claiming that designers “control what is and what is not visualized, and that control has rhetorical consequences.” The notion of “rules of inclusion and exclusion” is

originally discussed by Marthalee Barton (1993) who considers maps as an ideological medium. According to Barton (1993), the rule of inclusion “determines whether something is mapped, what aspects of a thing are mapped, and what representational strategies and devices are used to map those aspects, and rules of exclusion is about what is to be excluded or repressed to serve dominant interests” (p.53-55, 59). These rules apply when producing visual images, since visual images always include certain aspects, while excluding others.

Depending on where an emphasis is, rhetoric (or visual rhetoric) sometimes concerns the issue of how ideology is shaped, and how power is produced or maintained through manipulating and controlling symbols. If rhetoric mainly concerns how to influence other people by persuading them into adopting a certain perspective or acting in a certain way, it cannot avoid the issue of who influences whom and who shapes other people’s attitudes, belief, values, knowledge, and behavior. For that reason, rhetoric cannot be free from the issue of power. Barry Brummet (2006), a rhetorical scholar, brings rhetoric closer to cultural studies, mainly investigating the issue of rhetorical struggle and power. He views rhetoric as “the ways in which signs influence people” (p.4), paying a close attention to manipulating signs and symbols for the purpose of achieving or securing power. He indicates that “texts²⁴ influence people to think and act in certain ways” (p.92). For that reason, we need to be “more specific about exactly what motivates or drives that influence: the *meanings* that texts encourage people to accept” (p.92). In other words, his main concern is about hidden motives or intention behind texts. According to Brummet, texts serve as “sites of struggle over meaning,” since “people struggle over how to construct these different texts in ways that suit

²⁴ Brummet (2006) defines “a text” as “a set of signs related to each other insofar as their meanings all contribute to the same set of effects or functions” (p.34).

their own interests” (p.93). He discusses how visual images relate to the issue of manipulation and power, describing the issue of symbol manipulation that entails power struggle as a common denominator of rhetoric and cultural studies.

5.1.2. Post-structuralism

Post-structuralism also grounds this study as the second component of the mixed theoretical perspective. As Madan Sarup (1993) claims, post-structuralism is “highly critical of the unity of the stable sign (the Saussurian view)” (p.3). Post-structuralism basically rejects the belief that meaning is pure, stable, and transcendental, and instead, emphasizes the contextual nature of meaning and representation. A literary critic, Terry Eagleton (1983), indicates that it is “difficult to know what a sign ‘originally’ means, what its ‘original’ context was: we simply encounter it in many different situations, and although it must maintain a certain consistency across those situations in order to be an identifiable sign at all, because its context is always different it is never *absolutely* the same, never quite identical with itself” (p.129). Depending on the context that surrounds a sign, the meaning of the sign changes. Hence, the traditional theories of meaning and representation, based on the assumption that signs reflect reality, does not stand any more. Eagleton (1983) further argues that, for a post-structuralist, such as Barthes, the “realist or representational sign” is “essentially unhealthy,” since it “effaces its own status as a sign, in order to foster the illusion that we are perceiving reality without its intervention” (p.136). As discussed earlier, post-structuralism and rhetoric are anti-foundationalist approach to meaning, representation, and communication.

In addition, post-structuralism encourages readers to take a more active role than before, undermining the authority of authors. Eagleton (1983) mentions that the “reader or critic shifts from the role of consumer to that of producer” (p.137). As Barthes’ famous notion, “death of the author,” implies, the absolute power and authority that have been enjoyed by authors is noticeably weakened in a post-structuralist line of thought, while readers rise as an active participant in communication. This study takes this post-structuralist assumption that readers actively construct meanings of visual images, such as diagrams.

5.1.3. Social Semiotics²⁵

Social semiotics also grounds this study as the third component of the mixed theoretical perspective. Social semiotics has emerged from criticism of the traditional semiotics. The traditional Saussurian semiotics and the enterprise of structuralism based on it have been criticized by later scholars, such as Roland Barthes and Jacques Derrida. Saussure defines a sign as a unity of signifier and signified, but Barthes discusses an inherent fallacy of Saussure’s model of sign with the notion of *polysemy*. According to Gottdiener (1995), polysemy refers to “the ambiguous nature of the signifier and the possibility (likelihood, actually) that any given signifier would be interpreted as linked to a different signified by different people” (p.20). He further argues that circumstance “and context in communication counts for so much that meaning is always volatile and any putative suggestion of a transcendental signified, as in Saussure, seems ignorant of the basic facts of human

²⁵ Social semiotics is also called socio-semiotics.

discourse” (p.20). As a result, the one-to-one correspondence between signifier and signified is undermined, and the transcendental nature of a sign is no longer accepted as true.

Polysemy is not the only issue that undermines Saussure’s semiotics. Hall (1997) criticizes Saussure’s semiotics for focusing “almost exclusively on the two aspects of the sign – *signifier* and *signified*”. On the other hand, Peirce pays greater attention to “the world of things, people and events outside language in the ‘real’ world” (p.34). Gottdiener (1995) discusses the fundamental difference between Saussure and Peirce; Saussure “did not consider, in his system, whether or not an objective world was essential to language. Peirce, in contrast, was no idealist. He believed the real world existed and played a role in signification” (p.10). In addition to ignoring the real world, Saussure’s semiotics puts too much emphasis on formal aspects of language (Hall, 1997, p.35), and therefore, diverts “attention from the more interactive and dialogical features of language” (p.35). Consequently, it does not raise an issue of power in language (p.35).

Efforts to overcome the limitations of the traditional semiotics have led to a new version of semiotics, social semiotics, which is able to cope with new awareness and perspectives arising in the realm of signification and representation. Social semiotics is a still developing area of study. Hence, a unified set of theories or assumptions is still to come. Therefore, I will discuss fundamental theories or assumptions of social semiotics discussed by groups of social semioticians.

Discussing a social semiotic theory of representation, Kress and van Leeuwen (2006) describe “representation as a process in which the makers of signs, whether child or adult, seek to make a representation of some object or entity, whether physical or semiotic, and in

which their interest in the object, at the point of making the representation, is a complex one, arising out of the cultural, social and psychological history of the sign-maker, and focused by the specific context in which the sign-maker produces the sign” (p.7). As they claim, the “social and psychological history of the sign-maker” and “the specific context” of sign-making are two key aspects emphasized in a social semiotic approach. Additionally, they use the term, *interest*, to describe the selective aspect of representation. Because of interest, sign-makers select some criterial aspect of an object when they describe it (p.7). In other words, “it is never the ‘whole object’ but only ever its criterial aspects which are represented” (p.7).

Furthermore, Kress and van Leeuwen discuss *motivation* in addition to interest as a fundamental nature of signs. While traditional semiotics views relationship between signifier and signified as objective likeness (icon), causal relation (index), or convention (symbol), social semiotics conceives “signs as motivated – not as arbitrary – conjunctions of signifiers (forms) and signifieds (meanings)” (p.8). This is so since sign-makers “use the forms they consider apt for the expression of their meaning, in any medium in which they can make signs” (p.8). Interest and motivation are useful concepts that provide underlying assumptions for this study in the sense that diagram designers select some criterial aspects, and choose “the most plausible” and “the most apt form” to represent their intended meaning in a given context (p.13).

Social semiotics also pays attention to the fact that “communication takes place in social structures which are inevitably marked by power differences” (p.13). “Participants in positions of power can force other participants into greater efforts of interpretation, and their notion of ‘maximal understanding’ is therefore different from that of participants who do

their best to produce messages that will require a minimal effort of interpretation, or from that of participants who, through lack of command of the representational system, produce messages that are harder to interpret” (p.13). Concern with interest and motivation in social semiotics inevitably leads to concern with the issue of power, since some people are given more opportunities to communicate their values, opinions, or argument to others who do not. Interest, motivation, and power as theoretical concepts taken from social semiotics can serve as useful tools for understanding the rhetoric of diagram. If we put this discussion in visual terms and connects it to the theme of this study, this might lead to the issue of the affiliation of diagrammatic style with the source of information. According to the source from which diagrams are selected, diagrammatic style might be different, and viewers might have different expectation about diagrammatic style, depending on the source.

Gottdiener (1995) also proposes several basic premises of social semiotics. As opposed to the emphasis on the *conception* of culture (i.e. the mental image) in traditional semiotics, “social semiotics accounts for the articulation of the mental and the exo-semiotic, the articulation, between the material context of daily life and the signifying practices within a social context” (p.26). Under the influence of the Peircian semiotic tradition, Gottdiener considers material world as a critical aspect in his semiotic model. The emphasis on the material world is a central assumption for this study, since visual images such as diagrams belong to the material world.

Social semiotic approach further assumes that material forms are encoded by ideological meanings which are engineered²⁶ into form (p.28). “According to socio-semiotics, any material object constitutes the intersection between social context and the codified, connotative ideologies of social practice, on the one hand, and the material, objective, production or design practice which produces the object world, on the other” (p.56). The notion of ideologies codified in material forms is a useful one for this study because this study aims to explore values, attitudes, or ideologies encoded in diagrams.

5.2. Conceptual Framework

The conceptual framework for this study is diagrammed in Figure 43.

²⁶ Gottdiener interpret this term as “materialized” (1995, p.28).

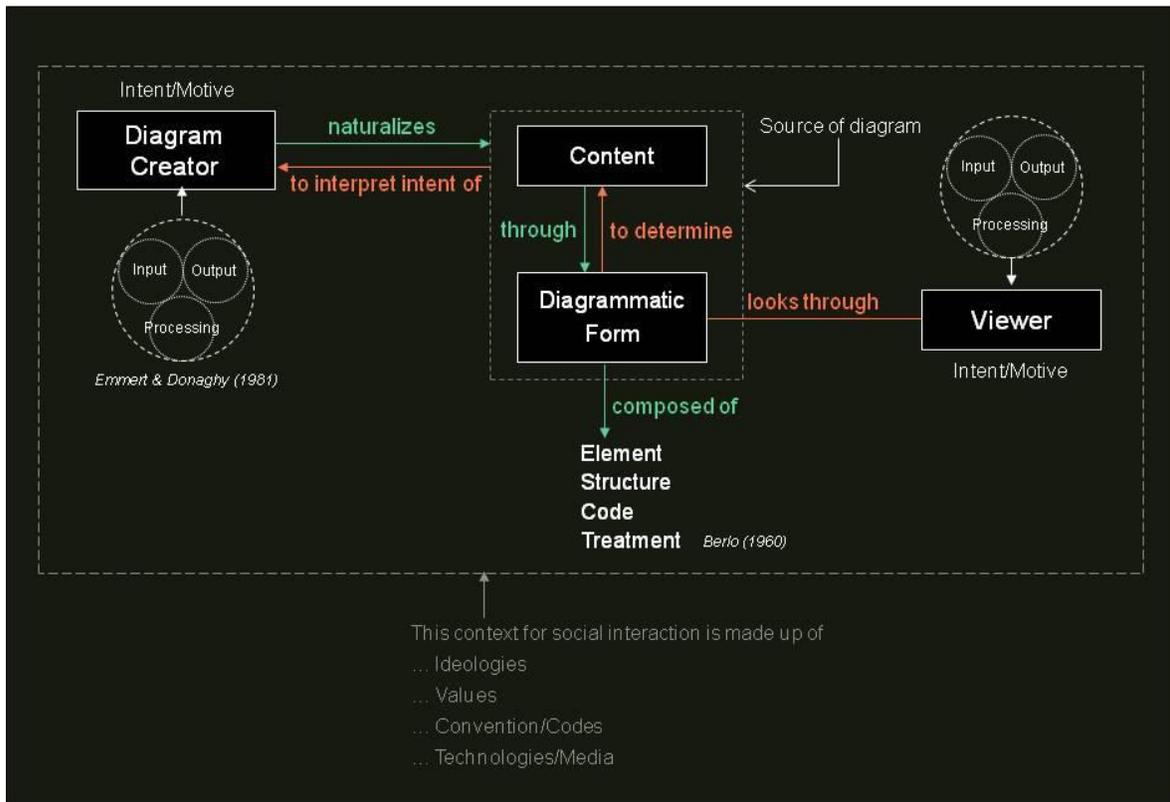


Figure 43. Conceptual Framework²⁷

As depicted by the green arrows in Figure 43, in the visual communication through diagrams, a creator of a diagram (the originator of the data or the designer who both created the diagram content and designed the diagram), either consciously or unconsciously, naturalize

²⁷ Although diagrammatic form and content are positioned in separate boxes in Figure 43, and thus, seem to be separate at a glance, I do not mean to show that they are separable. They are actually not separable, but closely integrated. If a closer look is given to Figure 43, form and content are actually integrated in the dotted line. In the process of visualizing how communication through diagrams occurs, I realized that it was difficult to represent it diagrammatically in a way that does not reproduce the conduit model based on modern ideas. Thus, much of what I diagrammed in Figure 43 still seems to be under the influence of modernism. However, I acknowledge that the modern idea that form and content are split is problematic, and postmodern alternative to the modern model should be devised to properly describe the communication process through diagrams.

the message content of diagrams through diagrammatic form that is composed of element, structure, code, and treatment (or style).²⁸ On the other hand, viewers look through diagrammatic form to determine the message content of diagrams, and ultimately, to interpret the intent of the diagram creator. Diagrams are interpreted in the context of the source, that is to say, from what magazine or newspaper it comes from.

Both designers and viewers bring their own intent or motive, either conscious or unconscious, to the visual communication through diagrams, and both of them are informed by all the inputs, outputs, and processing they had in the past.²⁹ Both designers and viewers communicate in the social context, since the visual communication between designers and viewers through diagrams does not happen in vacuum, but in a social context made up of ideologies, values, convention & codes, and technologies & media.

5.3. Research Questions

Main Question:

What rhetorical significance do viewers assign to diagrams on the basis of the formal qualities of diagrammatic elements or configurations?

²⁸ To define the notion of diagrammatic form, I borrow from Berlo's (1960)'s five components of a message. Berlo describes five components that make up a message; content, element, structure, code, and treatment (or style). Among the five components, element, structure, code, and treatment constitute formal qualities of a message.

²⁹ I borrow the three concepts from Emmert and Donaghy (1981).

Sub-questions:

1. To what elements or configurations of diagrams are viewers likely to assign rhetorical significance? (Answered by a rhetorical analysis)
2. To what elements or configurations of diagrams do viewers actually assign rhetorical significance? (Answered by the 1st qualitative interview)
3. What diagrammatic elements or configurations do viewers select to accomplish specified rhetorical goals, and why do they select them? (Answered by the 2nd qualitative interview)

5.4. Definition of Key Terms

● *Diagram*: A simplified and structured visual representation of concepts, ideas, relationships, and quantitative, statistical, or qualitative data used in all aspects of human communication. Charts, graphs, and maps, not intended for general reference, but convey particular themes, are all defined as diagrams. Although maps are sometimes considered as a separate genre from diagrams, I include them to the genre of diagram in this study, calling them map-based diagrams. For example, line graphs, bar graphs, pie charts, map-based diagrams, flow charts, concept maps, Venn diagrams, and etc. are all sub-genres under diagram.

● *Rhetorical*: To simplify, an academic term for “persuasive.” Visual communication through visual images or artifacts has some kinds of *influence* on viewers who interact with

the images or artifacts themselves. There is influence exerted on viewers as a result of visual communication, since visual images or artifacts express particular point(s) of view or value(s), and persuade viewers in a particular way. In this sense, visual communication through visual images or artifacts always involves persuasive dimension. Therefore, I conceive of visual communication through diagrams as inherently “rhetorical,” in the sense that it always expresses point(s) of view or value(s), and persuade viewers in a particular way, encouraging viewers to accept the expressed point(s) of view or value(s).

- *Persuade*: A form of exerting influence on someone. “Persuading” is a process of causing someone to adopt a certain idea, point of view, perspective, position, belief, or course of action. In this study, I especially focus on how visual images or artifacts encourage us to adopt a certain idea, point of view, perspective, position, belief, or course of action.

- *Rhetorical Significance*: I define “having rhetorical significance” as “expressing point(s) of view or value and attempting to persuade in particular ways. Rhetoric has been traditionally defined as a realm of persuasion by scholars who conceive “persuasion” as its central function. While the traditional definition of rhetoric as overt persuasion has been dominant, scholars, such as Burke, proposes an alternative lens to see rhetoric, providing us with a way to add a more indirect definition of rhetoric, which enables us to define rhetoric as expressing and promoting point(s) of view or values as well. Burke does this through his famous notion, “identification.” According to Burke (1969), the need to identify with others arises from the fundamental situation in which human beings are in, “division.” He argues that “If men were

not apart from one another, there would be no need for the rhetorician to proclaim their unity” (p.22). Proposing the contrasting concepts, identification and division, Burke argues that “A is not identical with his colleague, B. But insofar as their interests are joined, A is identified with B. Or he may identify himself with B even when their interests are not joined, if he assumes that they are, or is persuaded to believe so” (1969, p.20). He, then, connects the notion of identification with consubstantiality, another main concept that grounds his theory. He continues to argue that “To identify A with B is to make A “consubstantial” with B,” and “in acting together, men have common sensations, concepts, images, ideas, attitudes that make them *consubstantial*” (p.21). Thus, through the process of identification, points of view or values that one has can be shared and identified by the other, and this enables us to define rhetoric as expressing points of view(s) or values as well. As Burke argues that “the basic function of rhetoric, the use of words by human agents to form attitudes or to induce actions in other human agents, is certainly not “magical,”” the other person’s attitude, belief, or behavior might be influenced as a result of identification. I integrate the two different definition of rhetoric into the term, rhetorical significance, understanding rhetoric both as persuasion and as expressing and promoting point(s) of view or value(s).

- *Formal Qualities of Diagrammatic Elements or Configurations*: Physical aspect of diagrams created by the elements of a diagram and their configuration. To elaborate on this basic definition, I borrow from Berlo’s (1960)’s five components of a message. Berlo describes five components that make up a message; content, element, structure, code, and treatment (or style). Among the five components, element, structure, code, and treatment

have something to do with formal qualities of a message. In a diagram, an element means a physical constituent of a diagram, such as lines, bars, pie-shaped figures, arrows, maps, colors, and etc. A structure means arrangement of diagrammatic elements. A code refers to cultural conventions that determine how we read and interpret diagrams. Treatment refers to a particular manner or technique by which a diagram is represented. By *formal qualities of diagrammatic elements or configurations*, I refer to the overall qualities of diagrams that arise from the combination of individual elements (element), the manner by which they are represented (treatment), the way elements are arranged (structure), and the conventions that influence the ways in which elements are arranged (code).

- *Diagrammatic Element*: A constituent part of diagrams, such as lines, bars, pie-shaped figures, arrows, maps, colors, and etc.
- *Diagrammatic Configuration*: Visual or spatial arrangement of elements in a diagram.
- *Value*: A principle, standard, or quality considered worthwhile or desirable by an individual or a group of individuals
- *Point of View*: A position or perspective from which something is considered or evaluated.

CHAPTER 6. RESEARCH DESIGN AND METHODOLOGY

6.1. Research Design Overview

The goal of this study is to explore what rhetorical significance viewers assign to diagrams on the basis of the formal qualities of diagrammatic elements or configurations. In order to investigate this, first, I need to analyze to what elements or configurations of diagrams viewers are likely to assign rhetorical significance through a rhetorical analysis. Then, I can confirm or disconfirm the result of my rhetorical analysis by examining to what elements or configurations of diagrams viewers actually assign rhetorical significance, and then, comparing the result from my analysis with the result from viewers' actual response. Through this process, I can address the question, "what rhetorical significance viewers assign to diagrams on the basis of the formal qualities of diagrammatic element or configurations."

In order to address the main research question, I employ a 'sequential multi-method qual→QUAL' research design (Tashakkori & Teddlie, 2003, p.10), composed of two qualitative research methods, a rhetorical analysis and qualitative interviews, taken in sequential phases (Table 3). The phase 1A is "a rhetorical analysis" of pre-existing diagrams, employed for the purpose of identifying diagrammatic elements or configurations to which viewers are likely to assign rhetorical significance. Then, in order to compare the results of the rhetorical analysis with individuals' actual perceptions and responses, I, in the phase 1B, adopt a "qualitative interviewing" method, and investigate "to what elements or configurations of diagrams viewers actually assign rhetorical significance." Next, in the phase 2, I examine viewers' perceptions as revealed through the diagrams they choose in order to accomplish two different rhetorical goals, choosing diagrams that would be

appropriate for a chapter on global warming in a college science textbook vs. choosing diagrams that would be appropriate in a printed report from social activists or lobbyists designed to persuade legislators about issues of global warming. The phase 2 is employed for the purpose of triangulation with the results from the phase 1.

Table 3. Research Design

	Sequential Multi-method qual → QUAL Research Design		
Phase	Phase 1		Phase 2
	A	B	
Research Method	Rhetorical Analysis of Pre-existing Diagrams	Qualitative Interview about Viewers' Perception	Qualitative Interview about Viewers' Perception through Their Choices of Diagrams
Research Question to Address	To what elements or configurations of diagrams are viewers likely to assign rhetorical significance?	To what elements or configurations of diagrams do viewers actually assign rhetorical significance?	What diagrammatic elements or configurations do viewers select to accomplish specified rhetorical goals and why do they select them?

The rationale for choosing a multi-method research design is that the results from the rhetorical analysis taken in the phase 1A provide necessary data for the next phase, 1B, in terms of justifying what diagrams should be selected for the interviews in the 1B and 2 phase. By comparing the elements and configurations of diagrams identified by the rhetorical analysis (phase 1A) with the elements and configurations to which viewers actually assign rhetorical significance (phase 1B), we can address the research questions. Then, the second qualitative interviews (phase 2) further provide data to be triangulated with results from the previous phase, ultimately enabling us to address the main research question.

6.2. Sample and Sampling

For this research, I need two kinds of samples, diagrams for a rhetorical analysis, and participants who will have interviews. The fundamental principle for the two samples is “purposeful sampling” strategy (Patton, 2003, p.230), since I aim to choose information-rich samples to yield useful data relevant to my research question rather than to make generalization from a sample to a larger population. Purposeful sampling strategy can provide insights and in-depth understanding about my research question.

6.2.1. Diagram Sampling

In terms of sampling diagrams, I collected diagrams that deal with the issue of global warming, since it is not only one of the hot topics that currently attracts public attention, but also a sufficiently complex and rich area within which science, rhetoric, politics, ideologies, values, and interests of various groups coexist. Indeed, global warming is one of the typical

social issues in which different points of view, ideologies, values, and interests of scientists, politicians, media, and environmentalists compete against one another in order to acquire dominance and authority. The choice of global warming as an area of topic is based on “typical case sampling” (Patton, 2003, p.236) among many purposeful sampling techniques, since it is a typical case of many social issues that are inherently complex, involving conflicting points of view and interests. The sampling of global warming as the subject matter is illustrative rather than definitive (Patton, 2003, p.236), since, by choosing it, I aim to illuminate the cases of similar social issues rather than to make a generalized statement from the case.

In terms of sources, I sampled diagrams from articles selected from both politically conservative and liberal magazines and newspapers, such as *The New American*, *Time*, *Newsweek*, *Mother Jones*, *The New Scientist*, *The Wall Street Journal*, *The New York Times*, and *USA Today*, in order to keep a balance between different positions on the chosen social issue. By collecting diagrams from the magazines and newspapers that take different political positions, I was able to sample various diagrams that represent different ideologies, values, and interests. In other words, the decision on the choice of the magazines and newspapers from which I sampled diagrams is based on “heterogeneity sampling” (Patton, 2003, p.234).

In terms of time, I collected diagrams from articles published between 2004 and 2008. The reason I chose the time frame is because a documentary film, *The Inconvenient Truth*, had been released in 2006. I consider the release of the film as a remarkable moment in the history of the global warming issue, since the impact that this film had on public understanding of global warming has been huge. The release of the film has put the issue of

global warming into the public discourse. I sampled diagrams from articles published between 2004 and 2008, since it covers the three different time frames, before the release, at the release, and after the release of the film.

Basically, I sampled diagrams with elements or configurations that have rhetorical meanings. In addition, based on heterogeneity sampling, I tried to maximize the variation of diagrammatic elements and configurations that have rhetorical meanings. By doing so, I was not only able to come up with as many diagrammatic elements and configurations that have rhetorical meanings as possible, but also able to utilize the identified diagrammatic elements and configurations in order to create a comprehensive set of elements and configurations to be provided to participants for interviews.

For diagram sampling, I collected every diagram that deals with global warming from the magazines and the newspapers published between 2004 and 2008. Then, I selected diagrams from that larger set based on the following aspects: maximization of variation of diagrammatic elements and configurations, selection of diagrams from various time periods between January 2004 and June 2008, selection of similar number of articles from each of the various sources, and availability of diagrams that fit the conditions described so far from each source. The total number of diagrams sampled from the sources is 56, and the final number of diagrams sampled from each source is as follows.

Table 4. Number of Diagrams Selected from Each Source

Source of Diagram Collection	Magazines					Newspapers			Total No.
	The New American	Time	Newsweek	Mother Jones	The New Scientist	The Wall Street Journal	The NY Times	USA Today	
No. of Collected Articles	3	6	4	3	8	5	5	5	39
No. of Collected Diagrams	9	8	4	3	15	5	6	6	56

6.2.2. Participant Sampling

In order to sample participants for the research, I sampled native English speakers who satisfy two conditions. First, I sampled native English speakers who are familiar with the source magazines and newspapers from which the sampled diagrams are chosen, and thus, can understand the rhetorical significance of the diagrammatic elements or configurations in the sampled diagrams. In order to make sure that the sampled participants are familiar with the sources, prior to having an interview, I asked participants to fill out a form asking about their familiarity with the source magazines and newspapers.

Second, I limited the range of participant samples to university students. This study is an initial attempt to explore the rhetoric of diagrams, and university students are a relatively

well-defined group of people whom I assume to have more access to diagrams in textbooks, magazines, or newspapers than other groups of people. How this group of people read and interpret diagrams can serve as a good starting point from which I set out the study of the rhetoric of diagrams. Thus, I aim to study what rhetorical significance the sampled university students assign to diagrams on the basis of the formal qualities of diagrammatic elements or configurations.

I sampled 30 students who speak English as a native language from Yonsei University in Korea and the National University of Singapore in Singapore.³⁰ Adopting “stratified purposeful sampling” (Patton, 2003, p.240), I originally attempted to recruit students from diverse majors, trying to allocate the same number to each major. This sampling choice is based on the assumption that students’ major might affect their perception of the diagrams. Although I was not able to get the exactly same number of students from each major, I sampled a wide range of students in terms of their major. As shown in Table 5, the 30 students were chosen from the 16 different majors. The final result of the participant sampling is as follows.

³⁰ First, I sampled 24 students from Yonsei University in Korea, but there was only one student who majored in Engineering in the original sample. Thus, I sampled 6 more students from the College of Engineering in the National University of Singapore in Singapore, in order to have variety in terms of students’ major by making sure that I have enough students from engineering major.

Table 5. Number of Participants Selected from Each Major and College

Student's Major	No. of Sampled Students	College	Total No. from Each College
Literature	1	Humanities	2
Dramatic Arts	1		
International Relations	6	Social Science	19
International Trade	4		
Korean Studies	4		
Sociology	1		
Anthropology	1		
Politics	1		
Psychology	1		
History	1		
Economics	1		
Business Management	1		
Chemical Engineering	3	Engineering	7
Computer Science	2		
Mechanical Engineering	1		
Biomedical Engineering	1		

6.3. Data Collection Methods

6.3.1. Rhetorical Analysis of the Pre-existing Diagrams (Phase 1A)

The first research method in the sequential multi-method research design is a rhetorical analysis of the sampled diagrams, which is designed to address the sub-question 1, “To what elements or configurations of diagrams are viewers likely to assign rhetorical significance?” Thus, the purpose of doing a rhetorical analysis is to identify elements or configurations of diagrams that viewers are likely to assign rhetorical significance. A visual rhetorical analysis is a qualitative research method that examines viewers’ rhetorical responses to visual images or artifacts. Thus, its main focus is on investigating the communicative dimensions of visual images or artifacts – how the use of visual symbols through visual images or artifacts influence people’s thinking, values, or behavior – through analyzing formal and substantive natures and the function that visual images or artifacts perform. As the research questions that I proposed earlier indicate, the focus of this study is on investigating the rhetorical function of diagrammatic forms. Thus, a visual rhetorical analysis is the most suitable research method for generating useful data that enable us to answer the sub-question 1.

Rather than taking a deductive approach to diagrams, which relies on rhetorical theory as a guiding analytical tool (Foss, 2005, p.148), I took an inductive approach to diagrams, eventually constructing my own analytical tool, in order to identify elements or configurations of the sampled diagrams to which viewers are likely to assign rhetorical significance. In other words, I generated my own method of criticism rather than using a previously developed formal method of criticism in order to illuminate the sampled diagrams

as thoroughly as possible rather than fitting the analysis to a particular rhetorical theory. By employing an inductive approach, I was able to avoid missing significant and interesting findings that cannot be fully captured by a pre-established method.

According to Foss (2004), a generative criticism involves a couple of steps for analyzing visual images or artifacts, and I took some useful ones out of them that I thought necessary for generating my own method of analysis. Foss indicates that a generative criticism starts with “encountering a curious artifact” (p.411), and then, coding of the artifact (p.413). Coding of the sampled diagrams has been geared toward identifying elements or configurations of the sampled diagrams to which viewers are likely to assign rhetorical significance, in order to address the research question 1. At this pre-analysis stage, I tried not to bring in other people’s theories, letting the data reveal insights independent of any preconceived theories (p.415). To facilitate the coding process, I wrote down potential diagrammatic elements or configurations to which viewers are likely to assign rhetorical significance.

Next, I searched for already existing conventional ways to explain the diagrammatic elements or configurations identified from the sampled diagrams by the coding procedure. The existing conventional ways to explain are derived from relevant concepts or theories in rhetorical theory. In order to find them, I investigated journal articles and book chapters that can inform me of analysis of similar images or topics. I created a list of useful concepts and theories from rhetorical theory and criticism by writing them down on a piece of paper.

Then, I had “a conceptualizing conversation” (p.420) with three students in order to share my coding result with other people. I chose students who are not familiar with visual

rhetoric and communication, and had a conversation with each of them about the sampled diagrams, since students who are not trained in visual rhetoric and communication can see things that I, as a critic, cannot see, and provide fresh perspectives or ideas that are not confined by a specific body of knowledge (p.421). The three students were an undergraduate student studying mathematics, an undergraduate student studying sociology, and a graduate student studying computer science. Through the conversation, I was able to compare the diagrammatic elements or configurations that I identified through the coding procedure with those that they identified. I coded the sampled diagrams again after having a conceptualizing conversation, and came up with a list of diagrammatic elements or configurations to which viewers are likely to assign rhetorical significance and a list of useful concepts and theories that I can use for a rhetorical analysis. Then, in order to increase dependability of the coding result, I recoded the sampled diagrams approximately four months after the diagrams had been first seriously coded after the conceptualizing conversation without looking at the codes found in the first serious coding procedure.

Then, I did a literature review of the key concepts and theories in the list, and built up a viable theoretical framework for my rhetorical analysis, synthesizing them. Using the theoretical framework, I did a rhetorical analysis of the sampled diagrams, and identified diagrammatic elements or configurations to which viewers are likely to assign rhetorical significance in order to address the sub-question 1.

6.3.2. The First Qualitative Interview (Phase 1B)

After I finished a rhetorical analysis of the sampled diagrams, I selected 12 articles from the original 39 (24 diagrams from the original 56). The criteria for selection are as follows. First, I reduced the original appendix of the identified elements and configurations of diagrams (Appendix 3) to a more concise one, which left only the diagrammatic elements and configurations identified more than three times in the horizontal axis (Appendix 4), and then checked which diagram has the elements and configurations. Then, I selected some from the 56 diagrams on the vertical axis, trying to maximize the number of identified diagrammatic elements or configurations to be contained in the diagrams chosen for the 1B and 2 phase, the two qualitative interviews. I also tried to include at least one article from each magazine or newspaper in order to make sure that I collected articles from source materials taking various political positions. Last, I tried to control the number of identified diagrammatic elements or configurations to be contained in the 24 diagrams according to how many times each of them was identified, trying to increase the number of inclusion when a diagrammatic element was identified more than others.

Then, I divided the 12 articles, which include the 24 diagrams, into 6 groups by pairing 2 of them, trying to have similar number of identified diagrammatic elements or configurations in each set of articles and also trying to make sure that I had two articles from different sources in each pair. Then, in order to assign the 12 articles divided into 6 sets to the participants, I randomly divided the 30 sampled students into 6 groups, trying to have compatible groups in terms of their majors, and then, randomly assigned the 6 sets of articles to the 6 groups of interviewees. Prior to interview, I asked interviewees to read the assigned

articles and see the diagrams in them alone for 20 minutes, and then, had an interview, using the attached interview protocol (Appendix 6) as a guiding tool. I videotaped and audio-taped during interviews.

6.3.3. The Second Qualitative Interview (Phase 2) ³¹

In order to answer the third research question as well as to triangulate with the results from the phase 1, I adopted the second qualitative interview as a data collection method in “phase 2.” For the second interviews, I randomly divided the 30 participants into two groups, again trying to have compatible groups in terms of their majors. Before the interview, I cut out all the diagrams from the 12 articles selected from the original 39, and, during interview, randomly arranged them on a table except the ones that each interviewee had already seen in the first qualitative interview. Then, I asked the first group of participants to choose a diagram that they thought would be appropriate for a chapter on global warming in a college science textbook. After they chose, I had an interview with them, using the interview protocol (Appendix 6) as a guiding tool. I asked the other group of participants to select a diagram that they thought would be appropriate in a printed report from social activists or lobbyists designed to persuade legislators about issues of global warming. ³² Then, I had an interview with each of them, using the interview protocol (Appendix 6) as a guiding tool. The interviews were both videotaped and audio-taped.

³¹ The second qualitative interviews were done with the same 30 interviewees who did the first interviews. The second one followed right after the first interview session was over because of convenience.

³² I also asked them to choose some for pro argument (the globe is warming) and some for counterargument (the globe is not warming), since some diagrams are for global warming, while others are against global warming.

The purpose of the qualitative interviews in the phase 2 was to know participants' perception through their choices of diagrams and what they said about their choices. In other words, it was geared toward identifying to what diagrammatic elements or configurations they actually assign rhetorical significance through the analysis of what choices they made and what diagrammatic elements or configurations they mentioned as a reason for their choice, when they were given the pre-existing sampled diagrams that accompany the identified elements or configurations as an inventory for accomplishing the rhetorical goals they were supposed to accomplish. While the phase 1b reveals data through interviewees' interpretation of the diagrams ("what they say"), the phase 2 reveals another set of data through both what they choose to get other people to interpret diagrams ("what they do") and what they talk about their choices ("what they say"). The results from the two phases have been integrated for triangulation.

6.4. Limitations of the Research

The sampled diagrams are limited to the ones that deal with the issue of global warming only, and thus, the study of the rhetoric of diagrams pursued in this research is limited to the context of global warming. The diagrammatic elements and configurations identified through this study are the ones that diagram makers chose in order to effectively convey messages relevant to the unique issue. Therefore, we cannot make a generalized statement from the findings from this unique study.

As mentioned earlier, this study is an initial attempt to explore the rhetoric of diagrams. Because of little precedent studies that deal with the similar topic, I sampled

university students as participants for the interviews in the expectation that how this relatively well-defined group of people read and interpret diagrams can serve as a good starting point from which the study of the rhetoric of diagrams begins. Therefore, the result of the first and second qualitative interview that influences the findings from this study is based on university students' perception of the sampled diagrams.

In addition, although I originally attempted to recruit students from diverse majors, trying to allocate the same number to each major, I was not able to get the exactly same number of students from each major. Although I sampled a wide range of students in terms of their major, 10 out of the 30 students in total are students from International Relations or International Trade.

6.5. Quality Standards

I consulted Guba's (1981) four categories of quality standards in a naturalistic inquiry; credibility, transferability, dependability and confirmability to enhance the overall quality of my study. I discuss what kinds of efforts have been made to increase the quality of this study in detail.

6.5.1. Credibility

To increase the credibility of this study, triangulation has been employed. Denzin stresses that a variety of data sources, different investigators, different perspectives (theories), and different methods should be used to cross-check data and interpretations (Guba, 1981, p.85). In this study, I employed a multi-method research design that consists of a rhetorical

analysis and two different qualitative interviews, the first one focusing on what people say, and the second one focusing on what people choose and what they say about their choices. I sequentially took the three data collection procedures for cross-examination.

Additionally, member checks have been used. According to Guba (1981), for member checks, researchers need to continuously test data and interpretations as they are derived with members of the various audiences and groups from which data are solicited (p.85). Guba emphasizes member checks as the single most important action inquirers can take, for it goes to the heart of the credibility criterion. In order to do the member checks, I provided the interviewees with interview transcripts, and asked questions firsthand, especially about things that I did not understand very clearly. From this procedure, I was able to have a better understanding of what they mean by what they say. Sometimes, corrections have been made when necessary based on their feedback.

6.5.2. Transferability

As Guba (1981) puts it, it is not possible to develop “truth” statements that have general applicability in naturalistic inquiries. Rather, one must be content with statements descriptive or interpretative of a given context – ideographic or context-relevant statements. Guba states that transferability can be acquired when the research findings can be extended to other contexts. Since this study uses the diagrams selected from the fore-mentioned magazines and newspapers, and the diagrams have been analyzed and interpreted by a particular group of people, university students, the research findings cannot be generalized to larger populations. However, it is applicable to other similar cases in which we have similar diagrams, similar

magazines or newspapers, and similar group of people. In terms of subject matter of diagrams, global warming chosen for this study is one of the typical social issues that involve science, rhetoric, politics, ideologies, values, and interests of various groups. Thus, the research findings are transferable to diagrams that deal with similar social issues.

6.5.3. Dependability

According to Guba (1981), dependability is related to keeping stability of data from different realities being tapped or instrumental shift. To enhance dependability, in the rhetorical analysis of the sampled diagrams, I coded major themes twice with time interval between the first and the second coding. Approximately four months after the diagrams had been coded from the diagrams, I recoded them, and identified codes again without looking at the codes found in the first coding procedure four months ago.

Guba argues that auditing by an external auditor can enhance dependability. According to this advice, I had a conceptualizing conversation with three students who are not trained in visual rhetoric in order to compare my findings with theirs. The three students whom I had a conceptualizing conversation with can serve as an external auditor, who can bring a different lens to interpret the sampled diagrams.

In addition, I analyzed interview transcripts collected from the two qualitative interviews twice. Approximately seven months after the data was first analyzed and the diagrammatic elements or configurations to which the interviewees assigned rhetorical significance identified, I analyzed the same data again, and re-identified diagrammatic elements and configurations without looking at the results from the first analysis and

identification. Then, I compared the results from the two, and when there was discrepancy between the code identified through the first coding procedure and the code through the second coding procedure, I took a better one out of the two codes, which I think more appropriate for the given transcript.

Last, I did an intercoder reliability check with the diagrammatic elements and configurations that had been identified through the interviews. The check has been done by one graduate student and two undergraduate students, and the scores of agreement were 91%, 96%, and 98%, respectively. I provided each of the three students with the documents for the check in person, and had a conversation about the instruction for coding and the definitions of the codes provided. I made sure that they understood what the instruction asks them to do and what each definition of code means, and answered their question when they have one. When they had further questions, I answered through email.

6.5.4. Confirmability

In order to enhance confirmability, multiple data sources were used and multiple research methods were employed. As Groat and Wang (2002) mention, researchers in a qualitative research are considered as a measurement device, while researchers in a quantitative approach rely on external measurement device. Therefore, understanding and interpretation that researchers bring to the study become important, and consequently, researcher's value, point of view, and bias become a key factor that might affect the study. To minimize my personal point of view and bias, I left notes to reflect on my "subjective" thinking.

CHAPTER 7. FINDINGS

7.1. A Rhetorical Analysis of the Sampled Diagrams and Findings

7.1.1. Introduction to a Rhetorical Analysis

As planned earlier, the first phase (1A) of the research is a rhetorical analysis of the pre-existing diagrams, designed to address the sub-question no.1, “To what elements or configurations of diagrams are viewers likely to assign rhetorical significance?” Thus, it is an investigation of the diagrammatic elements or configurations that circulate in the culture and context that could be used to inform viewers of “rhetorical significance,” that is, “of images or artifacts that express points of view or values and attempt to persuade in particular ways.”

In order to do a rhetorical analysis of the 56 diagrams sampled from the fore-mentioned magazines and newspapers, I developed a viable framework for analysis through integrating my coding of the sampled diagrams, the three students’ coding of the sampled diagrams derived from the conceptualizing conversation, and the list of useful concepts or theories for rhetorical theory identified by a literature review. Then, I rhetorically analyzed the diagrams, applying the viable framework to my analysis.

7.1.2. Literature Review

Among theoretical concepts and ideas in rhetorical theory and criticism, I focused on four particularly useful concepts and ideas for the purpose of identifying diagrammatic elements or configurations to which viewers are likely to assign rhetorical significance. The first concept is visual argument. This concept is essential for my analysis, since the analysis starts with an assumption that at least some diagrams, if not all, function as visual arguments.

Thus, I assumed that analyzing the sampled diagrams through the lens of visual argument would enable me to identify diagrammatic elements or configurations to which viewers are likely to assign rhetorical significance. The concept of visual argument and the surrounding discussions are useful for my rhetorical analysis in the sense that they offer a rhetorical lens through which I explore how diagrams persuade in a rational way, functioning as visual argument, and thus, mainly appealing to our logoi. I also discuss theoretical concepts related to visual argument, such as visual enthymeme, visual demonstration, context, genre, and style, since they are useful for building up the theoretical concept of visual argument as an essential tool for my analysis.

Second, I reviewed literature that deal with rhetorical analysis of colors, especially literatures on similar cases, since they offer useful guidelines for my analysis, helping me analyze the use of colors in the sampled diagrams. Indeed, colors are an effective tool for persuasion, since they not only appeal to our emotion, but also, sometimes, contribute to promoting particular points of view or values. Especially, red, blue, green, and grey are main colors repetitively used in the sampled diagrams, and thus, I focus on the colors for my analysis.

Third, I review Osborn's (1967 & 1978) concept of 'vertical scale metaphor,' a sub-category concept under his overarching notion of archetypal metaphors. Most line graphs and bar graphs in the sampled diagrams display an upward trend through either a line or multiple consecutive bars in order to visualize one of the three main themes of global warming, rising global temperature, rising CO₂ emissions, and rising sea levels. An upward trend that

rhetorically functions can be best analyzed with the theoretical concept of vertical scale metaphor, since it addresses basic human motivations related to the notion of up and down.

Fourth, I review Johnson's (2009) notion of 'tempered apocalypticism,' focusing on analyzing how this modified type of rhetoric from original apocalypticism functions in the sampled diagrams, persuading viewers about issues of global warming both rationally and emotionally.

By synthesizing these concepts and theories, I built up a viable framework for my analysis. In the following section, I discuss the four particularly useful concepts and ideas.

7.1.2.1. Visual Argument

Some scholars in rhetorical criticism foreshadow the idea of 'diagrams as visual argument' in the process of analyzing diagrams from a rhetorical perspective. Lee Brasseur (2005) discusses how Florence Nightingale used her rose diagrams in reporting on the poor sanitary conditions in military hospitals during the Crimean War in order to persuade the government to take necessary actions. On the other hand, Miles Kimball (2006) rhetorically analyzes Charles Booth's maps of London poverty (1889-1902) with his focus on discussing how the maps based on eight color coding schemes makes the overall patterns of London inhabitants' economic (or social) state visible at a glance, consequently making the invisible concept of poverty visible.

Although they analyze two different types of visual representation, they share the notion of *visual argument* in their analysis. None of them consciously draws on the concept of visual argument, but they do pay attention to the argumentative function performed by the

diagram and the map they analyzed, intuitively using the term, “visual argument.” In doing so, they open up a possibility to look at diagrams and maps as visual arguments. As the two articles stop at simply touching on the notion of visual argument, no study so far has systematically looked at diagrams or maps as visual arguments, even in the emerging scholarship on visual argumentation. Yet, I argue that diagrams, at least some diagrams if not all, can argue visually.

I argue so, not only based on the potential to apply the notion of visual argument to diagrams or maps as shown by the literature review, but also based on my observation of the pre-existing diagrams and maps around us, including some of the sampled diagrams about global warming. From my observation of the sampled diagrams, I realized that some of the sampled diagrams, which pretend to simply present purely factual information, actually function as visual arguments.

In controversial social issues such as global warming, different points of view, values, ideologies, or interests collide against one another. Accordingly, scientists, politicians, the media, and environmentalists who have different, and sometimes even conflicting, attitudes toward the issue, compete against one another in order to occupy a dominant position in the discourse. People who compete for a dominant position often use diagrams in order to take advantage of their persuasive, or sometimes argumentative, power in communication. In other words, they make arguments through diagrams to persuade others. Thus, diagrams can function as a useful channel through which people make arguments. This approach to diagrams from a visual argument perspective provides a useful theoretical and critical framework for my rhetorical analysis of the sampled diagrams.

As emphasized earlier, *Visual argument* is one of the most useful concepts for my analysis because it provides a conceptual tool to explore how diagrams persuade in a rational way, mainly appealing to our reason. The concept, ultimately, helped me answer the question that I raised earlier, “To what elements or configurations of diagrams are viewers likely to assign rhetorical significance?,” by enabling me to identify diagrammatic elements or configurations that promote points of view or values and that viewers are likely to find persuading in a rational way. In order to establish visual argument as one of the key theoretical concepts that underpin my analysis, and then apply it for identification of elements or configurations, I investigate how the notion of visual argument has been discussed by scholars in visual argumentation studies so far.

The scholarship on argumentation has long been considered as exclusively belonging to verbal discourse so that visual images have been excluded from the domain. Yet, as visual images become an increasingly pervasive and significant means of contemporary communication, there is increasing recognition of the need to reconsider the boundary of argumentation. According to Hatfield et al. (2007), “scholars began a major effort to examine the role of the visual in argumentation” in the latter half of the 1990s (p.145).

Because of its short history, the scholarship on visual argument is still in its inception, and thus, no single unified theory of visual argument is available yet. However, there are some central concepts and ideas commonly discussed by scholars in this area. I take some of them, most relevant to my analysis, and then, put them in a literature map as shown in Figure 44. I discuss the relevant concepts and issues in the literature map, and clarify what my

understanding of visual argument is by taking a position on them in order to establish visual argument as the first key concept for my analysis.

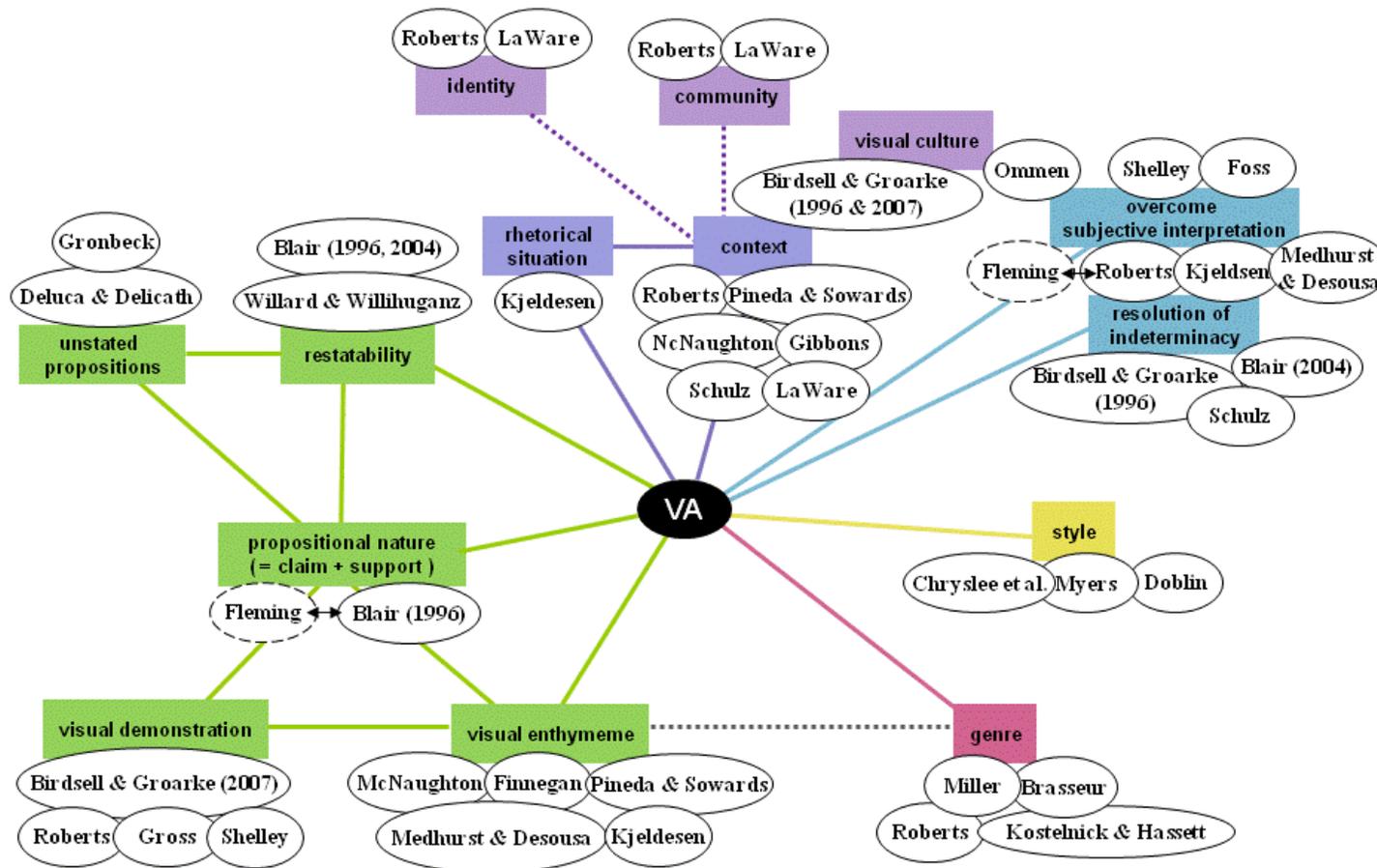


Figure 44. Literature Review Map about Visual Argument

Among many concepts and issues surrounding visual argument, I first focus on the five theoretical concepts linked together on the left side of the map (light green boxes). With the concept of propositional nature in the center, the five concepts, propositional nature, unstated propositions, restatability, visual demonstration, and visual enthymeme, form a close relationship with one another. As implied by its location in the center, the most critical one among the five is *propositional nature*, since I see it as a useful concept for analyzing visual arguments in the sampled diagrams. By having propositional nature, I mean that arguments contain a proposition (or propositions) and a reason (or reasons). According to its definition, a proposition is what is expressed by a sentence that has a truth value, which is to say that it is either true or false” (Blair, 2004, p.44).

As scholars disagree with this issue, which will be discussed in detail later, it is the single most controversial issue regarding whether visual arguments should carry a proposition in themselves. Propositional nature has been the most essential characteristic of traditional form of verbal argument, and thus, scholars in visual argument seek to apply this to visual argument as well. For example, Fleming (1996), as a scholar who sticks to the conventional understanding of argument, opposes to the possibility of visual argument, proposing “two-part structure composed of claim and support” as one of the fundamental conditions for an argument. He demonstrates that pictures cannot be an argument, pointing out the deficiency of propositional nature in visual images, caused by the lack of “internal differentiation between claim and support.”

In opposition to Fleming’s skepticism about visual argument, Blair (1996) defends the possibility of visual arguments, arguing that visual arguments are “easily assimilated to

the paradigm model of verbal argument characterized by O’Keefe’s concept of arguments” (p.11). Drawing from O’Keefe’s model, Blair shows that visual images can become arguments in two significant ways. First, in order to satisfy O’Keefe’s condition for something to be an argument, “arguments are propositional,” he demonstrates that we can draw claims and reasons from some examples of visual arguments in painting, sculpture, and political cartoons with recourse to inference and contextual cues. The second concept that he draws from the model is restatability, as summarized in “arguments are not necessarily linguistic or verbal arguments” (p.4). As long as we can discern claims and reasons, and then, restate them in language, visual arguments can be arguments. Willard and Willihuganz (2003) touch the issue of restatability as well, discussing that “even the fiercest proponents of logocentric views of argument by the 1980s had conceded that as long as nondiscursive premises are linguistically-explicable, they can be analyzed as parts of arguments” (p.632).

Restatability is the second central concept useful for my analysis, since it gives us a way to provide a propositional structure to visual arguments by enabling us to reconstruct claims and reasons from them. While claims and reasons are directly proposed, and therefore, easily discernable in typical traditional verbal arguments, they are implied in visual arguments, requiring viewers’ active construction process. The notion of *unstated proposition* describes this unique characteristic of visual arguments that carry implied propositions. Serving as a reason that we need the concept of restatability for visual argument to function as argument, the notion of unstated proposition expands my previous discussion of the two concepts, propositional nature and restatability. Pointing out the rapidly changing communication environment where “human codes of communication include many more

conventionalized sign systems than phonemic or morphemic languages,” Gronbeck argues that it is time to “rethink our conception of propositions” and “even to introduce and contemplate the idea of unstated propositions” (p.539). There are scholars who encourage us to “rethink our conception of propositions” by introducing new types of proposition. For instance, introducing a particular kind of visual argument called “image events,”³³ DeLuca and Delicath (2003) argue “how images ... are capable of offering unstated propositions, and advancing indirect and incomplete claims in ways that function to block enthymemes as well as advance alternatives” (p.317-318).

While visual arguments are unstated, and thus, implicit in terms of the way they embody propositional nature, additional factors contribute to compensating this uncertainty caused by the implicit nature. Factors involved in the reconstructing process of implicit propositions and reasons are as follows; enthymematic nature of visual argument, context, visual culture, and genre. These factors help viewers not only fixate the meaning of visual images, but also reconstruct and restate claims and reasons from visual arguments. Among the above four factors, I discuss visual enthymeme first.

Visual enthymeme is another central concept that has a close relationship with the three concepts discussed so far. I find it useful for my analysis, since it is another appropriate concept to describe how visual arguments function in a fundamentally different way from verbal arguments. Before I discuss visual enthymeme, I discuss the notion of enthymeme briefly first. Smith (2007) notes that scholars define enthymeme as “an incomplete

³³ “Image events are a postmodern form of argument that employs acts of protest to deliver images as argumentative fragments that serve as inventional resources for public deliberation, and which shift the responsibility for argument construction to audiences” (p. x). DeLuca & Delicath (200?) give examples of image events such as Greenpeace’s confrontation with whale hunters.

syllogism” in which “one of the premises or the conclusion is suppressed because the audience is expected to supply the missing part from common knowledge” (p.115). As shown in the definition, because of its enthymematic nature, visual arguments function indirectly and incompletely, unlike verbal arguments, and all the previously discussed issues, such as restatability, unstated propositions, and viewers’ active role in claim and reason construction, are derived from such a unique characteristic of visual argument.

On the basis of their own contemplation and also analysis of other scholars’ works ³⁴, Pineda and Sowards (2007) also point out the enthymematic nature of visual arguments, arguing that in “visual arguments, audiences must interpret the image they see enthymematically.” Scholars such as McNaughton (2007) demonstrates how “prison tattoos argue enthymematically,” showing that the missing claims and premises of prison tattoos are filled by viewers who draw from necessary cultural knowledge. ³⁵ Medhurst and Desousa (1981) and Kjeldesen (2007) also exemplify how visual enthymeme functions in a Danish political advertisement and in political cartoons respectively.

Medhurst and Desousa (1981) discuss that readers are invited to supply missing links in cartoons in order to complete the message, and, in this process, they depend on their cultural memories (p.220). They then continue to explain that different readers construct different enthymemes from political cartoons and interpret them in different ways because “different readers are resonating with different layers of the culturally-induced message” (p.220). However, this does not raise the ambiguity or indeterminacy issue of visual

³⁴ Pineda and Sowards cite from Barbatsis (1996), Finnegan (2001), and Lancioni (1996).

³⁵ Penitentiary culture does not allow individuals to have autonomy, agency, or freedom to act. Thus, prisoners’ ability to construct individual and communal identities and opportunities for public interaction is limited. Prisoners draw from this cultural knowledge when they see prison tattoos.

meanings, since Medhurst and Desousa argue that (cartoon) artists can set boundaries and limits within which the reader is invited to unpack the multiple layers of culture and remember their meanings (p.222-223). Their discussion is echoed by Kjeldsen's study (2007) of a political advertisement, which illustrates that there is a limit in people's reconstruction of visual arguments although different interpretations are possible,³⁶ through his empirical study of public perception.

Finnegan (2001) further develops the idea of enthymeme, dealing with the case of the skull photographs that provoked the "skull controversy" in 1930s.³⁷ Through demonstrating how the photographs misrepresented the actual drought condition through photographic manipulation, she discusses how strongly naturalism or realism is associated with photographs and photographic practice. According to her discussion, because of this association entrenched in our consciousness, we tend to see and interpret photographs transparently.

Going back to the notion of visual enthymeme, what Finnegan means by naturalistic enthymeme is that "the viewer of the photograph 'fills in the blank' with the assumption that the image is 'real'" in three senses: "that it is a representation of something in the world (*representational realism*), actually occurring before the camera at a particular time and place (*ontological realism*), captured by the camera with no intervention from the photographer (*mechanical realism*)" (p.143). Thus, at the core of the naturalistic enthymeme

³⁶ I attempted to explore this through the empirical part of my research. The ways in which people reconstructed visual arguments and the range of their interpretations could be empirically explored by showing the interviewees the sampled diagrams and then interviewing them, as I planned to do in the second phase of the research.

³⁷ The main source of the controversy is that the photographs misrepresented the actual drought condition in South Dakota, through photographic manipulation, in order to exaggerate the seriousness.

are “the deeply-held, socially constructed and culturally reinforced beliefs” about photographs as a transparent conveyor of reality (p.144). This belief is deep-rooted in our consciousness, and intervenes in the process of filling in the blank when we read photographs.

Finnegan then incorporates the idea of naturalistic enthymeme with visual argument by claiming that “the naturalistic enthymeme offers scholars of visual argument an additional way to conceptualize the argumentative potential” of highly representational images such as photographs, documentary film, television news, and political advertising (p.148). What she says is that photographs “may be considered to be visual arguments inasmuch as they embody the possibility of the naturalistic enthymeme” (p.143). This is so because photographs are visual arguments, which make an argument about its own realism (p.143). Thus, the naturalistic enthymeme in photographs and other highly representational images feeds on their naturalism, realism, and transparency, and serves as an argumentative resource.

The concept of naturalistic enthymeme as an argumentative resource is not directly applicable to my analysis, since diagrams are not highly representational images. Nevertheless, it offers a valuable resource for me to coin a new concept that can be applied to diagrams. While photographs take a highly representational style, diagrams take a different visual style by transforming things into geometric and abstract forms. Yet, in spite of their different representational styles, diagrams and photographs are similar in that they are both considered transparent and neutral reflections of reality. Gastel’s (1983) argument that if “realism is important, the best choice may well be photographs. Otherwise, diagrams, which allow you to emphasize certain features and eliminate the rest, are often the best medium” (p.13) confirms the same quality inherent in the two different styles of visual form.

Drawing on Finnegan's discussion of naturalistic enthymeme and Gastel's argument, I propose a new concept, *diagrammatic enthymeme*, which can best describe the uniquely enthymematic nature of diagrams mainly composed of abstract and geometric forms. What I mean by diagrammatic enthymeme is that viewers of diagrams fill in the blank with the assumption that diagrams are transparent and neutral representations of reality. This assumption is grounded in the deeply held, socially constructed, and culturally reinforced beliefs about diagrams as an objective, rational, transparent, and neutral representation of reality. As photographs are visual arguments that make an argument about their own realism and naturalism, diagrams are visual arguments that make an argument about their own realism based on objectivity, rationality, transparency and neutrality. The invention of diagrammatic enthymeme can also expand the domain of visual argumentation through exploring how diagrams function enthymematically as visual arguments.

As the notion of naturalistic enthymeme and diagrammatic enthymeme, as argumentative resources, imply in themselves, photographs and diagrams are effective media for *visual demonstration*. They are visual demonstration in the sense that they visualize something to argue for their own veracity through employing strategies such as realism and transparency strongly attached to them. For instance, while photographs and maps respectively purport to be a true representation of the objects, people, or places captured by camera and of "the arrangement of places in space" (Birdsell & Groarke, 2007, p.106), graphs and diagrams purport to be a true representation of relationships or arrangements among variables. Regarding this view about photographs and diagrams as visual demonstration, Birdsell and Groarke (2007) contend that a "visual demonstration is

inherently propositional because a visual image is used to convey information that is purportedly true” (p.106). To be more specific, they give five types of visual demonstration such as maps, photographs, graphs, diagrams, and illustrations (p.106). Birdsell and Groarke’s discussion about visual demonstration provides us with a sound basis on which we can not only categorize the five types of visual images, including photographs and diagrams, into visual demonstration, but also assign “inherently propositional” nature to them.

Next, I discuss the purple, the blue, and the red cluster of theoretical concepts together, since the concepts are closely related. The issue of *indeterminacy (or ambiguity) in visual meaning* and *subjective interpretation* as resulting from it in the blue cluster are main reasons frequently mentioned by scholars who limit argument to the realm of the verbal. Indeed, they are evidences that scholars present to claim that visual images cannot argue. For example, Fleming (1996) contends that “Because of their inherent richness, concreteness, and ineffability, visual artifacts actually resist assertion” (p.15), citing Becker’s (1986) argument that “pictures are too subtle to act as assertions” (p. 275). However, other scholars in visual argumentation studies, such as Birdsell and Groarke (1996, 2007), Blair (2004), Schulz (2005), Roberts (2007), Kjeldsen (2007), Medhurst and Desousa (1981), Shelley (1996), Foss (1986), and Ommen (2003), argue that visual meanings can be disambiguated, and thus, fixed, citing different, but sometimes overlapping, factors. The factors that help us fix meanings of visual images are enthymematic nature of visual arguments, context, visual culture, and genre as already mentioned earlier with the notion of unstatedness and restatability.

In order to support their argument that visual meaning is not necessarily arbitrary, vague, or ambiguous, Birdsell and Groarke (1996, 2007) identify five modes of visual meaning, such as flags, demonstrations, metaphors, symbols, and archetypes, and also, emphasize that three kinds of context, immediate visual context, immediate verbal context, and visual culture, play an important role in fixing the meaning of visual images.³⁸ Blair also points out the importance of context, mentioning that we can provide propositional structure to visual arguments with recourse to inference and contextual cues (1996, p.6). Especially, his indication that visual arguments' verbal content can (and often does) function to disambiguate them or make them sufficiently precise" (2004, p.47) echoes Birdsell and Groarke's discussion of immediate verbal context.

In their analysis of visual images or artifacts as visual arguments, nearly all scholars that I reviewed discuss *context* as a key component contributing to disambiguation of visual meanings. McNaughton focuses on men's penitentiaries as a context for prison tattoos, while LaWare (1998) addresses the particular context of Chicano murals, the historical experience of Mexican Americans in the United States and their ethnic origins, and the particular situation of the Chicago neighborhood where the murals are located (p.229). Schulz (2005) is another scholar who points out context as a determining factor for visual argument, defining visual artifacts displayed at the George H. W. Bush (41) Museum as a visual argument, but not the same artifacts in the archives of the library. Based on his discussion, context is the key element that determines whether a visual artifact is a visual argument or not.

³⁸ The three kinds of context have been introduced first in 1996 and reemphasized in 2007.

On the other hand, Gibbons's (2007) analysis is unique in the sense that he shows how the same visual images argue differently in two different contexts. He demonstrates "how functional brain images often argue differently, and even misleadingly, as they move from the scientific journal to the newspaper story" (p.175). Roberts' study (2007) and Pineda and Sowards' (2007) are similar in that their visual artifacts are both in intercultural context, sharing the issue of cultural identity and community in common. However, Roberts shows how context can "anchor" an image in meaning just as effectively as words can" (p.162) through the example of the Blackfeet beadwork as a case of folk art. What is unique about his analysis is that it shows how the Blackfeet argue for a continued assertion of their nationhood and sacred beliefs by refusing to adopt fully the floral designs of powerful culture (p.161). In other words, their argument is in the fact that they continue to employ their own traditional style, based on triangular motif, for the Blackfeet in spite of the pressure from the dominant culture to adopt the floral designs.

On the other hand, Pineda and Sowards (2007) illustrate how flag waving constitutes a visual argument about cultural citizenship interpreted differently by two different audiences, immigrant rights advocates and anti-immigration advocates (p.165). "The deployment of Mexican and other foreign flags at the immigration protests and rallies held from March through May, 2006, advances a potent visual argument about civic virtue and cultural citizenship. The flags argue for immigrants' rights and cultural identity while also expressing pride" (p.171). On the other hand, for anti-immigration advocates, the flag waving was interpreted as separatism, deviance, and the failure to protect their borders and the heated reactions to it represent attempts to refute the original arguments (p.170). It not only address

how the two different groups interact with the same context of immigration protests and rallies, but also serves as a unique case in which the original argument is refuted by another group of people who have a different cultural identity.

Kjeldsen (2007) presents the notion of *rhetorical situation* as a similar concept to context, analyzing a political advertisement in the context of the ongoing election campaign discourse regarding asylum and immigration policy (p.129). Drawing the notion from Bitzer (1968, 1980), he emphasizes rhetorical situation, which draws upon all of the three kinds of context, immediate visual context, immediate verbal context, and visual culture, discussed by Birdsell and Groarke (p.125).

Ommen (2003) shows another way to resolve the problem of ambiguity of visual meanings and the subsequent issue of subjective interpretation by further developing Birdsell and Groarke's notion of *visual culture*, and then applying it to his analysis of how the Darwin fish image evolves through multiple process of appropriation. Through the analysis, he demonstrates that "visual culture can offer the contextualizing linearity to visual images that would empower rhetorical frameworks of visual interpretation" (p.497). He then emphasizes the importance of visual culture as an important factor for visual argument to function, by noting that visual culture is one of the keys to create the conditions for visual argumentation via an external linearity of visual imitation that occurs via both form and location (p.498).

In addition to context, *genre* also contributes to fixing visual meanings, ultimately contributing to functioning of visual argument (please see the orange box in the literature map). Roberts (2007) illustrates this ability of genre as an enabling factor for visual argument to function, indicating how the "folk art genre resolves certain concerns about visual

argument's possibilities" (p.154). Such is the case, since, unlike fine artists, folk artists respect "conventions shared within a community" and do not "cross the boundaries of meaning, taste, or experience that their community expects" (p.153). In other words, "folk art's collective nature – its emphasis on community – again ameliorates some of the objects raised against the possibility of visual argument" (p.153). The boundaries and conventions set by folk art, which come from the centripetal force of the folk art genre, help folk artworks function as visual arguments.

Like folk art, the diagram is also a well-established genre with relatively clear boundaries, conventions, and also with obvious generic features in terms of its form and function. Although diagrammatic forms and functions vary depending on the subcategories of diagrams, such as line graph, bar graph, pie chart, and etc, particular form and function are consistent within each subcategory. As conventions shared within community help folk artworks to function as visual argument as shown in Roberts' (2007) analysis, recurring generic features of diagrams are helpful for us to build the concept of visual argument around diagrams. For that reason, our knowledge about genre is additional factor that contributes not only to fixing the meaning of diagrams but also to constructing visual arguments out of them.

The issue of genre also has a close relationship with the previous discussion of visual enthymeme, since genre knowledge is one of the most significant factors that enable diagram viewers to complete the blank through providing information about the recurring form and function of diagrams. Our knowledge about the diagram genre is additional information that we draw upon, whether consciously or unconsciously, when we read diagrams. Through education, this genre knowledge becomes naturalized within us, and is drawn upon whenever

we see diagrams. For example, whenever we see a line graph, we, in the process of interpreting it, draw from our genre knowledge regarding how line graphs work. In other words, as soon as we see a line graph, we, on the basis of genre knowledge, presume that it depicts up and down trends. Thus, whenever we come across a line graph, we instantly look for an overall trend, created by the relationship between x and y. In this way, our genre knowledge about line graph helps us construct visual argument out of them, which will be demonstrated in the actual rhetorical analysis of the sampled diagrams later.

Miller's (1994) discussion of 'rhetorical community as the cultural basis of genre' helps us further pursue exploration of the notion of genre here. Revisiting her original essay about genre (1984), Miller (1994) further develops her original discussion of genre by suggesting the third kind of community, rhetorical community, as addition to the previous two, taxonomic and relational community. In order to introduce the concept of rhetorical community, she begins her discussion with pointing out the importance of understanding "the relationship between, on the one hand, the observable particular (and peculiar) actions of individual agents and, on the other, the abstract yet distinctive influence of a culture, a society, or an institution" (p.70). Focusing on this relationship between individual agents and a culture, she brings in how Giddens (1984) avoids the traditional 'dualism' of action theories and institutional theories, introducing the notion of 'duality of structure' (p.70). According to Miller, what Giddens means by this is that, serving as the explanatory nexus between individuals and collectivities, between, that is, the concreteness and particularity of action and the abstractness and endurance of institutions, structure is 'both medium and outcome' of the social practices it recursively organizes (1984: 25); structure, in other words,

is both means and end, both resource and product (Miller, 1994, p.70). In other words, structure is medium when individual actors rely on “already available structures, on shared classifications and interpretations” (p.71) while serving as outcome when individual actors create structure (p.71). Put together, structure serves as “a specific mechanism by which individual communicative action and social system structure each other and interact with each other” (p.72), based on addressivity or relational quality.

Although, in Miller’s essay, her main focus was on investigation of the duality of structure, what I especially intended to scrutinize further for my study is what if we apply the concept to diagrams. I sought to do so because understanding the role of structure as means/resource/medium, which concerns how culture/society/institution imposes certain structures on individual agents, can help us with framing the notion of visual argument around diagrams.³⁹

The most informative point of the entire discussion of structure is made by the issue of “the reproduction of structure” originally discussed by Giddens, and then, developed by Miller. While Giddens emphasizes the concept of “reproduction” by arguing that ‘the conduct of individual actors reproduces the structural properties of larger collectivities’ (1984: 24), Miller finds similarity between Giddens’s term, reproduction, and a rhetorical term, recurrence. Miller indicates that “Reproduction is thus a stronger way to characterize what rhetoricians have called ‘recurrence’ . She then finds out the essential quality shared by the two terms, saying that “it seemed to be a matter primarily of intersubjective perception:

³⁹ I do believe that the concept of structure as end/product/outcome is also important in the sense that individual diagram viewers play their role in gradually shaping the genre of diagram, but I would like to spend more time in discussing the other concept, genre as means/resource/medium, here, since it helps us frame the notion of visual argument around diagrams.

‘Recurrence is implied by our understanding of situations as somehow “comparable”, “similar”, or “analogous” to other situations’ (Miller 1984: 156”).

The concept of “reproduction,” therefore, implies how “social actors create recurrence in their actions by reproducing the structural aspects of institutions, by using available structures as the medium of their action and thereby producing those structures again as virtual outcomes, available for further memory, interpretation, and use” (Miller, p.71). The discussion of structure and the notion of reproduction can be applied to my discussion of genre, since genre also functions as a structure not only imposed on individual agents⁴⁰ but also involved in the process of reading and interpreting artifacts such as diagrams. Especially, the notion of reproduction has something to do with the centripetal force of genres, which brings forth creation of recurrence in social actors’ actions and “intersubjective perception” among social actors. I summarize Miller’s discussion, since again it enables me to frame the notion of visual argument around diagrams. If the above discussion of reproduction is the case, diagram viewers would create recurrence in their actions of reading and interpreting diagrams by reproducing structural properties imposed by culture, by using the available communicative structures as the medium of their action.

Style of a visual image is also an important dimension to be discussed before I construct the notion of visual argument (see the yellow cluster in Figure 44). Chrystee, Foss, and Ranney (1996) mention the same point, arguing that differences “in the process of visual argumentation between representational and nonrepresentational images need to be explored”

⁴⁰ This point, genre as structure, has been already made by Miller. She argues that “What I want to propose, then, is that we see genre as a specific, and important, constituent of society, a major aspect of its communicative structure, one of the structures of power that institutions wield” (p.71).

(p.13). They also argue that style “also may be a dimension that affects visual argumentation; how the various aspects of diverse styles affect the process may be critical in explaining how visual argumentation works.”

Myers (1988) is another scholar who concerns the issue of style by distinguishing categories of pictures, and then, showing “how they differ in their conventions and their rhetorical effects” (p.237). His categories of pictures consist of a spectrum with photographs on the left end and with imaginary figures on the right (Figure 45). In between, drawings, maps, and graphs/models/tables are in order from left to right. The categories are arranged in order from the one with more gratuitous detail on the left end to the one with less gratuitous detail on the right.

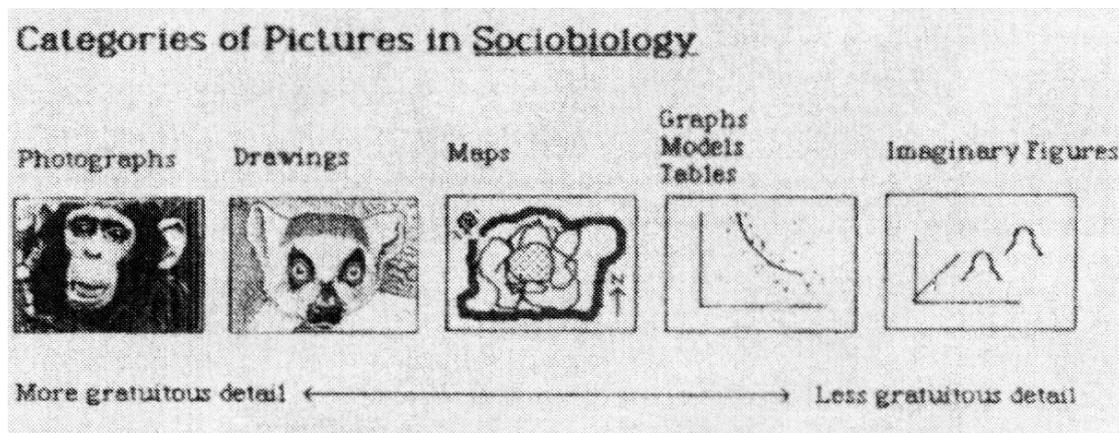


Figure 45. Categories of Pictures in Sociology

Myers' categories are similar to Doblin's (1980) model of visual information messages (Figure 46). As introduced earlier, Doblin (1980) also proposes a model that systematizes the categories of visual images, classifying visual images according to their level of abstraction. Doblin's model also has photographs, drawings, drafting & maps, charts & graphs, and marks in order on the ladder from realistic at the bottom to abstract at the top, as corresponding to Myers' five categories. The only difference is that Doblin's has "models" at the bottom of the ladder as the most realistic one, which means reality itself.

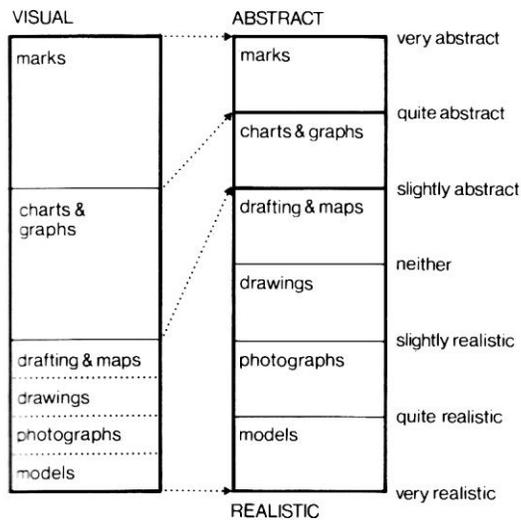


Figure 46. Model of Visual Information Messages

Diagrams are usually composed of simple geometric visual elements such as lines, bars, pie-shaped charts, dots, arrows, and sometimes, maps or illustrations, depending on the

type of diagram, and thus, they are highly abstract in terms of visual style. As Myers points out that style is a dimension that affects visual argumentation, I argue that the unique visual style of diagrams is also an important factor that enables diagrams to function as visual argument. Such is the case, since the abstract style encourages viewers to look at diagrams as objective, neutral, and transparent reflections of reality. While drawings that appear in both Myers' categories and Doblin's ladder, for example, do not possess a particular style distinct from other visual images, displaying a wider range of variation in terms of style, diagrams show a particular style shaped by repetitive use of geometric and abstract form, recurring within the same category of diagram. Among the various categories of visual images, diagrams are a type of visual image that is easy to frame the notion of visual argument around.

So far, I have reviewed the theoretical concepts, diagrammed in the literature map about visual argument, that I think useful for establishing visual argument as a key concept for my analysis. Now, based on the review, I clarify what my understanding of visual argument is in the context of diagrams. Basically, I argue that the scholarship on traditional argument that centers on verbal language is not obsolete when we discuss visual argument, since it can provide some basic conceptual resources that can help us explain how diagrams function as visual arguments. One of the main concepts that I draw from the traditional understanding of argument is propositional nature. As Blair points out that arguments "must have propositional content" (Blair, 2004, p.26), I argue that propositional nature is one of the essential conditions that I think useful when we build up the notion of visual argument around this specific type of visual image called diagrams. Thus, it should be one of the

defining concepts that help us construct the notion of visual argument in the context of diagrams.

Before I continue, it is necessary to clarify that the scope of defining visual argument in this study is limited to the context of diagrams. Answering the general question of whether visual images can argue or not is beyond the scope of this study. Also, I do not intend to develop “a comprehensive theory of visual argument capable of accounting for the complex ways in which images may argue” (DeLuca & Delicath, 1999, p.245). I agree with DeLuca and Delicath’s (1999) argument that “there are different kinds of visual argument” and “different conceptual tools are necessary for analyzing different kinds of visual materials” (p.245). Thus, in arguing that propositional nature is one of the defining characteristics that are necessary when we build up the notion of visual argument, I limit the scope of this argument to the context of diagrams. To put it in another way, I do not mean that propositional nature is a defining concept that can explain how other types of visual images function as visual argument. For example, in case of DeLuca and Delicath’s (1999 & 2003) exploration of image events as a form of argumentative practice, propositionality in a traditional sense is not a condition that determines whether they are visual arguments or not.

While I argue that verbal argument and visual argument are similar in that they share propositional nature as one of the defining concepts, they are fundamentally different in the way that they are propositional. While typical verbal arguments present propositions and reasons directly, visual arguments do so indirectly, since they imply propositions and reasons in themselves, requiring viewers’ active reconstructing process. As evident with the notion of unstated proposition discussed earlier, visual arguments are not explicitly given but implied,

and thus, should be reconstructed by viewers in an enthymematic way. This is the reason that the notion of visual enthymeme is such an essential concept in explaining how visual arguments in the context of diagrams function in a fundamentally different way from verbal arguments. Indeed, visual enthymeme is a key conceptual tool that enables us to challenge the conventional way of understanding argument, since it provides us with a way to broaden the boundary of argument by allowing us to include visual arguments within its realm.

Together with the enthymematic nature, the notion of restatability also frees us from the narrow view about argument shaped under the traditional linguistic model of argument. The notion of restatability, implied in Blair's argument that "arguments are not necessarily linguistic or verbal arguments" (Blair, 1996, p. 4), also enables us to provide propositional structure to diagrams, and eventually to broaden the traditional view about argument through including visual arguments within its scope. Restatability is a useful concept to explain how visual arguments operate, since, unlike the case of verbal arguments, we should reconstruct propositions and reasons from diagrams, and then, restate them in language.

To sum up the discussions made so far, while I argue that propositional nature should be one of the main concepts that define visual arguments in the context of diagrams, I distinguish the way that they are propositional from the way verbal arguments are. I argue that diagrams, as a unique type of visual image, function as arguments in a fundamentally different way than verbal arguments do. The fundamental difference of visual arguments in the context of diagrams can be well explained by the concept of visual enthymeme, and justified by restatability. While visual enthymeme is useful concept to describe the unique way that propositional structure is assigned to visual arguments, restatability another useful

concept that offers a sound ground on which we provide propositional structure to visual arguments.

As discussed earlier, context, visual culture, genre, and style are also useful for building up the notion of visual argument around diagrams, since they are factors that help us explain how diagrams can function as visual argument. First, context is an element that helps us reconstruct a proposition and a reason from diagrams by enabling us to anchor the meaning of diagrams. Since a proposition and a reason are implied in diagrams, the three dimensions of context, immediate verbal context, immediate visual context, and visual culture, play a significant role when we reconstruct them from diagrams, eventually helping us build an argument.

Among the three components, visual culture is worth further discussion here. Although scholars find it difficult to define visual culture, some scholars' attempts to define it are helpful for understanding what Birdsell and Groarke (1996) mean by visual culture.⁴¹ Düttmann (2002) points out "the possibility of linking vision and culture," the two keywords, "visual" and "culture" of "visual culture," saying that visual culture means that "vision should be cultivated in a given culture, or that the cultural creation of a framework for vision should itself be made visible, as should the cultural mediation of the images which appear by virtue of such a framework" (p.101). Mitchell (2002) also notes the complex dimensions in visual culture, mentioning that visual culture is "the visual construction of the social, not just the social construction of vision" (p.170). Birdsell and Groarke's understanding of visual

⁴¹ I do not seek to join the discussion of scholars in the study of visual culture by exploring what visual culture is. In this study, I understand visual culture as the third dimension of context, discussed by Birdsell and Groarke (1996). Thus, the definition of visual culture in this study is what they mean by the concept.

culture puts more emphasis on the social construction of vision. They argue that “visual culture changes significantly over time, and that developments in art, technology, philosophy, and science promote different ways of seeing over time” (p.x). As the previous definitions of visual culture imply, visual culture is “conventions of seeing” (Gibbons, 2007, p.179), providing the ways people see visual images, which keeps changing depending on advancements in art, technology, philosophy, and science, and also ideals and values of a given society.

Kostelnick and Hassett’s (2003) concept of visual convention has something to do with the notion of visual culture, since visual conventions shared in a particular discourse community form visual culture of the community. Visual convention is shared understanding about visual codes accepted as true within a discourse community, and is inherently social, since it is “invented, proliferated, and sustained by groups of users” (p. p.17) that consist of “designers who deploy conventional codes and the readers who interpret them” (p.23). Kostelnick and Hassett (2003) also point out mutability as a significant character of conventions, arguing that “in a given historical moment, users can easily mistake them for timeless universals, rather than social constructs that are invented, that evolve, and that undergo constant scrutiny” (p.17). In other words, people think of the way we see and interpret diagrams in the current period as a fixed and timeless rule, but instead, it is only a byproduct of constant evolution over a long period of time, and still keeps changing even though we do not recognize it.

They also continue to discuss the naturalizing effect of conventions, arguing that “Concealed by their habitual use within discourse communities, conventions become so

ingrained that users can take them for granted as direct conduits of information, rather than as social constructs that mediate it” (p.34). The naturalizing effect works in diagrams as well because we see diagrams as a direct and transparent conduit of information free of any kind of mediation. However, it is merely socially constructed conventions, and in a visual culture of diagrams, which is socially constructed, we see and interpret diagrams. The discussion of visual culture and visual convention enable us to break the myth of diagrams as a timeless universal and to realize that they are product of social construction.

As mentioned earlier, diagrams are a well-established genre with clear boundaries and conventions, which displays obvious generic features in terms of its form and function.⁴² Compared to other types of visual images, such as painting and sculpture, diagrams have recurring form and function more obviously. In terms of recurrence discussed earlier by Miller, we have more recurrence in some visual genres than in others. Visual images have factors that conform to the genre that they belong to, while they might have factors that do not. In other words, in a genre, both centripetal and centrifugal force is under operation. In genres such as diagrams, centripetal force is stronger than centrifugal force, compared to other genres, and thus, they show clearer visual conventions and more recurrence in terms of form and function. To be more specific, diagrams show recurring forms depending on subcategories, and each subcategory performs a consistent function.

For example, in terms of form, line graphs and bar graphs both display data in plot frames with x-y axes, while pie charts in circular fields (Koestelnick & Hassett, 2003, p.98).

⁴² Kostelnick and Hassett (2003) mention that bar charts, line graphs, and pie charts as separate genres, while Brasseur (2003) classifies line, bar, and pie graph types as three distinct subcategories under the genre of graph that is a subgenre under “technical visual genres”. Brasseur (2003) argues that the technical illustration, table, graph, chart, and diagram are standard technical genres.

In addition to the basic ground format, line graphs embody basic elements such as a grid, data points, lines connecting data points, labels, and notations (p.122, p.134). Based on the same basic format of plot frames with x-y coordinates, bar graphs also embody basic elements such as a grid, bars displaying quantity, labels, and notations. Although it is not as frequently used as line or bar graphs, a scatter diagram is also based upon a plot frame with x-y axes. The difference is that a scatter diagram visualizes the relationship between two variables by displaying values for the two variables as collection of points on the diagram. Unlike the case of a line graph, in a scatter diagram, not only position of the displayed points but also density provides an important key in interpreting information.

On the other hand, on the basis of circular fields, pie charts are divided into multiple slices with different coloring or shading, and embody elements such as labels. In terms of function, line graphs and bar graphs visualize quantitative data through showing up/down line trend(s) and showing height of bars respectively. Pie charts visualize relative size, amount, or quantity of something through encouraging readers to compare the size of the relative parts to the whole or to one another.

As such, diagrams have distinct recurring form and function, allowing them to have stronger centripetal force than centrifugal force. Centripetal force in visual genres, such as painting, is not as strong as the diagram genre so that it is difficult to pinpoint identical visual elements shared by all of the paintings and identical function performed by all of the paintings. Because of the high intensity in centripetal force of the diagram genre, designers have less room to improvise and scarcely flout the conventions. On the other hand, painters have more freedom to improvise and are more likely to flout conventions so that they can

freely experiment with art. History of art shows that centrifugal force is stronger than centripetal force in genres like painting. From readers' perspectives, if diagram designers have less room for improvisation and hardly break the convention, readers are likely to disambiguate meanings of diagrams more easily and identify what they argue by reconstructing a claim and a reason more easily. This is why it is easier for us to build up the notion of visual argument around diagrams, where centripetal force predominates, than around paintings where centrifugal force is superior.

Kostelnick (2004) notes that forms like "pie chart, bar chart, and line graph developed strong conventional status over the past century and today claim enormously large currencies", while "other forms like population distribution chart, percept chart, rank chart, and wind rose (also known as a polar chart) still have conventional status" today, "though they claim smaller currencies" (p.219). This means that some types of diagrams such as line graphs, bar graphs, and pie charts have stronger conventional status than others. In other words, even in the genre of diagram, some are stronger than others in terms of conventional status.

The issue of style is related to the issue of genre as evident in Foss' (2004) argument that stylistic characteristics are an important element of a rhetorical genre (p.193).⁴³ Indeed, style varies depending on genre, and visual images that belong to the same genre share similar style. Visuals in the diagram genre are basically based on the principle of abstraction and simplicity, which reduces reality into logical and geometrical forms. Plot frames with x-y

⁴³ Foss (2004) argues that "A rhetorical genre is a constellation fusion, or clustering of three different kinds of elements so that a unique kind of artifact is created" (p.193). The three kinds of elements are "situational requirements or the perception of conditions in a situation," "substantive and stylistic characteristics," "the organizing principle" (p.193-194).

axes, grid, data points, lines, bars, circular fields, slices in pie charts, as listed earlier, are all geometrical and logical forms, embodying the principle of abstraction and simplicity.

Brasseur (2003) indicates that, behind this unique visual style of diagrams, there is “a long line of Cartesian-based analytical thought that privileges the isolation of certain key aspects of a situation and whose message communicates an innate “rational” perspective with its resulting display” (p.4). Brasseur elaborates that the “idea that we can move, as human beings, from confusion to a central truth is at the heart of Cartesian thinking. Indeed, as Bernstein writes, “After all, at the heart of Cartesian [and indeed most modern and ancient] philosophy has been the conviction of the universality of reason and the belief that there are universal standards and criteria of rationality (however extensive or narrow we take human rationality to be)” [p.29]. This view of rationality has key implications for graphs, charts, diagrams, illustrations – indeed, any technical visual form. ... Cartesian thinking’s roots and modern-day manifestations lie in the kind of geometric, mathematical, and logical theories that are the basis of the technical visual genres” (p.4-5).

7.1.2.2. Rhetoric of Colors

I analyze colors used in the sampled diagrams, since color is one of the major diagrammatic elements that can contribute to persuading viewers. The sampled diagrams employ a couple of main colors such as red, blue, green, grey, and brown, in order to visualize various issues about global warming, and, ultimately, to persuade viewers. Thus, color analysis is necessary, since it helps us identify what colors function to persuade viewers, with focus on how colors promote particular points of view or values and how they appeal to

viewers' emotion. For color analysis, I first discuss cultural associations embedded in the five main colors, repetitively used in the sampled diagrams. Then, I review literature regarding rhetorical analysis of colors, and then, other literature exclusively in the context of environmental rhetoric and rhetoric of climate change, since global warming is an issue under the category of environmental rhetoric and rhetoric of climate change. Rhetorical analysis of colors in the similar context provide some useful insights my analysis, and, ultimately, offer available resources and guidelines for my color analysis of the sampled diagrams.

Eiseman (2000), in the introduction of her book, *Pantone Guide to Communicating with Color*, emphasizes the persuasive and emotionally appealing effect of color. After first pointing out the persuasive effect, along with a comment that “Much of the human reaction to color is subliminal and consumers are generally unaware of the pervasive and persuasive effects of color” (p.7), she continues to argue that “color symbolizes abstract concepts and thoughts ... and produces an aesthetic or emotional response” (p.6). Bellizzi and others (1983) also touch the same issue, arguing that “A review of the research reveals that color can produce certain autonomic biological reactions, create certain emotional responses, and obtain attention” (p21-22). In the similar line of thought, Lichtle (2007) comments that “Historically, colour has always been used to fulfill symbolic and aesthetic functions. Colours can symbolize elements (red and orange for fire, green for water), space (light blue represents the vertical dimension), or time and timelessness (black and white)” (p.39).

Among the five main colors that I decided to focus on for the purpose of my color analysis, red is the most frequently used one in the sampled diagrams, since global warming

mainly deals with hot themes, such as temperature rise, heat, and warming. Eiseman (2000) not only mentions our instantaneous physiological reaction to red color, but also mentions what cultural meanings we bring up when we see red color. He indicates that the “pituitary gland really springs into action when it sees red. A chemical message is sent to your adrenal medulla and releases the hormone epinephrine. This alters your body chemistry, causing you to breathe more rapidly, increases your blood pressure, pulse rate, heartbeat, your flow of adrenaline and GSR – Galvanic Skin Response (a fancy term for perspiration and the basis of lie detector tests). These reactions are physiological, and we have no control over the effect. As a result, red is indelibly imprinted on the human mind to connect with excitement and high energy” (p.19). Bellizzi and others (1983) also identify the meanings that we generally associate with red, “active, adventurous, and stimulating, energetic, and vital” (p.25).

While red evokes some positive meanings as mentioned above, it also evokes some negative meanings such as fire, danger, blood, war, and stop under a particular context such as global warming. Eiseman (2000) points out the arousing effect of red, arguing that “Warm tones are known as high-arousal colors and red, in particular, creates the highest arousal threshold in humans ... It has an aggressive nature, commanding attention and demanding action” (p.20). Not only Eiseman, but also Bellizzi and others (1983), argue the same point, quoting Schaie and Heiss’ comment (1964) that the “high wavelength colors (red, orange, and yellow) possess strong excitation potential and high arousal qualities, and they induce elated mood states” (p.24).

I argue that red color used in the sampled diagrams does not simply convey negative meanings such as heat, warming, rise in temperature, rise in CO₂ emissions, and danger, but

actually, based on the negative cultural connotation, functions to persuade viewers into believing what the diagrams attempt to communicate (for example, the global temperature is rising, CO2 emission is rising, and the sea level is rising), arousing viewers' attention, upgrading a catastrophic mood, and appealing to viewers' feeling and emotion.

In opposition to red, blue means cooling, which has a positive meaning in the context of global warming. According to Eiseman (2000), blue is "restful. In the presence of a blue environment, we feel calm. Humans are soothed and replenished when they view blue and there is some evidence that when blue enters our line of vision, the brain sends out chemical signals that work as a tranquilizer" (p.39-40). Bellizzi and others' (1983) comment about blue color is similar to Eiseman's, since they indicate that the "low wavelength colors, such as green and blue, are associated with more sedate mood states ... The cool colors have many redeeming properties. They generally soothe, relax, and induce leisure and contemplation. They are thought to be calm, secure, peaceful, and restful (Sharpe 1974)" (p.25). In the context of global warming, blue, in opposition to red, conveys positive meanings, such as decreasing temperature, cooling, tranquilizing, and soothing.

Bellizzi and others' (1983) quotation that "Adjectives found to be associated with the color green are: secure, comfortable, calm, peaceful, serene (Murray and Deabler 1957), and also young, ill, and fresh (Hofstatter and Lubbert 1958)" (p.25) shows the similarity shared by green and blue in terms of what they evoke in human mind. Green is frequently used in the sampled diagrams as a typical color that represents nature and environment, since it is the color of foliage and grass. Eiseman (2000) confirms this association between green and nature/environment, arguing that "Word association tests show that most people will link

many shades of green to nature” (p.43). Besides, traditionally, environmentalists have continuously employed green color to support their argument about protection of the environment. Thus, it functions like a representative color that symbolizes environmentalists, their movement, and environmental friendliness. Ells (2008) also argues that the color green is one of the “extensive vocabulary of richly connotative symbols used by the environmental movement, together with the redwood tree, the panda, and the Earth (p.15). Investigating the realm of environmental advertising, Kangun and others (1991) link green color to concepts such as ““degradable,” “recycled,” “recyclable,” “ozone friendly,” or otherwise good for the environment” (p.48). In the context of global warming, green, in opposition to red, conveys positive meanings, such as nature and environmental friendliness.

Usually classified as a neutral color, grey is a “psychological presence that impart(s) a message of dependability ... identified with time and antiquity, the durability of ancient monuments, buildings and temples ... seen as solid, enduring, timeless ...” (Eiseman, 2000, p.51). However, it evokes different meanings, such as dirtiness, pollution, and contamination, when used in the context of global warming. Citing from Adams & Osgood (1973) and Williams & Roberson (1967), Sherman & Clore (2009) point out that “ideas of dirtiness and impurity are themselves grounded in the perceptual experience of the color black, which is seen not just as the opposite of white, but also as a potent impurity that can contaminate whiteness” (p.1019). If we consider that grey and black are on the same color scheme, only positioning at different scales, black on the darkest end and grey a little more toward the lighter end, we can extend the meaning of “impurity that contaminate whiteness” to grey color as well. In the context of global warming, grey signifies the outcome of environmental

destruction and pollution, making a good contrast with green that symbolizes nature and environmental friendliness.

Eiseman (2000) describes brown color as “the ultimate earth color associated with hearth and home, substance and stability,” mentioning that it is “seen as the most rooted, protective and secure of all shades because they are inevitably connected to the earth” (p.35). Sharing similarity with green color, brown represents nature as well, embodying positive meanings in the context of global warming.

In many cases of the sampled diagrams, colors have interrelationships with one another. For example, red and grey represent negative meanings, such as heat, temperature rise, fire, warming, danger, dirtiness, pollution, and environmental destruction, while green, blue, and brown positive meanings, such as nature, environmental friendliness, purity, and the earth. The two groups of colors effectively communicate the two different themes that run through the issue of global warming, such as warming vs. cooling, human vs. nature, and environmental protection vs. destruction, making a good contrast with each other.

Studies that specifically deal with the visual rhetoric of color are limited, and thus, a systematic approach to color as a vehicle for persuasion is not available yet. Hence, I reviewed literature that did a rhetorical analysis of colors. Analyzing how colors are used in Web page design, Richards and David (2009) discuss “the rhetorical potential of color, which is one of the first decorative elements to capture the eye, in a multitude of roles in Web page design” (p.32). Their analysis is inspiring in the sense that it not only conceives color as a rhetorical phenomenon (p.31), but also pays attention to the emotional effects of color.

Courtis (2004) explores “the use of colour as an aspect of visual rhetoric in financial reporting” (p.267). The result of the experimental study he conducted confirms his main hypothesis that “colour in annual reports is capable of influencing the perceptions and judgments of users. Through the experiments, he argues that a particular color can be “a persuasive element in an investor’s decision to allocate higher/lower amounts of investable resources” (p.271). Like Richards and David (2009), he also points out that “Colour plays a role in emotional reaction” (p.267). As the limited literature shows, little has been done in this area regarding the rhetorical potential of color. Richards and David’s (2009) analysis and Courtis’ (2004) analysis barely opens the issue regarding the rhetorical function of color.

Although Richards and David (2009) and Courtis (2004) deal with visual images in web design and annual reports, different from diagrams about global warming that appeared in magazines or newspapers, their analysis and argument justify my attempt to rhetorically analyze colors used in the sampled diagrams. In addition, they both argue about the emotional effects of colors, which support my previous argument that colors used in the sampled diagrams persuade viewers emotionally.

Now, I turn to literature in the context of environmental rhetoric and rhetoric of climate change, since they provide similar cases to my analysis, and ultimately, offer some useful guidelines for my color analysis of the sampled diagrams. Color analysis takes a significant part in Smerecnik & Renegar’s (2010) rhetorical analysis of British Petroleum’s Helios Power Campaign. They analyze how the theme color green, combined with the image of “wind turbines, clean Helios-symbolic car emissions, weather, and nature” (p.165) rhetorically create “a rhetorical representation of BP’s products as being clean and all

natural” by associating the brand with a clean environment (p.158). In their rhetorical analysis, Smerecnik & Renegar demonstrate how color plays a crucial role in assigning “environmental values” (p.157) to the non-environmental company and its practices.

Wolfe’s (2008) essay about Dr. Seuss’s *The Lorax*, a book for children with environmental messages, is another piece of rhetorical analysis in which color plays an important role in constructing visual rhetoric. Unlike the case of BP’s campaign, there are “the shifts in color, from drab to bright and back again, presenting the image of destruction through the tone of color” (p.15). Wolfe conceptualizes color, in *The Lorax*, as “an ideological tool conveying the moral statement of ecological destruction” (p.15). In *The Lorax*, color is a main tool that contributes to visualizing environmental destruction, countering “the dominant ideology of progressive capitalism” (p.12) and propagating the “ideology of early environmentalism” (p.9).

Temple (2011), in his rhetorical analysis of Al Gore’s documentary film, *The Inconvenient Truth*, mentions a bit about how color is used in the film. He analyzes hot colors, such as red, orange, and yellow, as a part of one of the overarching themes, “cityscapes on fire.” Adopting theoretical concepts, such as metaphor, metonymy, and fantasy theme analysis, he discusses the hot colors, as a conveyor of the meanings of heat and fire, integrated with images of cities, factories, and smokestacks, all together function as a metaphor of the notion of rational and scientific progress and advancement of humankind. Although color does not receive exclusive attention in his study, it is worth noting, since Temple’s analysis is one of those few studies that discuss color in the context of global warming.

7.1.2.3. Vertical Archetypal Metaphor

Some of the main themes of global warming are rising global temperature, rising levels of CO₂ emissions, and rising sea levels. All these themes in common require an image of something that can depict an upward movement for effective visualization. In the sampled diagrams, most line graphs and bar graphs, except a few, display an upward trend, visualizing one of the above themes. As predominance of the line/bar graphs with an upward trend exemplifies, increasing line/bar trends almost function like a symbol of global warming, together with images of the burning earth and melting ice. For that reason, we come across those line or bar graphs repeatedly, not only in the diagram samples, but also in mass media.

A theoretical concept useful for analyzing upward trends of line/bar graph is vertical archetypal metaphor discussed by Osborn.⁴⁴ Vertical archetypal metaphor is a sub-category of archetypal metaphor, which again belongs to the upper category, metaphor. Osborn (1962) defines archetypal metaphor as a type of metaphor that “extend(s) beyond the limits of a given time or culture and depend upon experiences common to men of many races and ages” (p.229). Osborn (1967) also points out some unique features of archetypal metaphor. According to Osborn, archetypal metaphors are “immune to changes wrought by time,” “unaffected by cultural variation,” and “grounded in prominent features of experience, in objects, actions, or conditions which are inescapably salient in human consciousness” (p.116). For those reasons, “the appeal of the archetypal metaphor is contingent upon its embodiment of basic human motivations,” and thus, archetypal metaphors have “persuasive potency”

⁴⁴ I am indebted to Temple (2008 & 2011) for his original idea of analyzing trends in line graphs with Osborn’s archetype of above and below. Using the concept, he analyzes line graphs that appeared in the DVD, *An Inconvenient Truth*.

(p.116). Osborn (1967) provides some representative examples of archetypal metaphor, based on “pervasive and generic relationships – the contrast between above and below, light and darkness, war and peace, the land and the sea, etc” (1962, p.229).

Among many types of archetypal metaphor, the one useful for my analysis is vertical archetypal metaphor. Osborn (1962) defines it as a type of archetypal metaphor that “project(s) desirable objects above the listener and undesirable objects below” (p.116), finding its grounding in basic human motivations regarding the notion of up/down or above/below. One interesting thing about this archetypal metaphor is that it is associated with certain values, as implied in Osborn’s definition through the words like “desirable” and “undesirable.” Osborn (1989) associates the above with positive values, mentioning that “we look and strive upwards towards our gods and ideas” (p.6). In the above-below contrast, above “symbolize(s) the difficult effort by man to improve upon his condition, to aspire to “higher” ideas and attainments” (1967, p.122), while the below is laden with negative meanings.

Archetypal metaphors including vertical archetypal metaphor enables us to explore the realm of basic human motivations activated when we reason about, understand, and interpret things. Their ability as a fundamental structure that guide human reasoning and understanding is reconfirmed by later scholars, Lakoff and Johnson, who again illuminate the same issue through their investigation of metaphor. Davis (2008) finds similarity between Osborn’s archetypal metaphor and Lakoff and Johnson’s metaphor, noting that Osborn’s discussions of archetypal metaphor “pre-frame the later ideas of Lakoff and Johnson of how all metaphors operate” (p.30). Giving an example of “*more is up*,” Johnson (1987)

demonstrates how the statement is “not merely a linguistic mode of expressions, rather, it is one of the chief cognitive structures by which we are able to have coherent ordered experiences that we can reason about and make sense of” (p.xv). Through examples, he shows how the basic vertical structure of up-and-down operates in our understanding and interpretation of prices, numbers, and etc. He also points out that basic human motivation regarding spatial (vertical among many kinds in this case) orientation is related to basic up and down bodily experiences.

After introducing vertical archetypal metaphor as a theoretical concept to analyze trends in line graphs, Temple (2011) argues that “Normally, a line moving up has a positive connotation; in the context of the AGW (Anthropogenic Global Warming) rhetoric that connotation is inverted” (p.214). In depicting the popular themes of global warming, such as rising global temperature, rising levels of CO₂ emissions, and rising sea levels, positive meanings originally associated to the above and negative meanings to the below are inverted. Thus, the escalating line trends in most line or bar graphs of the sample diagram collection move us towards the extreme of negative results, catastrophic ends.

One last thing to note about the increasing line/bar trends is that they are repetitively employed in most line or bar graphs. From readers’ perspective, our sense of crisis is gradually reinforced by repetitive exposure to the same kind of visual stimulus. Temple (2011) also makes a similar argument, noting that the “fantasy themes relied on visual metaphors and metonyms as vehicles to communicate undesirable change that other contributors to the internet chained out through the creation and active posting of similar images. Used alone, the images would not hold as much power; however, as fantasy themes

each of these images is repeated in some form or another many times across the internet and appeared several times throughout the length of Gore's film. The repetition of the image types potentially allows for each fantasy theme carried through them to be more salient and significant in the mind of a given viewer" (p.185-186).

7.1.2.4. Rhetoric of Tempered Apocalypticism

As shown in multiple studies (Foust, Murphy & Stow, 2008; Spoel, Goforth & Cheu, 2009; Johnson, 2009; Temple, 2011), apocalyptic rhetoric is one of the most popular themes repeatedly employed for analysis, not only in global warming discourse, but also in environmental discourse. While apocalypticism enjoys much popularity as a useful concept within the discourse of global warming and environmental rhetoric, Johnson (2009) proposes a new concept, "tempered apocalypticism," as a lens for analyzing Al Gore's *An Inconvenient Truth*. She argues that Gore's film has more dimensions that cannot be fully conceptualized by the apocalyptic rhetoric only, proposing the notion of tempered apocalypticism as a more appropriate theme for analyzing the film. Among the four modes of writing and speaking about place, Johnson integrates scientific rhetoric and apocalyptic rhetoric, and, through the integration, proposes the notion of tempered apocalypticism, "one that mixes apocalyptic appeals with scientific rationalism" (p.31).⁴⁵ She argues that "the film offers multiple elements that complicate and distract from its apocalyptic images" (p.36), such as "depersonalizing images and rational explanations" (p.43).

The element that I focus on is rational explanations, since it is relevant to my analysis

⁴⁵ Johnson (2009) discusses "four modes of writing and speaking about place," such as scientific, utilitarian, aesthetic, and apocalyptic (p.32-33).

of the sampled diagrams. Johnson (2009) argues that *An Inconvenient Truth* “moderates its apocalyptic tendencies” (p.29), using “scientific modes of visualization” (p.43) through “his (Gore’s) use of charts and graphs” (p.37). Somewhat moderated version of apocalypticism Johnson (2009) proposed is well-suited for my analysis of the sampled diagrams, since many of them also embody somewhat moderated version of apocalyptic rhetoric, relying on scientific mode of visualization. Thus, I add tempered apocalypticism as another useful lens through which I analyze the sampled diagrams.

7.1.3. Rhetorical Analysis and Identified Diagrammatic Elements and Configurations

The result of a rhetorical analysis of the sampled diagrams is summarized in Appendix 3. Total 41 diagrammatic elements and configurations were identified through a rhetorical analysis, and 20 of them were highlighted with bold letters, since they were identified more than three times from the sampled diagrams. The 20 diagrammatic elements and configurations are as follows; 1) line graph as a type, 2) bar graph as a type, 3) an upward trend of a line in a line graph, 4) a downward trend of a line in a line graph, 5) a spike in line trend in a line graph, 6) correlation between lines by similar line trend or line overlap in a line graph, 7) contrast between different line trends in a line graph, 8) no correlation between two lines in a line graph, 9) an upward trend of bars (gradual increase of bar height) in a bar graph, 10) relative height of bars in a bar graph, 11) red color signifying warming, heat, or CO₂, 12) blue color signifying cooling, 13) green color signifying nature, 14) grey color signifying pollution or smoke, 15) color coding, 16) use of map, 17) decrease in area size on

a map, 18) filling up most areas on a map with red or similar colors, 19) relative sector size in a pie chart, and 20) thickness of line.

Since the table simply displays the elements and configurations identified through the rhetorical analysis, a more detailed version of rhetorical analysis follows. The following rhetorical analysis focuses on an analysis of the 20 diagrammatic elements and configurations identified more than three times from the entire sampled diagrams. I select some key cases for each element for a detailed analysis and discussion, since they are redundant in other similar cases. Since the purpose of this rhetorical analysis is to identify to what elements or configurations of diagrams viewers are likely to assign rhetorical significance, I focus on individual visual elements in the diagrams by analyzing them element by element in the following detailed analysis and discussion, although I attempted to rhetorically analyze the diagrams and the context they are under together, maintaining a perspective that goes beyond the level of individual element.

7.1.3.1. An Upward Trend of a Line

A sub-category of diagram most frequently appeared in the sampled diagrams is the line graph. A notable thing about line graphs in the sample collection is that most of them show an upward trend to visualize rise either in global temperature or in CO₂ emissions, two most popular themes under the issue of global warming. A representative example is DS53. The line graph in DS53 visualizes an upward trend of a line to depict rising levels of CO₂ emissions, generally blamed as a main cause of global warming. I begin a rhetorical analysis of this graph, first analyzing it from the perspective of visual argument. In order to

demonstrate that this graph is a visual argument, what I first have to do is to see whether this graph has a propositional nature, since I conceived propositionality as a key concept of visual argument in the context of diagrams. As I discussed the notion of unstatedness as a key characteristic of visual argument in the literature review, since a claim and a reason in a visual argument are implicitly visualized in the graph rather than directly stated in words, it is necessary for us to reconstruct them from the graph in order to build a proposition. In the process of reconstructing a claim and a reason, we need supports from the fore-mentioned multiple concepts and factors, such as restatability, visual enthymeme, context, genre, and style. In the following analysis of the graph, I will not only demonstrate how we can reconstruct a proposition from the graph, but also show how the fore-mentioned concepts and factors help us reconstruct a proposition from the line graph, and how they all together ultimately enable us to build a visual argument from the graph.

Generally, in a line graph like DS53, the variable given in the y-axis functions as a subject of a claim that we are supposed to reconstruct from the graph, while the trend of the line as a predicate of the claim, which describes how the variable is. Together, they can formulate a claim, being integrated as a subject and a verb (S+V) that constitute the full claim sentence. In other words, in the graph, the variable in the y-axis, “the degree to which temperature rises,” and the predicate implied in the trend of the line, “increases,” together formulate a claim; “the degree to which temperature rises increases.” The reason that supports the claim is the trend of the line itself, since the increasing trend of the line is evidence that brings what the claim means before our eyes. As such, in this type of line graph that visualizes an upward trend with a single line, the line trend performs a double function,

not only providing us a clue from which we are able to develop the predicate part of the proposition, but also acting as a reason that supports the claim by bringing the evidence before our eyes.

Underneath the above process of building the proposition from the graph, there are multiple factors working to make it possible. The factors are hidden under the surface so that we do not even think that they are involved when we reconstruct a proposition from the graph. Now, I discuss what they are, and how they facilitate the process of building the proposition. First, we need Blair's argument that arguments do not necessarily have to be in linguistic or verbal form (p.4). Admitting that arguments are not necessarily linguistic or verbal is the first step that needs to be taken in order to break away from the conventional conceptualization of argument, and for us to think of possibility that we build a visual argument from graphs such as DS53. Once the notion of argument is reconceptualized, we can then turn our eye to non-discursive forms of argument, such as visual argument.

The next concept that helps us continue to further break the old conception of argument is restatability. Restatability is a very important concept for the proposition reconstructing process, since it enables us to provide a propositional structure to visual images, such as diagrams, where it didn't exist. If we can consider argumentative possibility in non-discursive forms such as diagrams, then the next step is to discern what claims are and what reasons are in them. In order to build a proposition that consists of a claim and a reason, we need a way to provide a propositional structure where it didn't already exist, such as in diagrams. Blair's concept of restatability is the one that makes this possible. Thanks to the

concept, we can reconstruct the proposition from the graph, “the degree to which temperature rises increases.”

Then, if we turn our eye to context of the graph, we can think of immediate verbal context, immediate visual context, and visual culture. The original article is composed of two separate pages, one with a map and the other with the graph in DS53. In the first page, the main title of the original newspaper article is “The Debate’s Over: Globe is Warming,” and, in the same page, a world map filled up with red color, signifying global warming, are positioned under the main title. In the second page where the graph in DS53 is positioned, another title shows that “Bush administration favors long-range and voluntary plans of action.” As an immediate visual context, in the second page, four time-lapse photographs, depicting gradually melting glacier, are positioned right next to the line graph. Although the line graph does not seem to be directly related to the fore-mentioned titles and photos, it is nested in all the surrounding contextual elements as such. On the other hand, the title for the graph and the explanation under it give us more detailed information directly related to the graph itself, providing us with information regarding how to read variables in the graph and how to interpret the graph. In DS53, the title of the graph and the explanation under it give us clues from which we can determine what the variables in the two axes are and what the numbers mean. However, the role the title and the textual information under it play in reconstructing the argument is not crucial in this case, since we are able to reconstruct the argument mostly from the graph itself.

The next factor that I discuss is genre. In order to be able to discern a claim and a reason from the graph, we first need to be familiar with what each element in the line graph

means and what role they play. Through education and the constant experience of reading and interpreting diagrams, we not only acquire visual literacy of how to read different types of diagrams, but also become aware of what role various diagrammatic elements function. For example, a line graph such as DS53 visualizes a trend in data over time, displaying a subject (variable) in the y-axis, and time variable in the x-axis. This experience-based knowledge about the line graph genre should be premised first before we are able to build a visual argument from the graph by constructing a proposition from it. Through repetitive experience of reading and interpreting graphs like DS53, our eye checks out the y-axis to see what the variable is, and also, the line to see what the line trend is like. From experience, we already know that the x-axis plots time variable. The basic knowledge about how this particular type of visual structure called a line graph works enables us to reconstruct a proposition from the graph that does not overtly state but imply.

The reason that we are not consciously aware of the operation of genre is that it is so ingrained and naturalized within us that we take it for granted. Citing from Barthes (1964, 1972) and Barton and Barton (1993), Kostelnick (2003) elaborates on this invisibility of the operation of genre, arguing that “concealed by their habitual use within discourse communities, conventions become so ingrained that users can take them for granted as direct conduits of information, rather than as social constructs that mediate it. Conventions so densely populate our perceptual landscape that it “naturalizes” them – that is, we believe that they mirror nature, rather than artificially represent it (Barthes, 1972, p.129-31; Barthes, 1964, p.34, p.29-40; Barton and Barton, 1993). Enculturated in visual discourse communities, users ignore the artifice of conventions that, to them at least, appear *natural* and absent of

any mediation” (p.34). As discussed thus far, in spite of its invisibility in the process of building a proposition, the role that genre plays is significant. By helping us reconstruct a claim and a reason from the graph, it enables us to build a visual argument from diagrams.

In addition to genre, visual enthymeme is another crucial concept that we need when we construct the notion of visual argument in the context of diagrams. Since visual argument, in the case of diagrams, is not something that is given as the case of typical traditional arguments, but something that should be inferred and reconstructed through our active inferring process, it is fundamentally enthymematic. As shown earlier in the reconstructing process of the proposition from the graph in DS53, people are asked to construct a proposition through excavating a claim and a reason from x-axis, y-axis, and a line, and then, to weave them together in the way we assemble puzzles scattered here and there. Arguments reside in diagrams as a form of “incomplete syllogism” (Smith, 2007, p.115) where a claim and a reason do exist, but not as separate entities that can be perceived sequentially, but as a mixed form that is perceived simultaneously. This is a unique characteristic of visual argument that makes it difficult for us to conceive the notion of visual argument with visual images. Because of lack of internal differentiation, an inherent weakness of visual argument, diagrams seem to be disqualified to function as arguments at a glance. However, if only we can bear with the minimal efforts in reconstructing a proposition, lack of internal differentiation does not keep us from reconstructing arguments from visual images such as diagrams.

Exploring the issue of internal differentiation encourages us to rethink the question, “isn’t there internal differentiation at all in diagrams?” Interestingly enough, as we witnessed

in the reconstruction process of the line graph in DS53, diagrams are slightly different from other visual images, such as a piece of painting, in terms of internal differentiation. They actually reside somewhere in the middle ground between traditional verbal arguments composed of a claim and a reason and visual images such as a piece of painting in which it is difficult to distinguish a claim and a reason. Compared to a piece of painting in which internal differentiation of individual entities is difficult, internal differentiation of elements and location of a claim and a reason are much easier in a line graph as shown in the case of DS53. The basic structure of “S+V” formulated by the relationship between y-axis and the trend of line is almost a fixed one that can be applied to other line graphs like DS53.

The last factor that helps us reconstruct an argument from the graph is style. As discussed earlier in the literature review, style is closely related to genre, since visual images under the same genre share similar style. Diagrams are usually composed of geometric visual elements, such as lines, bars, pie-shaped charts, dots, and etc., creating a style grounded in the basic principle of simplicity and abstraction. Mainly because of this unique style, we are predisposed to view diagrams as objective, neutral, and transparent reflections of reality. Our belief in diagrams as direct reflections of reality, considerably rooted in their unique visual style, also functions as additional evidence that supports what diagrams argue. The main reason supporting the claim of the graph in DS53 is the line trend, but our belief in diagrams as direct reflections of reality also can function as an additional reason that supports what the graph argues, since it plays a significant role in making what the graph argues more reliable. Similarly, genre also functions as another supporting reason, even though it functions indirectly like style does, since our conception of diagrams, such as the graph in DS53, as

direct reflections of reality, is deeply grounded in our knowledge of the genre. Our repetitive exposure to diagrams and experience of reading and interpreting diagrams have shaped our knowledge about the genre over a long period of time, and we are reminded of the belief in diagrams as direct reflections of reality whenever we come across a diagram. Thus, genre also functions as additional reason that supports the argument in an indirect way.

Therefore, my answer to the question that I raised earlier, “can the line graph in DS53 be a visual argument?” is yes. Thus far, I have demonstrated this by showing how to construct a proposition from it, relying on concepts, such as restatability, visual enthymeme, context, genre, and style. However, the ultimate goal of the current rhetorical analysis is not to figure out whether the graph is a visual argument, but to identify to what elements or configurations of the graph viewers are likely to assign rhetorical significance. Originally, I have employed the theoretical concept of visual argument to investigate how diagrams persuade in a rational way, functioning as a visual argument, and thus, mainly appealing to our logos. Argument, as “a distinct form of human communication” (Cox & Willard, 1982, p. xiv), is a particular way of persuading. For the purpose of persuading others, argument takes a measure of giving reasons for claims, and, for that reason, arguments persuade us with “appeals addressed to the reason” (p.xvi).

Then, my next question is what diagrammatic elements or configurations of the graph contribute to persuading us in a rational way by serving as a component of the visual argument that we reconstructed from the graph. First, the variable in the y-axis, functioning as a subject of the reconstructed claim, is neither a visual element nor a configuration, but an abstract concept labeled verbally. Also, the time variable plotted in the x-axis is another

abstract concept labeled verbally as well, not a visual element. On the other hand, the line and its trend functions not only as a clue from which we build the predicate part of the claim, but also as a reason supporting the claim. So, if we pick a diagrammatic element that contributes to persuading us in a rational way by serving as a part or component of a visual argument that we reconstructed from the graph, it is the line and its trend. In other words, in the graph, the line and its trend are diagrammatic elements to which viewers are likely to assign rhetorical significance.

7.1.3.2. Line Graph as a Type

After I identified the line and the upward trend of it as diagrammatic elements to which viewers are likely to assign rhetorical significance, I asked myself again if it is the only element that has rhetorical significance. This follow-up question encouraged me to further explore how else of the line graph might function as a driving force, if it cannot be reduced to an individual element or component of the graph, in making the graph function as a visual argument. We can find an answer to this question from the additional factors discussed earlier, such as visual enthymeme, genre, context, and style. Even though the additional factors are not visual elements of the line graph, they provide a lens through which we see the line graph from a wider perspective, enabling us to go beyond individual elements of the graph.

The factor that I focus on here in my quest of finding additional driving force is genre. As discussed earlier, even though genre is not a tangible visual element that takes a physical shape and place in the graph, it plays a significant role in our conceptualization of the graph

as a visual argument. For that reason, there might be more room for discussion in terms of its ability to generate additional driving force. Evidently, genre cannot be reduced to one independent visual element in the graph, but it can possibly be conceived through the overall visual structure of the line graph, composed of the two perpendicular lines that create x-y axes, the line, annotations, and etc. Such is the case, since we recognize the graph in DS53 as belonging to a certain genre when we see the overall visual structure of line graph, composed of the fore-mentioned multiple visual elements. I think this overall visual structure is a decisive factor that enables us to recognize that the graph belongs to the genre of line graph, and also, that enables us to reconstruct an argument from the graph. Therefore, on top of the line identified earlier as a visual element that has rhetorical significance, I add the overall visual structure of the line graph as another visual configuration, if it is inappropriate to call it a visual element, which has rhetorical significance. Both the line and the overall visual structure of the line graph ultimately help the graph persuade people in a rational way, functioning either as an element that serves for argument reconstruction or as a configuration that enables us to recognize the graph as a genre that can generate a visual argument and actually enables us to reconstruct an argument from it.

7.1.3.3. A Downward Trend of a Line

Demonstration process is similar with other line graphs in spite of different line trends. For example, there are line graphs that visualize a downward trend as shown DS1. According to the process taken with the previous graph (DS53) analysis, we can construct a proposition from this graph, “surface temperature in the Sargaso Sea has been falling.” The

“S+V” continues to function as a useful sentence structure for reconstructing a proposition from the graph as well. To be more specific, the variable in the y-axis, “sea surface temperature,” functions as a subject, while the line trend functions as a predicate, “has been falling,” together formulating a claim, “the sea surface temperature has been falling.” The reason supporting the claim is the falling trend of the line itself. In this case, the line is a visual element that has rhetorical significance, and the overall visual structure of the line graph is a visual configuration that has rhetorical significance.

7.1.3.4. A Spike in Line Trend

The line graph in DS40 shows a spike on the right end, a sudden increase in line trend after a long stable line. If we apply the basic structure of “S+V” again to the graph, we can develop a proposition, “difference in temperature (compared to 1961-1990) has suddenly increased recently, between 1900 and 2000.” The variable in the y-axis, “difference in temperature,” functions as a subject, while the sudden spike in the line trend enables us to formulate the predicate part, “has suddenly increased recently.” The reason supporting the claim is the spike in the line trend. In this case, the spike on the right end of the line is a visual element that has rhetorical significance, and the overall visual structure of the line graph is a visual configuration that has rhetorical significance.

7.1.3.5. Correlation between Lines by Similar Line Trends or Line Overlap

While some line graphs visualize various trends of a line as shown in the previous three cases, others depict relationships among multiple line trends. DS3 is the an example of

a line graph that depicts relationships among line trends. DS3 visualizes two lines, and they show similar line trends, almost overlapping with each other. In this case, the previous structure of “S+V” should be a little bit modified, since there are two variables, one on the left y-axis and the other on the right y-axis. So, if we apply “S+S+V” structure to the graph, we can construct a claim, “temperature deviation and solar magnetic cycle length are in a close relationship with each other.” The reason that supports the claim is the overlapping trend of the two lines. In this case, the overlap of the two lines is a visual element that has rhetorical significance, and the overall visual structure of the line graph is a visual configuration that has rhetorical significance.

7.1.3.6. Contrast between Different Line Trends

While DS3 is about similarity between the line trends, the line graph in DS28 about contrast between different line trends. The line graph in DS28 depicts two lines showing overlap of line trends in the left side, and then, divergence on the right. The main message delivered by the graph is that the red line, signifying increase in temperature caused by predicted sum of natural and anthropogenic changes, goes up, while the green line, signifying increase in temperature caused by predicted natural changes, either stays the same or slightly goes down. Thus, the conclusion that we get to by this graph is that increase in temperature is caused by human activities.

Then, how do we construct a visual argument from the graph, and how do we come to the conclusion? Using the “S+V” structure, we can develop two propositions separately from this graph. First, if we only focus on the red line, we can formulate a proposition,

“temperature increase caused by natural and anthropogenic changes has gone up.” Then, if we focus on the green line, we can reconstruct another proposition, “temperature increase caused by natural changes has been the same.” Each line trend functions as a supporting reason for each proposition. However, the central argument of this graph is not those two separate propositions, but in a deeper level. It should be further inferred from the relationship between the two line trends. The ultimate proposition that this graph attempts to deliver is that “increase in temperature is caused by anthropogenic changes rather than natural changes.” The supporting reason is the upward trend of the red line, in contrast to the status quo or a bit downward trend of the green line. This line graph is slightly different from the first four graphs in the sense that it requires further inferring process. It asks us to reconstruct the claim from the relationship between the two lines, and in the process of doing it, inferring process is required. In this case, the divergence in line trends on the right half is a visual element that has rhetorical significance, and the overall visual structure of the line graph is a visual configuration that has rhetorical significance.

7.1.3.7. No Correlation between Two Lines

While DS3 is about correlation between lines supported by the similarity in trend between the two lines, DS2 describes that there is no correlation between the two lines. DS2 visualizes the two lines. The yellow line representing temperature rise had peaked in 1940 before the white line representing CO₂ concentration had peaked after 1980. Thus, we cannot blame CO₂ for causing temperature rise, since temperature had already increased and peaked before CO₂ had increased. If we analyze DS2 from the angle of visual argument, the previous

structure of “S+V” should be a little bit modified again, since there are two variables, one on the left y-axis and the other on the right y-axis. So, if we apply “S+S+V” structure to the graph, we can reconstruct a claim, “temperature deviation and CO₂ concentration are not in a relationship with each other.” The trends of the yellow and the white line that act independently without any relationship serve as a supporting reason for the proposition that we developed. Therefore, in this case, lack of relationship between the two lines is a diagrammatic element to which viewers are likely to assign rhetorical significance, and the overall visual structure of DS2 as a line graph is a visual configuration to which viewers are likely to assign rhetorical significance.

7.1.3.8. An Upward Trend of Bars (Gradual Increase of Bar Height)

The next sub-category of diagrams that I focus on is bar graphs. As most line graphs in the sample collection depict an upward trend in line, bar graphs do the same, since most of them are also used to visualize rise either in global temperature or in CO₂ emissions, popular themes of global warming. The consecutively positioned bars in DS30 show an upward trend in common, either stiff or not. Using the basic structure of “S+V” again, we can formulate a claim, “fuel consumption has increased in the six countries (even though the degree of increase is various).” The reason supporting the claim is the gradual increase commonly observed in the heights of the consecutive bars in the six countries. In this case, I first identify gradual increase in bar height as a visual element to which viewers are likely to assign rhetorical significance.

7.1.3.9. Bar Graph as a Type

Then, like the case of the previous line graphs, bar graphs can be conceived through their overall visual structure, composed of the two perpendicular lines that create x-y axis, bars, annotations, and etc. Therefore, on top of the gradual increase in bar height identified as a visual element that has rhetorical significance, I add the overall visual structure of bar graph as another visual configuration that has rhetorical significance.

7.1.3.10. Relative Height of Bars

Other bar graphs like DS38 visualize various bar heights to encourage us to compare relative amounts of something across the countries. A notable thing about this bar graph is that the x-axis does not represent a time variable. In other words, the bars do not depict gradual change of one variable over time, but relative amount of something through multiple independent bars. X-axis represents countries, as individual units, instead of time. The variable given in the y-axis is CO₂ emissions. The way a claim and a reason are reconstructed from this bar graph is slightly different from the previous cases, since time variable in the x-axis is replaced by multiple countries. As mentioned, this graph is not about a trend any more, but either about the definitive amount of CO₂ emitted by each country or about relative amount of CO₂ emission among the countries. Therefore, we can reconstruct multiple claims from the graph, such as, for example, “Canada’s average per capita CO₂ emissions per year is 18 tonnes,” “India’s average per capita CO₂ emissions per year is 1 tonne,” “The U.S. emits most average per capita CO₂ emissions per year among the countries being compared,” and “The U.K.’s average per capita CO₂ emissions per year is more than China’s.” The reasons

supporting the claims are either the height of each bar that signifies amount of CO₂ emissions or the relative difference among the bar heights. In this case, I identify the height of each bar and relative difference among the bar heights as a visual element that has rhetorical significance. Then, I add the overall visual structure of bar graph as another visual configuration that has rhetorical significance.

7.1.3.11. REDUNDANCY

Thus far, I have demonstrated that the seven graphs analyzed are visual arguments, and, in the process of demonstrating it, identified diagrammatic elements or configurations to which viewers are likely to assign rhetorical significance. As shown in the index of diagrammatic elements or configurations to which viewers are likely to assign rhetorical significance, I have found redundancies in other similar examples. Because of redundancies, I only discussed one key example from each category of diagrammatic elements/configurations. Other similar examples have confirmed this general perception that I gained from the rhetorical analysis of the key examples. On the basis of visual argument as a medium for rational and scientific communication, the key examples and other similar examples persuade us in a rational way, mainly appealing to our logos.

Although, in the previous analysis, I identified and focused on the line/bar trends and the visual structure of line/bar graphs as diagrammatic elements and configurations to which viewers are likely to assign rhetorical significance, the graphs analyzed so far do have multiple diagrammatic elements or configurations at the same time. Hence, some additional elements have not been mentioned above. As clarified earlier, in order not to discuss the

same redundant element over and over again, I arranged elements and configurations identified from the sampled diagrams in the index of diagrammatic elements or configurations, and discussed them one by one, that is, element by element, rather than analyzing multiple elements of a diagram at the same time and then moving to the next diagram.

7.1.3.12. Additional Analysis of Line Graphs through Vertical Archetypal Metaphor

Line graphs such as DS18, the line graph about “yearly change from average Arctic temperature” in DS11, and DS27 can also be analyzed through the concept of vertical archetypal metaphor as well as through the concept of visual argument. As discussed earlier in the literature review of the concept, the values originally associated to the above (desirable & positive) and the below (undesirable & negative) in the concept should be inverted not only in DS18, the line graph about “yearly change from average Arctic temperature” in DS11, and DS27, but also in other similar line graphs to them. Thus, a positive connotation normally assigned to upward trend of line is replaced by negative connotation, which eventually leads us to catastrophic ends caused by global warming. Although the fundamental cognitive structure regarding up-and-down or above-and-below should be inverted in order to read and interpret the line graphs properly, I argue that the inversions do not necessarily weaken their persuasive potency, since we are accustomed to this inversion through our exposure to the same type of line graph that repetitively appears in mass media. Because of its effectiveness in describing rise in temperature or in CO₂ emissions, line graphs with an upward line almost functions as a representative icon of global warming. For that

reason, we have been familiar with this kind of inversion through our constant exposure to similar line graphs disseminated by mass media.

Analyzing line graphs, such as DS18, the line graph about “yearly change from average Arctic temperature” in DS11, and DS27, from the lens of vertical archetypal metaphor, enables us to identify the upward trend of line again as a diagrammatic element to which viewers are likely to assign rhetorical significance. It has rhetorical significance in the sense that it persuades us into believing that rise in temperature or in CO₂ emissions will eventually bring us into a catastrophic end, activating our basic motivations shaped on the basis of the spatial structure of above/below. Although the values assigned to the above and the below are inverted here, it is not a problem, since, in spite of its inversion, the line graphs still performs a rhetorical function, persuading us in an somewhat emotional way by making us afraid of the catastrophic end that eventually will be led by the upward trend of negative happenings, such as rise in temperature or in CO₂ emissions.

7.1.3.13. Red Color

An upward trend of a line in a line graph becomes visually more salient by adding colors, such as red. As a color most frequently used in the sampled diagrams, red has been employed 36 times in the sample diagrams, signifying negative meanings, such as temperature rise, carbon emission, fire, drought, inundation, and etc. Red color has been applied to various visual elements throughout various types of diagram, but the most prominent case is when used as a color of a line that visualizes an upward trend in a line graph, such as DS18, the line graph about “yearly change from average Arctic temperature”

in DS11, and DS27. In these cases, red color, being integrated with an upward trend of a line, not only makes the line visually more salient than before, but also further intensifies negative connotations that the line signifies. The red color in the three diagrams not only strengthens the sense of crisis already visualized in the upward trend of the lines, but also makes the line graphs more appealing to our emotion, arousing our attention to the urgency of the matter, global warming. Being integrated, the upward trend of the line in the line graphs themselves and red color used for it together persuade us into believing either the argument that “temperature rises” or that “CO₂ emissions increases” in a somewhat emotional way.

As shown thus far, a rhetorical analysis of the previously selected line graphs through applying multiple theoretical concepts, has provided us with answers to the question, “to what diagrammatic elements or configurations are viewers likely to assign rhetorical significance?” First, I analyzed the graphs from a visual argument perspective, and have demonstrated that they persuade us in a rational way through giving reasons for claims. This process enabled me to identify the line trend and the overall visual structure of the line graphs as diagrammatic element and a configuration to which viewers are likely to assign rhetorical significance, and showed how they function to persuade us in a rational way.

Second, I applied the notion of vertical archetypal metaphor, and showed how the graphs emotionally persuade us into believing the catastrophic ends that we are likely to have after the rising trends visualized in them. This analysis has enabled me to identify the upward trends of the lines again. Therefore, the upward line trends perform double functions, sometimes, as a visual element that enables the graph to function as a visual argument, and

other times, as a visual element that persuades us into believing catastrophic ends of the rising trend, on the basis of inverted spatial structure of above and below.

Third, I analyzed the red color used for the lines with an upward trend, and demonstrated that it persuades us emotionally by intensifying a sense of crisis and arousing our attention to the urgency of the matter.

While DS18, the line graph about “yearly change from average Arctic temperature” in DS11, and DS27 illustrate cases in which red color is used for gradually increasing trend of line throughout a given time period, others, such as the upper line graph in DS32 and DS45, provide cases in which red color is used for highlighting a sudden increase on the right end of the line. The use of red color for gradually increasing line and the use for a spike are identical in nature except the range of applying the color. Therefore, applying the notion of visual argument to line graphs, such as the upper line graph in DS32 and DS45, we can identify the spike on the right end of the lines and the overall visual structure of the line graphs as a diagrammatic element and a configuration to which viewers are likely to assign rhetorical significance.

Through applying vertical archetypal metaphor, we can identify the spike on the right end again. In graphs, such as the upper line graph in DS32 and DS45, the sudden increase in line trends makes them more dramatic than simply increasing line trend. In addition, the red color used for the spike is an element to which viewers are likely to assign rhetorical significance, since it persuades us emotionally by intensifying a sense of crisis and arousing our attention to the urgency of the matter.

In line graphs, red color has been used for other purposes as well. In DS3, red color is used for the background of the line graph that visualizes correlation between temperature deviation and solar magnetic cycle length. What the graph presents is that temperature deviation is closely related to solar magnetic cycle length, as the overlap between the two lines shows. Hence, the main message of this graph is that change in temperature deviation is caused by solar activities, which is not anthropogenic influence, but natural influence. In this case, the red color in the background stands for the sun, the cause of fluctuation in temperature deviation, not having any negative connotation.

Red color in DS9 is used for the line signifying solar activity. Like DS3, DS9 also illustrates correlation between temperature and solar activity, attributing changes in temperature to solar activity. The difference between DS3 and DS9 is that, in DS9, red color is not used for the background, but for the line signifying solar activity. The red color in this case also stands for the sun, the cause of temperature fluctuation.

Red color is used for bar graphs as well. In DS38, red color stands for average per capita CO₂ emissions. CO₂ emission is recognized as the main cause of global warming, and thus, frequently represented by red color, possessing negative meanings such as warming, heat, or fire under the issue of global warming. The negative connotation of CO₂ emissions is intensified by integration with red color.

7.1.3.14. Blue Color

In opposition to red, blue means cooling, having a positive meaning in the context of global warming. In some of the sampled diagrams, in opposition to red, blue conveys

positive meanings, such as temperature decrease and cooling. For example, blue color is used for background in DS1. The color, which stands for temperature decrease or cooling in itself, goes with what the line graph basically argues, “temperature of Sargaso sea has been falling.” By using the soothing and tranquilizing color as a background color, the graph visually supports and strengthens what it argues. In DS4, 32, and 45, blue is used for the relatively stable lines that come before the sudden increase on the right end of the graphs. In these examples, making a good contrast with red used for the spikes, blue for the relatively stable line trend plays a role in making the red spike visually more salient.

In DS50, different shades of blue are used for each of the division under the projected lines that are likely to be drawn if we take measures shown on the right side of the line graph. Therefore, each of the shaded areas signifies amount of carbon emissions we can reduce by taking each measure. In this case, blue is used for signifying another positive meaning, reducible amount of carbon emissions. By its color only, the shaded areas signify positive meanings that can help us relieve the severity of global warming.

7.1.3.15. Green Color

As mentioned earlier in the literature review, green is a typical color that represents nature and environment. Because of its inherent association with nature and environment, traditionally, environmentalists have employed green color to support their argument about protection of the environment. Thus, it became a representative color that symbolizes environmentalists, their movement, and environmental friendliness as well. For example, scholars such as Kangun and others (1991) link green color to concepts such as

“degradable,” “recycled,” “recyclable,” “ozone friendly,” or otherwise good for the environment” (p.48).

In DS2, green color is used for the background of the line graph, indirectly providing a visual support to what the graph argues. The graph makes an argument, “CO₂ is not the cause of the temperature rise,” against environmentalists’ representative argument that “the increase in temperature is caused by the increase in atmospheric CO₂.” Visualizing the relationship between global surface temperature and CO₂ concentration over the past 120 years, the graph reveals that “most of the temperature rise from the late 1800s to today had already occurred by 1940, before most of the increase in atmospheric CO₂ had taken place.” Accordingly, the increase in CO₂ is not the cause of the temperature rise, since the cause cannot occur after the presumed effect. What the graph argues is one of the main arguments that conservative media make in opposition to environmentalists’ argument that human activities are the cause of global warming. Opposing to environmentalists’ position, conservative media attribute global warming to natural causes, such as solar activities. Thus, using green as a background color of the graph is a strategic choice not only to create a soothing and tranquilizing atmosphere, but also indirectly supports what the graph argues, since green reminds us of nature, which the graph attempts to evoke within us as a reason of global warming.

7.1.3.16. Red Color vs. Green Color

DS28 employs green color for the line representing “predicted natural changes,” in a good contrast to the red line representing “predicted sum of natural and anthropogenic

changes.” On the other hand, the black line represents actual observations. The graph basically argues that global warming is caused by human activities, since the black line for actual observations and the red line for sum of natural and anthropogenic changes significantly overlap. This proves that increase in temperature is due to human causes. Not only the obvious difference in trend between the red line and the green line between 1960 and 2000, but also the color contrast between red and green deliver the message about human-caused global warming in a visually persuasive way. Green color, in a good contrast to red, conveys positive meanings, such as nature, temperature decrease, and cooling in this graph.

7.1.3.17. Green Color vs. Grey Color

DS21 is a map-based diagram. The map in DS21 visualizes an index of environmental performance of each country, evaluating variables combining greenhouse-gas emissions, quality of water resources, and habitat protection. The map visualizes each country’s performance score, using a seven step color-coding system based on values, ranging from light green (best performance) to dark grey (worst performance). The color-coding system in DS21 basically relies on the culturally-associated meanings of green as nature, environment and eco-friendliness versus grey (or black) as smoke or pollution. The color contrast between green and grey provides a ground on which the color-coding system rhetorically plays a crucial role, not only in conveying how environmental performance has been scored worldwide, but also, more importantly, in encouraging us to view and interpret

the world with two contrasting values, positive value with the green color vs. negative value with the grey color.

DS39 combines a concept map and a pie chart. I focus on the concept map to analyze how green color and grey color are used as a contrasting pair. The human body that connects the left side colored by grey and the right side colored by green is the center point of the concept map that integrates individual elements with the four arrows. First, the human body is filled with red and black color. The red color is used here to signify that humans are the source of CO₂, which eventually causes global warming. Second, on the left side, there are three hot air balloons holding 11.1 tonnes of CO₂. Third, on the right, there are three ways in which we can offset the 11.1 tonnes of CO₂: planting 505 trees in the tropics, installing 111 energy-efficient light bulbs, and installing 85m² of solar panels. As the contrast between the grey and the green implies, the left side describes the generation of CO₂, which is something bad in the context of global warming, and the right the offsetting of CO₂, something good. The association that we usually make with green and grey color is taken advantage of here again. The contrast between green and grey effectively represents the positive and negative process that affects global warming, production of CO₂ on the left and offsetting of CO₂ on the right. What is more important about the color contrast here is that it encourages us to interpret the entire process of carbon generation and offsetting in a particular way by assigning negative values to the carbon generation on the left side and positive values to the carbon offsetting on the right side. This is facilitated by the positive and negative values originally attached to green and grey color.

In the sampled diagrams, colors have been used for various elements of diagrams, such as line, bar, arrow, shade under line, and background. As analyzed so far through the representative cases, color plays a significant role in constructing visual rhetoric in the sampled diagrams. First, communicative power of colors is strong, since we can instantly perceive meanings through colors. Second, colors play a considerably important role in the sampled diagrams that deal with the issue of global warming, since most of them employ colors as an essential visual element in persuading viewers effectively. Red color is an effective visual element that represents global warming, since it reminds us of various negative meanings, such as heat, warming, CO₂, danger, and crisis, while green and blue, in a good contrast to red, convey positive meanings, such as nature, environment, environmental friendliness, and sustainability. Grey color goes with red in a sense, since it signifies negative meanings, such as pollution and smoke, the reasons that cause global warming. As shown earlier, color contrast between red vs. green and green vs. grey also plays a rhetorical function, persuading us through the positive and negative values originally assigned to them. In many cases, colors persuade us in an emotional way. For example, red color used for an upward trend of a line of temperature of CO₂ emissions or a spike in line trend appeal to us in an emotional way by arousing sense of urgency and crisis.

7.1.3.18. Use of Map and Color Coding

Although maps are a genre independent from diagrams, I include them as a sub-genre under diagram for the purpose of this study, since many of the sampled diagrams are based on maps. In order to call the kind of diagram constructed upon a map, I use a term, map-

based diagrams, instead of maps. I argue that map-based diagrams in the sampled diagram collection are rhetorical, since they persuade us into believing a particular way of understanding a place. Rhetorical potentials of maps have been discussed by scholars, such as Barton and Barton (1993), Harley (2001), Proven (2007), and Davisson (2011). Barton and Barton (1993) argue that maps are “quintessentially ideological” (p.50), and therefore, we have to denaturalize the “innocent notion of the map as a factual rather than a semiological system” (p.51). Proven (2007) studies maps as a rhetorical object, arguing that maps have been understood “as bearing communicative, and in many cases, persuasive power” (p.236). Agreeing with Barton and Barton (1993) and Proven (2007), Davisson (2011) argues that it is “easy to accept that maps are persuasive” (p.104). She then continues to argue that the “maps people see everyday do not simply display the truth of a given environment, they argue for a particular understanding of that space” (p.105). Harley (2001) well summarizes what the previous scholars argue, asserting that “rhetoric permeates all layers of the map. As images of the world, maps are never neutral or value-free or ever completely scientific. Each map argues its own particular case” (p.37).

The first theoretical concept that I draw from the literature review to analyze some map-based diagrams is visual argument again. Not only line and bar graphs analyzed earlier, but also map-based diagrams, have rhetorical significance in the sense that they persuade us in a rational way, functioning as a visual argument. Thus, I analyze how map-based diagrams function as visual arguments, and, in the process of analyzing it, see to what diagrammatic elements or configurations viewers are likely to assign rhetorical significance.

To demonstrate that the map-based diagram in DS21 is a visual argument, I investigate whether it has a propositional nature through exploring whether we can reconstruct a proposition from it. The map presents multiple visual arguments, depending on whether we focus on individual countries or compare across countries. First, if we focus on the individual countries, we can reconstruct claims, such as “Cameroon is not so green (in terms of environmental performance)” because Cameroon’s dark green color falls under the score of 60-69.99 in the environmental performance index. The “S+V” structure should be modified to “S+(V+ADJ (adjective))” to fit to the sentence structure implied in the map-based diagram. Each country, taking each individual unit in the map, functions as a subject of a claim (“Cameroon”), while the color of the country as a predicate of a claim (“is”) that contains an adjective (“not so green”), describing quality of the subject. Together, they formulate a claim, “Cameroon is a not so green (in terms of environmental performance).” We can reconstruct other arguments in the same way, such as “Sweden is green,” “China is not so green”, and etc. The reason that supports the arguments is the degree to which the color of a particular country is light/dark on the color spectrum. If we focus on the continents rather than individual countries, a couple of additional arguments are to be reconstructed from DS21, such as “most countries in Africa are not green” and “most countries in America are green.”

Second, by comparing two countries, we can reconstruct claims, such as “Sweden is greener than Cameroon.” In order to be able to extract a claim composed of such a sentence structure, the “S+V” structure should be modified to “S₁+(V+ADJ+than)+S₂.” Sweden is the subject₁ of the claim, the color of Sweden as a predicate of a claim (“is”) that contains an

adjective (“greener than”), describing quality of the subject₁, and the subject₂, the counterpart compared to the subject₁. Together, they formulate the claim, “Sweden is greener than Cameroon.” The reason that supports the claim is the greener color of Sweden compared to that of Cameroon. We can reconstruct other arguments in the same way by comparing other pairs of countries.

Although DS21 can generate multiple arguments as shown so far, the main argument that it really attempts to deliver is one. What helps us fixate the meaning of the map-based diagram, and ultimately, enables us to reconstruct its central argument, is contextual element, such as the main title of the article, “Green and Not So Green,” and the sub-title, “Leaders and Loafers,” and, more importantly, the color contrast between grey cluster in the center and the green on the left and upper right side, created by the overall arrangement of the colors. First, the titles, “Green and Not So Green” and “Leaders and Loafers” predispose us to locate “green” versus “not so green” areas in the map, with the contrasting pair of colors in our mind. What catches our eye first in the map-based diagram is the “not so green” area, the cluster of the very dark green countries in Africa, because of its noticeably dark color and its location. The attention given to the center area might be expanded to the Asian countries, such as China and India, because of color similarity and proximity. As a result of the expansion, the “not so green” cluster is formed, encompassing the Africa and the lower Asian countries. From this cluster, we can build a general perception that the countries in this area are “not so green.” Then, our eye goes to the “green” areas on the left side and then the upper right. The bright green colors in the North and South American and Europe makes a good contrast with the “not so green” area in terms of color, forming another cluster. Therefore,

the central argument that we can reconstruct from DS21, after being informed by the titles and the visual contrast between grey and green areas, is “most African and Asian countries are “not so green,” while most American and European countries “green.” In terms of visual aspect, the grey vs. green cluster is a determining visual element that enables us to reconstruct the main argument from DS21.

Not only the color contrast, but also the color-coding system applied to the map is the key for us to reconstruct the above main argument. The color-coding system in DS21 not only encourages us to see the overall trend in color distribution at a glance, but also to develop a general perception about the trend, the contrast between the grey and green cluster. Thus, the color-coding system contributes to persuading us into interpreting the map-based diagram in a particular way, ultimately promoting a particular understanding of the given place.

The map-based diagram in DS21 is a good example in which multiple diagrammatic elements and configurations work together to persuade us into having a particular understanding about the given place in the map. First, the color contrast between grey and green cluster created by the overall arrangement of the colors is an essential diagrammatic element that enables the map-based diagram to persuade us in a rational way, functioning as a visual argument. The color contrast is indebted to the color-coding system and the general meanings associated with green/grey color. Thus, they are also diagrammatic elements that help the map-based diagram persuade us into viewing the given place in a particular way. To summarize, the diagrammatic elements, such as the color contrast, the color-coding system, and the culturally associated meanings of the colors, are the ones to which viewers are likely

to assign rhetorical significance, since they contribute to persuading us into understanding the given place in a particular way, for example, the world is divided into two contrasting clusters, the developed countries with superior values vs. the under-developed or developing countries with inferior values.

As shown so far, a rhetorical analysis of a map-based diagram, such as DS21, enables us to realize that it encourages us to have a particular understanding of a place, promoting particular values. However, the rhetorical dimension of map-based diagrams can be revealed only by taking a critical stance on them, employing a rhetorical lens. On the other hand, in reality, viewers have a tendency to recognize map-based diagrams as a neutral medium that conveys factual information. This belief in map-based diagrams as an exact representation of reality is strongly associated with them, and thus, it is evoked whenever we come across maps, eventually enhancing their persuasive power. Thus, selecting a map out of various representational possibilities, and using it as a base upon which we construct a diagram has rhetorical significance in itself, since it persuades viewers into believing what it presents is accurate representation of reality, relying on our belief in the particular representational style called a map. Therefore, I also identify “use of a map” as a diagrammatic element to which viewers are likely to assign rhetorical significance.

In the process of functioning as a medium for visual persuasion, map-based diagrams employ diagrammatic elements unique to the sub-genre. A color-coding system, already discussed in the previous analysis of DS21, is one of those that appeared more than three times in the sampled diagram collection. Other ones are filling up map-based diagrams with red or similar colors and decrease in area size on a map-based diagram. Since more than one

diagrammatic element is mixed in a couple of sampled map-based diagrams, I discuss them together in the following examples.

7.1.3.19. Filling Up Most Areas on a Map with Red or Similar Colors

The second diagrammatic element unique to map-based diagrams is filling up with red or similar colors. The map-based diagram in DS35 persuades us into having a particular conception about the world, and the visual strategy of filling up the map-based diagram with red color facilitates this process. From DS35, we can reconstruct a claim, “most areas in the world have a large (17.5-19) additional number of hottest years for 20 years,” since the color of most areas in the map is dark red, corresponding to the highest scale in the spectrum. From the claim, we can further infer a more comprehensive claim, “most areas in the world are warming,” since the large number of additional number of hottest years is a sign showing that the affected areas are warming. Thus, the central claim we can reconstruct from DS35 is “most areas in the world are warming,” and the fact that most areas in the world are filled up with the dark red color, corresponding to the highest scale, is visual evidence that supports the claim. As discussed so far in the above analysis of DS35 from the perspective visual argument, the strategy of filling up with red color contributes to persuading us into having a particular conception about the world, in a rational way, functioning as a key visual element enabling us to generate similar visual arguments, such as “most areas in the world are warming,” “global warming is everywhere in the world” or “global warming is a serious problem because it is omnipresent.”

The diagrammatic element, filling up with red color, persuades us in an emotional way as well as in a rational way. The emotional appeal of the element relies on the meanings culturally associated with the color and its arousing quality, while it is further strengthened by the fact that the scope of applying the color covers most of the world. Thanks to its negative connotation under the theme of global warming and arousing quality inherent in itself, red color appeals to our emotion, intensifying the sense of crisis that DS35 attempts to bring about. Omnipresent use of such a color makes the map-based diagram more appealing to our emotion, arousing our attention to the urgency of global warming.

7.1.3.20. Decrease in Area Size on a Map

The last diagrammatic element unique to map-based diagrams is decrease in area size. The map-based diagram in DS31 presents two ice images taken by NASA to compare the different size of the Arctic ice cover in September 1979 and in September 2003. The white area in 1979 has considerably shrunk in 2003, losing most of the ice in the western area. While the line graph positioned in between visualizes the entire trajectory of how the size of the ice has decreased between 1979 and 2005, the satellite images visualize the two selected moments only, 1979 and 2003.⁴⁶

First, the two ice images persuade us in a rational way, functioning as a visual argument. Using the “S+V” structure, we can construct a claim, “the Arctic ice cover has significantly decreased from 1979 to 2003,” since the upper sea ice cover in 1979 functions

⁴⁶ Although DS31 combines the line graph in the middle with the ice images, my focus is on the images because here I discuss “decrease in area size” as a diagrammatic element to which viewers are likely to assign rhetorical significance.

as a subject and the difference in the Arctic ice cover is the clue from which we can reconstruct the predicate part. The difference in the Arctic ice cover size is evidence supporting the claim.

Although we can analyze DS31 as a case of a visual argument, as discussed earlier, I argue that the two ice images in DS31 persuade us in an emotional way more than in a rational way. The decrease in the Arctic ice size is huge if we imagine the Arctic area in proportion to the entire globe. Loss of such a huge size of ice implies additional amount of water melted from the ice, which might cause flood somewhere in the globe, and another chain reaction, such as additional rise in global temperature, since the Arctic ice is the main factor that reduces global warming by reflecting sunlight. Thus, decrease in the ice size is an emotionally appealing diagrammatic element, since it visually warns us of a catastrophic end that might be led by the loss of the ice. By bringing what it argues before our eye, DS31 gains more persuasive power, mainly appealing to our emotion.

7.1.3.21. Relative Sector Size in a Pie Chart

The next diagrammatic element that I identified is “relative sector size” in pie charts. Pie charts are composed of a circular area divided into a couple of sectors, each with either different colors or different shades of a single color. Since the main purpose of employing pie charts is to represent relative quantity of something through comparing relative sizes of sectors and a part to the whole, the key to interpreting them is to compare relative sizes across sectors, proportional to quantity. The six pairs of pie charts in DS30 visualize “current contribution to global energy consumption” through the left pie chart, and “current

contribution to global CO₂ emissions” through the right pie chart. Because of the horizontal line-up of not only the pie charts, but also other diagrams above them, we can easily compare relative quantity across the six countries.⁴⁷

Depending on whether we concentrate on each country exclusively or compare six countries together, the pie charts at the bottom of DS30 make multiple visual arguments. If we focus on each country, we can reconstruct claims, such as “South Korea consumes 1.7% of global energy,” “the U.S. consumes 22.2% of global energy,” and “India releases 4.3% of global CO₂ emissions.” In this case, the size of the corresponding sector in each country functions as a reason that supports the claims. On the other hand, if we compare across countries, we can reconstruct a claim from the charts on the left, “the six countries selected consume the quantity of global energy, corresponding to the sector size, in relation to one another,” and another claim from the charts on the right, “the six countries selected release the quantity of CO₂ emissions, corresponding to the sector size, in relation to one another.”

Although the previously reconstructed visual arguments are informative, I argue that the central argument of the combination of the six pairs of pie charts is the one that puts the pairs in the mode of comparison. By visual configuration horizontally lining up the six countries, the diagrams in DS30 encourage us to find a general trend in quantity through comparing across countries, and then, to make a value judgment about which country contributes most or least, rather than focusing on individual countries. Thus, the main diagrammatic element that enables the two main arguments to function is the relative size of the sectors in the six pairs of pie charts.

⁴⁷ DS30 has been rearranged to fit into the given space of this dissertation. Originally, the six countries are horizontally in a row together.

7.1.3.22. Thickness of Line

The last significant diagrammatic element that appeared more than three times in the sampled diagrams is “thickness of lines.” It is used either in a map to denote intensity of water current in the sea, or in a flow chart to signify quantity of variable things. Since, a key example that I select to discuss this diagrammatic element is a flow chart in DS24, I briefly discuss what a flow chart is first. A flow chart is a sub-genre of diagram, in which entities typically in boxes of various kinds are arranged and connected to one another typically by arrows or lines in order to show complex flow or relationships among them. Therefore, it is a type of diagram appropriate for depicting process of something.

The flow chart in DS24 depicts where each greenhouse gas comes from and what percentage of greenhouse gas comes from the various sectors and activities. The relative percentage that each line takes up is brought before our eye through the key diagrammatic element, thickness of the lines relative to one another. The exact percentage of each line is shown in numbers as well, and we might want to go back to the numbers later for detailed understanding, but we can, first of all, find a general trend by making an instant comparison in terms of thickness of the lines. From the relative thickness of the lines, we can reconstruct a claim, “various greenhouse gases, such as carbon dioxide, methane, and nitrous oxide, take up the relative quantity of the world’s greenhouse gases, corresponding to the thickness of the lines, and each of them comes from the sectors and activities connected through the line, at the percentage, corresponding to the thickness of the lines.” The reason that supports this claim is the thickness and flow of the lines. Out of the two diagrammatic elements, the one that appeared more than three times is thickness of lines.

Thus far, I have shown some selected key examples that represent the 20 significant diagrammatic elements and configurations that appeared more than three times in the sampled diagrams, and therefore, I think to which viewers are likely to assign rhetorical significance. The detailed analysis has been presented in order to aid understanding of what they are, how they are likely to persuade viewers, and ultimately, in what ways viewers are likely to assign rhetorical significance to them. Based on my understanding of the identified elements and configurations, I move on to the next phase, the qualitative interviews, in order to compare my analysis with others’.

7.2. Findings from the First and Second Qualitative Interview

Prior to the first qualitative interview, I asked interviewees to read two articles randomly assigned to each of them, and see the diagrams in them alone for 20 minutes in a quiet classroom. Then, I had an interview in the same classroom, using the attached interview protocol (Appendix 6) as a guiding tool. I videotaped and audio-taped during interviews.

Before the second qualitative interview, I cut out all the diagrams from the 12 articles selected from the original 39. Then, during the interview, I randomly arranged them on a table except the ones that each interviewee had already seen in the first qualitative interview. Then, I asked the first group of participants to choose a diagram that they thought would be appropriate for a chapter on global warming in a college science textbook. After they chose, I had an interview with them, using the interview protocol (Appendix 6) as a guiding tool. I asked the second group of participants to select a diagram that they thought would be appropriate in a printed report from social activists or lobbyists designed to persuade

legislators about issues of global warming.⁴⁸ Then, I had an interview with each of them, using the interview protocol (Appendix 6) as a guiding tool. The interviews were both videotaped and audio-taped.

The findings from the first (phase 1B) and the second qualitative interviews (phase 2) are summarized together in Appendix 7, which gives detailed information about what diagrammatic elements or configurations were identified in which diagram how many times. While Appendix 7 arranges the result diagram by diagram, Appendix 8 shows how many times each diagrammatic element or configuration was identified in what phase, and at what percentage compared to the total number that each element might have been identified.

In Appendix 8, under “1A,” the left column shows the total number of times that I identified each element from the rhetorical analysis, while the right column titled as “x5 (no. of interviewees) shows the total number that each element might have been identified by 5 interviewees who were given the article with the diagram accompanying the element. Each of the three columns under “1B” displays the number of how many times a certain element was identified, the total number that the element might have been identified, and the percentage that the number of actual identification takes, compared to the total number that the element might have been identified. The same components are arranged in the same order under “2” as well.

⁴⁸ I also asked them to choose some for pro argument (the globe is warming) and some for counterargument (the globe is not warming), since some diagrams are for global warming, while others are against global warming.

7.2.1. Findings from the First Qualitative Interviews

The diagrammatic elements identified as convincing most frequently in the first qualitative interview are two, “an upward trend of bars” and “pictogram size,” mentioned by four out of five interviewees (80%) respectively. It is interesting to note that both elements were identified as convincing from DS30, the one and only diagram that employs the two elements at the same time. The following comments by P11 and P28 were made during the interview, when they identified “an upward trend of bars” when they were asked to identify a visual element of DS30 they found convincing.

Jae Young: Yeah. So, can you point to which part of these diagrams down here (pointing all of the different types of diagram in DS30) is convincing?

P11⁴⁹ : I think these (pointing the bars), particularly when you look at the coal consumptions, because that releases the most CO₂ that it talks about here, and in each country, especially in China, it's going way up.

Jae Young: So, you are talking about these bar graphs?

P11: Um-hum. The bar graphs. Yes.

Jae Young: So, is there any visual element of the diagrams (DS30) you found convincing?

⁴⁹ P11 means “Participant 11.”

P28: Okay. Well, I thought these (pointing at the line graph and the bar graph of DS30 together) because no matter what the scale was, you could see that the trend of CO₂ emissions ... is still increasing everywhere...

“Pictogram size” was also mentioned by 80% of the interviewees. I also identified this element as an element to which interviewees are likely to assign rhetorical significance through the rhetorical analysis, but it did not serve as a criterion for the selection of the original examples for interviews, since it was identified only once from DS30. The high percentage illustrates that the interviewees who mentioned this element actually assigned rhetorical significance to it although it is not a very popular diagrammatic element used for diagrams. The following comments were made by the interviewees, P15 and P28, who identified the element as a visual element they found convincing in DS30.

P15: Although I think China should be a lot bigger than the U.S. So, I don't know maybe they just didn't have space to put it in here. I didn't notice that before. But they tried to ... I'll just assume that this is mostly correct. So, it gives you good relative size, especially with the human, with the figures of the people (the pictograms at the top of DS30). The layout again ...it gives me a good understanding of ... you know ... relative to each other, how much they are consuming per capita and emitting per capita. So I thought it was good for comparison sake.

P28: I also found ... I thought the human scales (the pictograms at the top of DS30) were interesting ... because I mean there's an easy way to be like "Oh, okay, so this is actually how ... how much, you know, per person consume. So, you can definitely tell ... like the U.S. (pointing the pictogram of the United States) versus, you know, India (pointing the pictogram of India) ...or South Korea versus Japan. It was ... and I thought that was really interesting, too.

Jae Young: Uh-hmm...

P28: It was just like, "Wow, U.S. really consumes a lot more than...almost every country." So, I thought that was very convincing.

The second most frequently identified elements as convincing in the first qualitative interview are "a spike in line trend" and "decrease in area size on a map." Both elements were mentioned by 50% of the interviewees. 5 out of 10 interviewees identified a spike in line trend as convincing, while 10 out of 20 identified decrease in area size on a map as convincing. It is interesting to note that more interviewees identified a spike in the line trend as convincing when the spike was visually salient. For example, 4 interviewees mentioned the spike from DS40, a simple line graph employing a single line in which the spike is visually dominant, while only 1 interviewee identified the same element from DS14 in which the line graph with the spiking trend is only a small part of the entire diagram and is less noticeable because it is combined with other types of diagram. In the following comments, P10 and P26 identified the spike in line trend in DS40 as convincing.

Jae Young: Okay. Why did you choose this one (DS40)?

P10: The clear data (pointing at the spiking part of the line on the right end in DS40) is showing upward trend and also if we can take the ... we would remove this average line (the blue line before the spike) from beginning, it appears that the average below is about like negative 1.5 and again looking from the period of the modern era it's spiking...

Jae Young: Okay, and here (pointing DS40) if I ask you to point out visual elements, you would...

P26: I mean ... well the increase at the end ... (pointing the spike on the right end in DS40)

Jae Young: ...at the end here (pointing the spike on the right end in DS40)?

Interviewee: Yeah, that's really the point of the graph, right?

Interviewer: Um hmm.

Interviewee: It's really constant, constant, constant, constant (pointing the flat part of the line graph between 1000A.D. and 1900), and then up (pointing the spike after 1900).

“Decrease in area size on a map” was identified as convincing by interviewees from all of the four diagrams, DS11, 14, 31, and 46, which employ the element in common. The decrease in ice size visualized in highly realistic ice images in DS11 and DS31 was identified as convincing twice and 3 times respectively, while the same element was identified as

convincing once and 4 times respectively from DS14 and DS46, both taking more abstract style on the basis of map. I originally assumed that decrease in area size would be identified as convincing more frequently from highly realistic images than from abstract images, such as maps, but it was not confirmed from the result of the first qualitative interview.⁵⁰

The next diagrammatic elements identified as convincing by 40% of the interviewees are “a downward trend of bars,” “manipulation of y-axis scale,” “narrow range of uncertainty,” and “sharper angle of upward line created by making starting & ending point of x-axis closer.” The first one that I discuss is “a downward trend of bars.” I identified this element as an element to which interviewees are likely to assign rhetorical significance through the rhetorical analysis, but it did not serve as a criterion for the selection of the original examples for interviews, since it was identified only once from DS46, the one and only diagram that employs this element. The element was identified as convincing by 2 out of 5 interviewees.

P23: Um ... I guess what I found convincing (in DS46) was the actual ... um ... like numbers over the years and the fact that you can see, like, the decrease after sort of, like, somewhat stability for a while and then decrease ... (pointing the downward trend of the bar graph in DS46)

“Manipulation of y-axis scale” is also a diagrammatic element identified through the rhetorical analysis as an element to which interviewees are likely to assign rhetorical

⁵⁰ The four diagrams, DS11, 14, 31, and 46, all visualize the same information, the Arctic ice is melting. Thus, this kind of comparison can be made, since they deal with the same information in different forms.

significance, but it did not serve as a criterion for the selection of the original diagrams, since it was identified only once from DS30, the one and only diagram that employs this element. The element was mentioned by 2 out of 5 interviewees, scoring 40%.

“Narrow range of uncertainty” and “sharper angle of an upward line created by making starting and ending point of x-axis closer” are similar in the sense that they are diagrammatic elements that were not identified as an element to which interviewees are likely to assign rhetorical significance through the rhetorical analysis. On the other hand, they were both identified as convincing by interviewees in the first qualitative interview. Interviewees who mentioned these elements opened up, and expanded the results from the rhetorical analysis in the sense that they add new interpretive possibilities, encouraging me to analyze the diagrams from a fresh perspective. “Narrow range of uncertainty” was identified as convincing by 2 out of 5 interviewees from DS40.

P6: (looking at DS40) ... and you can see the range of uncertainty absolutely like getting smaller as you increase in years. So, in terms of just the diagram, I think it would appear very convincing that fossil fuels do have a large effect.

(omitted)

P6: Yeah, the margin starts getting much narrower, and I mean historically you can tell that around 18th, 19th century industrial revolution starts so you can just assume that usage of fossil fuels price starts to increase, and as you've reached the present, you can't tell the difference between the range of uncertainty and the data. I think that's from the diagram alone. I think that is the most convincing.

“Sharper angle of an upward line created by making starting and ending point of x-axis closer” is also an element that was not identified as an element to which interviewees are likely to assign rhetorical significance through the rhetorical analysis, but identified as convincing by interviewees in the first qualitative interview. While I focused on the trend of line when analyzing line graphs, interviewees identified this new element, noticing that the line trend can be made sharper by controlling the length of x-axis. This element was identified as convincing by 2 out of 5 interviewees from DS53. It is interesting to note that P22, in the following comment, discovered a sense of urgency from the element she identified as convincing.

P22: (looking at DS53) It’s surprising that the years aren’t too far away. It ends at 2100, and that’s still pretty close.

Jae Young: So, you mean from here to here (from the starting point of the x-axis to the ending point) or from here to here (from 2010 to 2020)?

P22: From here to here (from the starting point of the x-axis to the ending point).

Jae Young: Okay. It’s not that far?

P22: Yeah. It’s not too far ahead in our future, so we know that we have to do something about it now because it’s already too late.

It is surprising that “upward trend of line” only scored 34% in terms of how many interviewees out of the total identified this element as convincing. 34% is still considered high compared to that of other elements that scored lower, but it is lower than I expected

before the interview. My original hypothesis was that this element would be identified frequently, since it is the third most identified element through the rhetorical analysis, and the upward trend of line itself is a representative visual image frequently employed for depicting rise in either temperature or CO₂ emissions, two of the most popular themes in the context of global warming. However, the score is not as high as I expected.

The reason for this result might be either because the interviewees actually did not assign rhetorical significance to the element as much as I expected, or because there are many line graphs in the diagram samples that employ the element, but most of them are not very noticeable, since they are combined with other diagrams as shown in DS11 and 14. The second reason seems more plausible, since interviewees identified this element as convincing multiple times only from DS26 and 27, simple line graphs with a single line showing an upward trend, while not much in others in which a line graph is combined with other types of diagram. During the first qualitative interview, P5, P10, and P23 all identified this element as convincing from both DS26 and DS27.

Jae Young: Could you tell me why it (DS27) is convincing in terms of visual elements?

P10: Because it's ... because we are starting from a point in the past, like we are starting here from 1958 and we are starting here from 1850 and then there are very clear, clear rises. This (pointing the trend of DS26) is a very clear change. And this (pointing the trend of DS27) is a very clear change. Whereas if we were to look at *The New York Times* article here (DS46), this (DS46) is ... this (DS46) is less clear

because even though the values are changing a lot, just looking at it, it doesn't look like a dramatic shift. These (DS26 and DS27) look much more dramatic.

Jae Young: Okay. This one (the article with DS26, 27, and 28) has three diagrams on it. What did you find convincing about the diagrams in this article?

P23: Oh, this one (DS26), for example? Especially, the way it's laid out shows the dramatic rise in the CO₂ concentration and just looking at that from ... like ... not that long ago 50 years ago until now, it looks like a huge rise. So, that one was very convincing.

This one (DS27) ... I don't remember what this one is. Oh, the temperature rise, of course. This one again was kind of the same issue because it has such a dramatic change, and you can clearly see where it starts to rise ... like ... it starts off and then ... um ... So, I definitely thought that one was pretty convincing.

“Contrast between different line trends” was identified as convincing by 5 interviewees out of 15, scoring 33.3%. While this element was identified as an element to which interviewees are likely to assign rhetorical significance from the three diagrams, DS14, 28, 30 through the rhetorical analysis, most interviewees, 4 out of 5, identified the element as convincing from DS28 in which the contrast between the two lines is more distinct than in others because of the diverging pattern of the previously overlapped lines, and the color contrast between red and green makes the divergence more striking. The following comments were made by P20 and P23 who identified the element as convincing. P23

discussed how colors in addition to the contrast between different line trends enhance convincing power of DS28.

Jae Young: Okay, what visual elements in this one (DS28) did you find convincing?

P20: This one makes it easy to compare, at least according to the models, the difference between ... because we have two separate ones (the red line and the green line), right? We have “predicted sum of natural and anthropogenic changes” in the orange line (the red line) here, and then, we can see just “the predicted natural changes,” and we can see here that the sum of these is higher than just the natural changes alone, according to the prediction. So ... and we can see too, looking towards the more current time at the end of the graph, that they’re deviating or changing. There is a larger difference, which do of course correlate with human activity and so, yeah, in that respect, it’s more convincing because I can compare two different things, the natural facts alone and the facts of humans, the predicted effects of humans and natural effects. So, it gives me something to compare.

Jae Young: Okay. And what did you find convincing about this diagram here (DS28)?

P23: Um ... (laughing) ... this one was a little confusing actually because there are so many different colors in it. But I guess the most convincing thing about it was ... um ... how the colors ... especially like the green the predicted ... um ... kind of like two colors follow the same pattern and then the green kind of follows for a while and then

goes down. And I guess that versus like the observation line and where they split and how they split was convincing, but other than that the graph was actually kind of difficult to read.

Jae Young: So this part (the right end of the line graph where the two lines are diverging from each other)?

P23: Right. Showing like the, yeah, the difference between the two (the two lines showing different trends).

“Color coding” can be applied in various ways in various types of diagram, for example, to differentiate areas in the map; multiple lines in a line graph; proportions in a bar graph; sectors in a pie chart; and multiple flows in a flow chart. “Color coding” was identified as convincing 14 times out of 45, scoring 31.1%. According to the rhetorical analysis, the most common case in which color coding was used in maps was to show different degrees of something. The interview analysis confirms the result from the rhetorical analysis by showing that interviewees actually identified color coding as convincing most frequently in map-based diagrams as well. As shown in the following comments, the interviewees identified color coding as convincing from DS21 most frequently, 4 times, and from DS52 second most frequently, 3 times. The following comments were made by P24 and P25 respectively who identified color coding as convincing from DS21.

Jae Young: So, in terms of visual aspects of this diagram (DS21), does this one have any visual elements that make this one convincing?

P24: Yeah, I think the ... the colors. The color schemes. You know ... the dark or the actual completely different color. There is a few different shades of green, and then there is countries that are just below scale that are not even taken into account any type of recycling or eco-friendly steps. I think that was the fact. You had a light color that stood out, a light green that stood out. These places are working towards doing better and improving the pollution levels whereas the darker colors or the colors that are completely different need to work on that. And I think that was affective.

Jae Young: ... can you tell me what visual elements of this diagram (P21) did you find convincing if there was any convincing element?

P25: Um ... I mean ... I guess the ... the color usage, you know, going from like a lighter, cleaner green to ... to dark black ... I mean that ... that looks ... that looks right.

“Downward trend of line” was identified as convincing by 4 out of 15 interviewees, scoring 26.7%. This score is slightly lower than that of upward trend of line (34%). Among the three diagrams that I analyzed as having this diagrammatic element, the one from which interviewees identified the element as convincing most frequently is DS31. The following comment was made by P25 who picked this element as a diagrammatic element that he found convincing.

Jae Young: What did you find convincing about diagram in this article (the article that includes DS31)?

P25: I know that there is ... I believe in this trend of the overall trend of the ice mass, you know, decreasing (pointing the line graph in the middle of the two ice images).

Next, there are eight diagrammatic elements that scored 20% each, “fluctuation in line trend,” “correlation between lines by similar line trends or line overlap,” “no correlation between two lines,” “showing the most dramatic increase of line trend separately,” “grey color,” “relative sector size in a pie chart,” “use of realistic image,” and “two way arrows.” “Fluctuation in line trend” and “showing the most dramatic increase of line trend separately” are the new ones that were not identified by the rhetorical analysis. While I analyzed the line of DS1 as having a downward trend, interviewees, like P26 analyzed the same line in a different way, interpreting it as fluctuation in line trend. Fluctuation in line trend was mentioned once by P26, scoring 20%.

The other element that was not identified by the rhetorical analysis as an element to which interviewees are likely to assign rhetorical significance, but identified as convincing in the first interview is “showing the most dramatic increase of line trend selectively.” In addition to “sharper angle of upward line created by making starting and ending point of x-axis closer” mentioned earlier, “showing the most dramatic increase of line trend selectively” is another visual strategy for making an upward line look more dramatic through making the slope look steeper. This element was identified as convincing by 4 out of 20 interviewees, scoring 20%, and identified as convincing evenly across the four diagrams that employ this

element, DS14, 26, 27, and 53, once per each. In the following comment, P10 identified the element as convincing from DS26 and 27.

P10: I mean this (the bar graph in DS46) starts at point zero on the vertical axis, and so, it's difficult to draw any kind of conclusion here, whereas this graph here (DS26), it starts at point 310 and this is ... this (pointing the upward trend of the line in DS26) is what we are seeing. It's a very clear rise in CO₂. If they start from point zero, I am pretty sure it would look like this graph (DS46), and it wouldn't be as convincing because this is showing the important parts of it.

Um ... this one (DS27) again, it's ... it's taking ... it's trending it from the most ... from the most relevant points. So, from the start of the industrial revolution in 1850 all the way up to present day.

Unlike my expectation that interviewees are likely to assign rhetorical significance to colors, especially red, frequently, both red and green color scored only 10%, while grey color scored 20%, being identified as convincing by 2 out of 10 interviewees, from DS21 and 39, once per each. P4 mentioned the negative meaning associated with grey color, dirtiness, comparing it with green color associated with environmental friendliness. P9 also indicated that grey color is associated with negative meanings.

P4: Because then it (DS21) sort of provides like a contrast so like you look here in like North Korea and in Mongolia and so other countries are just like there is no

information. And then you have countries like China and so it's gray, so it looks like it's really dirty. And then you have the green colors which are supposed to be like really environmentally friendly. And I guess that's what was convincing.

P9: Another (visual element that I find convincing) would be the color because, green here, it represents positive aspect whereas black or grey would be negative...

“Relative sector size in a pie chart” was identified by 3 out of 15 interviewees, scoring 20% as well. Among the three diagrams that employ the element, DS29, 30, and 39, interviewees identified the element once from DS29 and twice from DS30.

Jae Young: And can you kind of focus on individual kind of units in terms of the question of what visual elements of the diagram you found convincing?

P15: Oh, sure, sure, sure. First of all, if we go to maybe like the bottom diagrams (pie chart at the bottom), that's to do with countries. I thought what was convincing or easy to or...

Jae Young: You mean this part (the pie charts at the bottom of DS30)?

P15: Yes, yes. Yes, the bottom part with the circles. It clearly shows what percentage of energy consumption and emissions each country does emit both by the number and by the actual area, so that ... and the number you could look at, but I think also the way they shaded the area also gives you a ... give me a visual clue of exactly what part of the big pie they are doing.

Jae Young: So, that's the main reason that you are choosing this one (DS30)?

P19: Yeah. These "o" graphs (pie charts at the bottom) seem somewhat effective, too, because you can see the ratio of emissions to energy consumption, so like you can see that China is being inefficient in using energy. Their energy consumption is producing more greenhouse gas compared to any of the others. So, it shows that ... you know ... cheap energy sources have a consequence.

Diagrams often attempt to enhance their persuasive power through employing realistic images, since realistic images are effective in increasing the reliability of what is described in a diagram. DS11 and 31 both employ realistic images of ice, comparing before and after size, in order to visualize that the sea ice has been decreasing because of global warming. DS11 and 31 combines the two diagrammatic elements "decrease in area size on a map," as discussed earlier, and "use of a realistic image," but they were identified separately as two different diagrammatic elements through the rhetorical analysis, since they are two independent elements, each performing persuasive function in different ways. The element, "use of a realistic image," was identified by 2 out of 10 interviewees, once from DS11, and once from DS31, respectively, scoring 20%. It is interesting to note that P24, in the following comment, indicated that the realistic quality of the ice images in DS31 is "effective in conveying the severity" of global warming.

Jae Young: What did you find convincing about the diagrams (the four diagrams in DS31) in this article?

P24: I felt as though the fact that it was like a solar image, like an actual image of earth, at least very realistic, showing the area as well as the mountains, the oceans, just everything was very realistic. And I felt that was effective in conveying the severity of the situation of global warming.

So far, I discussed the elements identified as convincing by more than 20% of the interviewees. Other elements that scored below 20% are “line graph as a type” (4%), “bar graph as a type” (6.6%), “relative height of bars in a bar graph” (10%), “red color” (10%), “green color” (10%), “green versus grey color” (10%), “use of map” (6%), “filling up most areas on a map with red or similar colors” (13.3), and “horizontal arrangement of things being compared.”

7.2.2. Findings from the Second Qualitative Interviews

“Upward trend of bars,” one of the two elements most frequently identified as convincing in the first interview, was not identified as appropriate for a science textbook, but was identified by 2 out of 15 interviewees as appropriate for persuading legislators in the second interview, scoring 13.3%. Compared to the high percentage scored in the first interview (80%), 0% and 13.3%, the scores in the second interview, are very low. However, in spite of the low scores, the results indicate that interviewees actually assigned rhetorical significance to this element under the context of persuading legislators.

The other element identified as convincing most frequently in the first interview, “pictogram size,” was identified as appropriate for a science textbook by 1 out of 10

interviewees, scoring 10%, and as appropriate for persuading legislators by 2 out of 15 interviewees, scoring 13.3%. The scores are a little bit higher than those scored by upward trend of bars, but, compared to 80% mentioned in the first interview, they are still low. However, in spite of the low scores, the results indicate that interviewees actually assigned rhetorical significance to this element regardless of the contexts provided and the rhetorical goals they were supposed to accomplish.

One of the two elements second most frequently identified as convincing in the first interview is “spike in line trend.” This element was identified as appropriate for a science textbook by 1 out of 23 interviewees, scoring 4.3%, and as appropriate for persuading legislators by 6 out of 27 interviewees, scoring 22.2%. Compared to 50% scored in the first interview, 4.3% is very low, but the 22.2% score by interviewees who chose this element as appropriate for persuading legislators, means something. It is also interesting to note that interviewees thought of this element as more appropriate for persuading legislators than for a science textbook.

The other element second most frequently identified as convincing in the first interview (50%) is “decrease in area size on a map.” This element was identified as appropriate for a science textbook by 7 out of 54 interviewees, scoring 13%, and as appropriate for persuading legislators by 13 out of 46 interviewees, scoring 28.3%. Although not many interviewees identified this element for a science textbook, this element, compared to other diagrammatic elements, was pretty evenly identified in the first and second interview, and also, for the two different contexts provided in the second interview. It is also interesting to note that, similar to the previous case of a spike in line trend, interviewees thought of this

element as more appropriate for persuading legislators than for a science textbook. I assume that interviewees thought that the obvious decrease in physical size would be effective in persuading legislators, not only because it appeals to them instantly, but also it is appropriate for depicting one of the most popular themes of global warming, melting ice.

The elements identified as convincing by 40% of the interviewees in the first interview, “downward trend of bars,” “manipulation of y-axis scale,” “narrow range of uncertainty,” “and “sharper angle of upward line created by making starting and ending point of x-axis closer,” were not identified in the second interview except that “downward trend of bars” was identified as appropriate for persuading legislators by 1 out of 12 interviewees, scoring 8.3%, and “narrow range of uncertainty” was identified as appropriate for persuading legislators by 1 out of 15 interviewees, scoring 6.7%. Thus, some interviewees, maybe fewer interviewees in the case of “manipulation of y-axis scale” and “sharper angle of upward line created by making starting and ending point of x-axis closer,” actually assigned rhetorical significance to the four elements, but not as much as the ones that scored higher.

“Upward trend of line” that scored lower than expected (34%) in the first interview was identified as appropriate for a science textbook 5 out of 131 times, scoring 3.8%, and as appropriate for persuading legislators 21 out of 119 times, scoring 17.6%. Although the scores are lower than expected again in the second interview, 17.6% seems enough to mean something, while 3.8% does not. I assume that interviewees thought that upward trend of line would be more appropriate for persuading legislators than for a science textbook, since it is a diagrammatic element more effective than others for the purpose of persuading someone into believing that things like temperature or sea level increases.

“Contrast between different line trends” that scored 33.3% in the first interview, was identified as appropriate for a science textbook 2 out of 36 times, and as appropriate for persuading legislators 3 out of 39 times, only scoring 5.5% and 7.7% respectively. Compared to 33.3% scored in the first interview, 5.5% and 7.7% are significantly low.

“Color coding” that scored 31.1% in the first interview, was identified as appropriate for a science textbook 11 out of 103 times, scoring 10.7%, and as appropriate for persuading legislators 9 out of 122 times, scoring 7.4%. Color coding was an unusual element that was relatively evenly identified throughout the first and second interview and for the two different contexts in the second interview. The scores imply that the interviewees who identified color coding actually assigned rhetorical significance to it regardless of rhetorical context or the goal for which the element was to be used. In addition, it was one of those rare cases in the sense that interviewees thought of this element as more appropriate for a science textbook than for persuading legislators.

“Downward trend of line” that scored 26.7% in the first interview, was identified as appropriate for a science textbook 3 out of 37 times, scoring 8.1%, and as appropriate for persuading legislators 7 out of 38 times, scoring 18.4%. While this element scored lower (26.7%) than that of upward trend of line (34%) in the first interview, it scored higher than upward trend of line both in the context of a science textbook (8.1% vs. 3.8%) and in the context of persuading legislators (18.4% vs. 17.6%) in the second interview. Another thing to note about this element is that its score for the context of persuading legislators (18.4%) was higher than that for the context of a science textbook (8.1%). I assume that interviewees thought that downward trend of line was more appropriate for persuading legislators than for

a science textbook, since it was one of those diagrammatic elements more effective for persuading someone into believing that that ice size or temperature is decreasing.

It is a noticeable result that “fluctuation in line trend” that scored 20% in the first interview, was identified as appropriate for persuading legislators by 6 out of 14 interviewees, scoring 42.8%, while was not identified as appropriate for a science textbook at all. The high score (42.8%) resulted from interviewees choosing DS1, the one and only diagram with the element, as appropriate for a counterargument (the globe is not warming), and fluctuation in line trend in DS1 was one a few diagrammatic elements that could be used to support the counterargument.⁵¹ The fluctuation in line trend for temperature in DS1 was seen as appropriate for persuading legislators into believing that the globe is not warming, since the globe is not warming if a line for visualizing global temperature simply fluctuates, not showing any specific trend. However, in this case, the result does not enable me to argue that interviewees assigned rhetorical significance to “fluctuation in line trend” on the basis of its formal qualities (for the purpose of persuading legislators), since interviewees chose DS1 and identified “fluctuation in line trend” in it, not because they thought that the formal qualities of the diagrammatic element would be appropriate for persuading legislators, but because the data in DS1 is appropriate for supporting the counterargument (the globe is warming).

“Correlation between lines by similar line trends or line overlap” that scored 20% as well in the first interview, was identified from DS3 as appropriate for a science textbook by 1 out of 11 interviewees, scoring 9.1%, and from DS3 as appropriate for persuading legislators

⁵¹ Among the 24 diagrams sampled for the first and second interview, only 3 diagrams, DS1, 2, and 3, support the counterargument (the globe is not warming). Thus, interviewees were given very limited number of diagrammatic elements, only the ones in DS1, DS2, and DS3, that are appropriate for persuading legislators into believing the counterargument.

by 3 out of 14 interviewees, scoring 21.4%. It is a main diagrammatic element of DS3 that describes correlation between temperature and solar activities, ultimately supporting the counterargument (the globe is not warming), since temperature simply fluctuates, correlating with solar activities. This element was also identified more frequently for the context of persuading legislators than for the context of a science textbook. However, in this case again, the result does not enable me to argue that interviewees assigned rhetorical significance to “correlation between lines by similar line trends or line overlap” on the basis of its formal qualities (for the purpose of persuading legislators), since interviewees chose DS3 and identified “correlation between lines by similar line trends or line overlap” in it, not because they thought that the formal qualities of the diagrammatic element would be appropriate for persuading legislators, but because the data in DS3 is appropriate for supporting the counterargument (the globe is warming). The following comment by P19 shows this.

Jae Young: Okay. These are for cons and why did you choose this one (DS3)?

P19: Well, they’re presenting an argument that global warming is not related to humans. It’s related to the sun. And when people hear that, they think that oh, okay, this can just be normal and everybody is overreacting and we should be patient and wait to see what may happen. It’s up and down, so it makes it seem just random what’s happening and I think many people when they hear about global warming, they’re convinced at first, but when you present a different possibility that, oh maybe this heat is just coming from the sun, then it makes me think twice that this is actually a one-sided argument. That’s why.

Jae Young: You're choosing this one for con because of the message?

P19: Yeah, it brings doubt into the situation that this is caused by humans.

“No correlation between two lines” that scored 20% in the first interview, was identified as appropriate for persuading legislators by 1 out of 14 interviewees, scoring 7.1%, while not being identified as appropriate for a science textbook at all. It is a main diagrammatic element of DS2 that depicts lack of relationship between temperature and CO₂, ultimately supporting another major counterargument, global warming is not caused by CO₂. However, in this case again, the result does not enable me to argue that interviewees assigned rhetorical significance to “No correlation between two lines” on the basis of its formal qualities (for the purpose of persuading legislators), since interviewees chose DS2 and identified “no correlation between two lines” in it, not because they thought that the formal qualities of the diagrammatic element would be appropriate for persuading legislators, but because the data in DS2 is appropriate for supporting the counterargument (global warming is not caused by CO₂). The following comment by P30 shows this.

Jae Young: Okay, and, out of these con ones (the diagrams P30 chose as appropriate for persuading legislators into believing the counterargument that the globe is warming), which one would be most appropriate for a printed report from social activists?

P30: This one. (DS2)

Jae Young: Why?

P30: Because it (DS2) shows why we don't need to decrease CO₂ emissions in the U.S. or anywhere else, I guess.

Jae Young: Okay.

P30: Yeah, these (DS1 and DS21) just say that it's not that bad, but this one (DS2) says, well, yeah ... it's sure global warming is happening. It's not because of CO₂, so I guess it gives you more of a ... a basis against these arguments.

Jae Young: Okay, okay, so it's because this one gives you more informative message, I believe.

P30: Yeah, yeah.

Jae Young: So, it's mainly about content, not visuals.

P30: Yeah.

“Showing the most dramatic increase of line trend selectively,” not identified by the rhetorical analysis, but identified and scored 20% in the first interview, was not identified in the second interview, and grey color, also scored 20% in the first interview, was not identified in the second interview. Thus, interviewees actually assigned rhetorical significance to the two elements less frequently than to other ones that scored higher.

“Relative sector size in a pie chart,” scored 20% in the first interview, was identified as appropriate for a science textbook 1 out of 35 times, scoring 2.8%, and as appropriate for persuading legislators 4 out of 40 times, scoring 10%. This is another element to which interviewees actually assigned rhetorical significance, more for the context of persuading legislators than for the context of a science textbook.

“Use of a realistic image,” scored 20% in the first interview, was identified as appropriate for a science textbook 6 out of 28 times, scoring 21.4%, and as appropriate for persuading legislators 7 out of 22 times, scoring 31.8%. The scores from the second interview are higher than that from the first interview, and the score for the context of persuading legislators is higher than that for the context of a science textbook. On the basis of the result from the second interview, I assume that interviewees actually assigned rhetorical significance to this element frequently, regardless of the rhetorical goals they had to accomplish, since 21.4% is the highest score among the scores under the context of a science textbook, and 31.8% is the third highest score among the scores under the context of persuading legislators. If we combine the two scores (21.4% and 31.8%), it is the highest score from the second interview. Thus, use of a realistic image is a diagrammatic element to which interviewees actually assigned rhetorical significance frequently.

I originally assumed that use of a realistic image would be most frequently identified as appropriate for the context of persuading legislators rather than for the context of a science textbook, since people have preconception that abstract data-driven diagrams are appropriate for a science textbook. However, although the score (21.4%) is a bit lower than the score for persuading legislators (31.8%), approximately 1 out of 5 interviewees identified this element as appropriate for a science textbook. This result does not go with my prior assumption that people would think of use of a realistic image as exclusively appropriate for persuading legislators.

For example, P3 is the one who selected DS11 with the realistic ice images as appropriate for a science textbook. In the following comment, she discussed that she chose

DS11, since she could “rely on” it because of the realistic nature of the ice images. In other words, the key quality that she associates with the realistic nature of the images is reliability, and she finds this quality important for the context of a science textbook.

P3: It (DS11) looks more realistic than any other diagrams because I don’t know if it’s real from the satellite picture. I don’t know if it’s real, but it looks more realistic than others ... And I felt more, I don’t know, like I felt more like I could rely on this because again it looks more realistic.

P11 selected DS31 that employs the realistic ice images as appropriate for a science textbook. She discussed the superior quality of image-driven diagrams to that of data-driven graphs, comparing DS31 and typical graphs. Through the comparison, she pointed out that the realistic ice images in DS31 can “illustrate the point more clearly” by enabling interviewees to actually see what is happening, and thus, draw more attention than graphs do.

Jae Young: Why did you choose this one (DS31) for a college science textbook?

P11: Because looking at graphs is one thing, but if you can actually like visually see how the earth is changing, I think it helps to illustrate the point more clearly. And like an actual picture of the earth will, I think, draw more attention, and keep the attention of college students more than just a graph or a chart, at least for me anyway.

P22 also chose DS31 that employs the realistic ice images as appropriate for a science textbook. As P11 did, P22 also contrasted typical type of data-driven diagrams, such as graphs and computer generated images, with the realistic ice images in DS31, pointing out that the realistic images in DS31 bring it “back down to like an actual real-life problem.” She discussed that realistic images like those in DS31 are more appropriate for a science textbook than diagrams or computer images are, since they feel like an impending real life problem, and thus, stimulate us to want to do something about it right away, while typical type of data-driven diagrams and computer images seem distant from us. This comparison reminds me of Norman’s (2004) visceral versus reflective aspect of design discussed earlier with the comparison between Figure 40 and 41. The higher degree of realness in realistic images, such as DS11 and 31, causes an immediate visceral reaction from viewers, giving a sense of presence and that someone who photographed the image was also present in the space, while abstract forms of data-driven diagrams, such as graphs, encourage us to rationally analyze diagrams.

During interview, I asked P22 what of DS31 made her to choose it as appropriate for a science textbook, and the reason that she mentioned was not because the realistic quality of the images is appropriate for a science textbook, but because DS31 is different from typical type of data-driven diagrams that we usually see in a science textbook, and therefore, stands out. To put it the other way, she agreed with the basic assumption that science textbooks usually carry data-driven diagrams, but she picked DS31 as appropriate for a science textbook because it would draw more of interviewees’ attention through the differentiated form.

Jae Young: And why did you choose this one (DS31)?

P22: This gives more of an actual visual instead of a graph or a manmade like computer imagery. Maybe this is computer image, but it looks more realistic, and you can tell what ... like how big the difference is in the dates.

Jae Young: Why do you think that this kind of comparison through realistic images is appropriate for a college science textbook?

P22: Because I think a lot of diagrams are computer images, and so a lot of times you have to imagine, and just kind of believe what they're telling you is right, and that they are making these diagrams correctly, while with this (DS31) ... it's like it brings it down to like real-life pictures. Like the computer images are nice to understand the concept and then this (DS31) is back to what we're talking about. This problem right here is what everything else is trying to explain.

Jae Young: By computer images, you mean this type of images (DS10)?

P22: Yeah.

Jae Young: Not necessarily these line graphs. Do you mean illustrations or...?

P22: Both.

Jae Young: Both?

P22: Yeah, diagrams that are just to display, like, a concept and try to explain, compare...

Jae Young: This one too, right? (DS10)

P22: Yes.

Jae Young: This one (DS10) and this one (DS12)?

P22: Yeah, this one (DS38) ... all of them.

Jae Young: But, unlike all of these (all the diagrams except DS31), this one (DS31) kind of captures a real moment in a life?

P22: Yeah, and it brings it back down to like an actual real-life problem, sort of like something you study about in your textbook like this shows. You can study about it in textbook, and then you have to do something about it because this is our earth that we live on. That's someone's house right there, and the ice is melting and we have to help.

Jae Young: Then, why do you think that this type of diagram is more appropriate than these computer images?

P22: I think it's just because when I saw all of them compared to each other, when I had to choose, the majority of the pictures are graphs and diagrams and computer images, and there was this one (DS31), real big pictures, and so it was just on the basis of thinking that if this book has all of these (all the diagrams except DS31) and then there's this (DS31), I'll pay attention to this (DS31) because it's different and stood out.

Jae Young: Okay. So... you assumed that that science textbook has all kinds of diagrams like these (all the diagrams except DS31). But you wanted something different.

P22: Yeah. But if the science textbook only had pictures like these (DS31), then I would've probably chosen a graph.

Jae Young: Okay. So, that means you kind of have this assumption that science textbooks have these types of diagrams (graph type) generally, not this type of one (real picture diagram like DS31).

P22: Yeah.

Jae Young: So, that's why you want to choose this one (DS31)... to kind of differentiate.

P22: Yeah.

In the following comment, P28 pointed out another quality associated with realistic images, accuracy. P28 thought of DS31 as appropriate for a science textbook, since the realistic images bring a sense of accuracy with them, and accuracy is an important feature needed for the context of a science textbook.

Jae Young: So, why did you choose this one (DS31) as appropriate for college's science textbook?

P28: Well, um, I like pictures (laughing), but, um ... it also ... this ... I guess this is like a polar ice cap...

Jae Young: Uh-hmm...

P28: ... so you can ... I'm assuming this is probably like a satellite picture or something or probably more or less something accurate...

On the other hand, other interviewees identified the same element for the context of persuading legislators. The reasons mentioned by those interviewees who identified “use of a realistic image” for the context of persuading legislators are similar. P2 mentioned that the realistic images of ice reduction could help us “prove officially” what has occurred. In other words, the images can function as reliable visual evidence that supports what has occurred to the ice, since they are accurate representation of reality that we can trust (or since they pretend to be accurate representation of reality that we can trust).

Jae Young: Okay. And why did you choose this diagram? (DS31)

P2: This diagram again, as it shows the drastic effects of nothing of just there has just been some drastic events that occurred in terms of the reduction of polar ice cap size. Visually, it’s very realistic. It’s a satellite image. So, that would help him in trying to prove officially what occurred throughout the past 30 years.

P20’s comment in the following is not significantly different from P2’s. He also pointed out the quality of accuracy associated with the style of the images, and that the images bring what has occurred before our eye, enabling us to see it right in front of us.

Jae Young: Okay, and can you tell me why you chose this one (DS31) for pro (pro argument, the globe is warming)?

P20: Well, yeah, we can see a very extreme effect. I mean this is not a very small effect whatsoever. It’s ... granted it’s fairly short span of time in history of the earth,

but ... 1979 to 2003, but given that they are based on satellite imaging we can be sure that they're accurate. Although maybe not certain of the cause, but we certainly know that something severe is going on, or maybe not severe, but there is a significant change and I can see it right in front of me.

P24 also indicated similar points about the realistic ice images in DS11 in the following comment. She also pointed out that the impact that the actual perception of the realistic images is stronger than that of data-driven diagrams based on percentage.

Jae Young: Okay, and why did you choose this one? (DS11)

P24: Like I said before, I kind of like the actual, like the solar images to see ... you know ... the type of ... you know ... all the time ... on the news and in TV they talk about, oh by such and such percent the ice caps are melting and yeah we can visualize it in our head, but to actually see it, I think it's a whole another ball game and I think it's a lot more effective to the severity of the situation for people, the general public to see, especially it being in an actual photo opposed to like some type of PhotoShop or something. So, I think that was my biggest one reason.

Except the unique case of P22 who identified use of a realistic image for a science textbook for the purpose of differentiation, other interviewees discussed similar points in terms of why using realistic images, either for a science textbook or for persuading legislators, is appropriate and advantageous. Although the score is a bit higher for the context

of persuading legislators than for a science textbook, “use of realistic image” is one of few diagrammatic elements to which interviewees evenly assigned rhetorical significance, regardless of the contexts provided and the rhetorical goals they were supposed to accomplish.

Through the rhetorical analysis, “two way arrows” was identified as an element to which interviewees are likely to assign rhetorical significance one time from DS14, the one and only diagram that employs this element. Then, it scored 20% in the first interview. In the second interview, it was identified as appropriate for persuading legislators by 1 out of 12 interviewees, scoring 8.3%, while not being identified for a science textbook.

“Relative height of bars” that scored 10% in the first interview, was identified as appropriate for a science textbook 5 out of 25 times, scoring 20%, and as appropriate for persuading legislators 2 out of 25 times, scoring 8%. 20% is the second highest score among the ones for the context of a science textbook, 1.4% lower than the highest score recorded by “use of realistic image” (21.4%). Compared to 20%, 8% scored for the context of persuading legislators is very low. Together with color coding, this element is one of those rare cases in the sense that interviewees thought of it as more appropriate for a science textbook than for persuading legislators. Interviewees assigned rhetorical significance to diagrammatic elements visualizing change in line trend, such as upward trend of line, a downward trend of line, and a spike in line trend, more frequently when they were supposed to choose a diagram for persuading legislators than when they were supposed to choose a diagram for a science textbook. On the other hand, they assigned rhetorical significance to relative height of bars,

which simply compares relative quantity of things, more frequently for the context of a science textbook than for persuading legislators.

Before the first and second interview, I originally assumed that interviewees would be likely to assign rhetorical significance to colors frequently, especially in the context of global warming, expecting that they would find colors, such as red as a symbol of the warming globe and color contrast between red and green or green and gray, convincing, since they appeal to us in an instant way.⁵² However, color-related diagrammatic elements did not score that high except color coding that scored 31.1% in the first interview and grey color that scored 20% in the first interview. Unlike my expectation, in the first interview, red, green, and green vs. grey only scored 10%, and blue and red vs. green scored 0%. One thing to note is that red color was identified as appropriate for a science textbook 5 times out of 283, scoring 1.8% , and as appropriate for persuading legislators 10 times out of 140, scoring 7.1%. Despite the low scores, this result goes with my assumption that red color would be likely to be identified as appropriate for persuading legislators more frequently than for a science textbook. I originally had an assumption that interviewees would be likely to choose red color as an appropriate diagrammatic element for them to use when they were supposed to persuade someone into believing that the globe is warming. This assumption was confirmed through the higher percentage (7.1%) scored for the context of persuading legislators. Although the percentage difference is smaller (1.5% for a science textbook and 3.3% for persuading legislators), green color was identified as appropriate for persuading legislators more frequently than for a science textbook as well, implying that interviewees

⁵² For example, red color has been identified most (36 times) from the sampled diagrams through the rhetorical analysis.

chose this element more frequently when they were asked to choose a diagram to persuade legislators than when they were asked to choose a diagram for a science textbook.

“Using a map” that scored 6% in the first interview, was identified as appropriate for a science textbook 4 out of 126 times, scoring 3.2%, and as appropriate for persuading legislators 6 out of 124 times, scoring 4.8%. The notable thing about the three scores is that they are all very low, which implies interviewees actually did not really assign rhetorical significance to this element. This might be either because they actually did not assign rhetorical significance to this element, or because they did not recognize maps as a diagrammatic element having a persuasive power, but consider them accurate representation of reality without room for artifice or manipulation.

“Filling up most areas on a map with red or similar colors” that scored 13.3% in the first interview, was not identified as appropriate for a science textbook, while being identified as appropriate for persuading legislators 4 out of 40 times, scoring 10%. Interviewees identified this element 3 out of the total 4 times from DS35 in which dark red color was used with little variation. It is interesting to note that this element was identified as appropriate for persuading legislators only, scoring 0% for the context of a science textbook. Like the case of red color discussed earlier, prior to interview, I assumed that this element would likely be identified as appropriate for persuading legislators more frequently than for a science textbook, since it is a diagrammatic element appropriate for arguing that the entire globe is warming. I assumed that the sense of crisis delivered by a world map filled with red color would be appropriate for persuading legislators into believing the severity or urgency of global warming. Thus, according to the result of the second interview, interviewees

actually assigned rhetorical significance to this element more frequently in the context of persuading legislators than in the context of a science textbook.

“Coloring a particular area on a map” was identified as an element to which interviewees are likely to assign rhetorical significance by the rhetorical analysis, but did not serve as a criterion for the selection of the original examples for interviews, since it was identified only once from the Florida map of DS11, the one and only diagram that employs the element. The element was not identified in the first interview and for the context of a science textbook in the second interview. On the other hand, it was identified 4 out of 10 times for the context of persuading legislators, scoring 40%, the second highest score right after 42.8% scored by fluctuation in line trend. The result shows that interviewees assigned rhetorical significance to this element more frequently in the context of persuading legislators than in the context of a science textbook.

Although they are not high, the percentages that “line graph as a type” and “bar graph as a type” were identified as appropriate for a science textbook are worth discussion. An interesting thing about the two elements is that they were not mentioned as appropriate for persuading legislators, while being identified as appropriate for a science textbook by 9.1% and 7.9% of the interviewees respectively. The result implies that interviewees identified the overall visual structure of a line graph and a bar graph, composed of x-y axis, scale, and lines or bars as appropriate for a science textbook only.

For example, P1 chose DS26, 27, 28, 30, 38, 40, 52, and 53 as appropriate for a science textbook, and all of them except DS52 are either a line graph or a bar graph. In the following comment, P1 discussed the common qualities found in DS26, 27, 28, 30, 38, 40, 52,

and 53 through the case of DS28 and 30. He first mentioned that the eight diagrams he chose are “standardized,” and thus, suited for textbooks rather than magazines. He did not clearly explain what he meant by “standardized,” but we can infer that he tried to identify the overall visual structure of a line graph or a bar graph from his comment that the reason that the eight diagrams are suited for textbooks rather than magazines is because they have graphs, charts, and lines. By focusing on the standardized overall visual structure of the line graphs and the bar graphs chosen for a science textbook, and contrasting it with the image-driven diagram, DS14, with a lot of pictures, he identified the two diagrammatic elements, “line graph as a type” and “bar graph as a type,” as appropriate for a science textbook.

P1: And these (DS26, 27, 28, 30, 38, 40, 52, and 53) seem a little bit more academic.

Jae Young: Okay. So could you tell me what about this diagram (DS30) makes it academic?

P1: It’s very standardized one, bar graphs, pie charts. So, it’s easier to follow and separated into regions.

(omitted)

Jae Young: Okay. So, you said that this one (DS30) has standard looking and what about this one (DS28)?

P1: Yeah, same as these (DS26, 27, 28, 30, 38, 40, 52, and 53). These are something that you would find in more of a textbook, right? Like it seems like these (DS26, 27, 28, 30, 38, 40, 52, and 53) would be more accurate, too, because you have the data, and it’s over a certain period of time or you have the proportions (pointing the bar

graphs in DS30) and you could sit down and try to make some implications or assumptions based on this, right? ... whereas this (DS14) is just sort of usual. It (DS14) seems like it's more for entertainment.

Jae Young: Okay. And the chosen ones are all standard looking?

P1: Well, I mean it seems like more suited for textbooks rather than like magazines.

Jae Young: So, I am trying to understand why you think that way. So you said things like...

P1: It (DS26, 27, 28, 30, 38, 40, 52, and 53) has graphs. It has charts. It has lines.

Jae Young: But this one (DS14) also has graphs, right?

P1: Yeah, but it (DS14) has a lot of pictures, too. And I think this (DS30) gives you a lot more information than say just this (the CO₂ line graph in DS14) and this (the global temperature line graph in DS14). I mean this sort of you can figure out.

P29 chose DS1, DS2, DS3, and DS40 as appropriate for a science textbook, and the four diagrams are all line graphs. I asked him what criteria he had in his mind when he was choosing, and he said that the reason he chose them is because they are line graphs. He then pointed out the components that make up the overall visual structure of a line graph, such as trend shown in a line, x-axis, and y-axis. He also contrasted the limited visual elements of the line graphs with DS14, the image-driven diagram, saying that he did not need additional decorative visual elements, such as the arrows in DS14, under the context of a science textbook.

P29: All right. First of all, I try to look for data as much as possible, which ones I can look at and quickly, actually, point ... like ... trends and information from. A lot of those are very pretty visual. Nice colors, and they kind of show some of the trend. But, I like graphs because you can see a trend over time. You have some sort of a y versus ... some of sort of x-axis you're comparing to because you see a trend measured against that x-axis. So, that's why I really like to look at ... definitely enjoy looking at graphs, and line graphs are the most straightforward. So, that's my reasoning for definitely wanting to look at those.

(omitted)

P29: (looking at DS14) I don't really need to see arrows of radiation coming down, bouncing off of an ice cap. Well, it's a cute little picture. It doesn't really do much to help me. These (DS1, DS2, and DS3) give more information in the same visual space.

To summarize, although the percentages are very low, interviewees actually assigned rhetorical significance to the diagrammatic element, “line graph as a type” and “bar graph as a type.” According to the result of the second interview, the two elements are highly context-sensitive ones, since interviewees identified them, only for the context of a science textbook, not for the context of persuading legislators.

In addition to the above-mentioned findings about which diagrammatic elements and configurations interviewees selected to accomplish each of the two different rhetorical goals, the result of the second interview also provides data regarding why they selected them. The data about the reasons for their choices offer additional ways to answer the main research

question, “what rhetorical significance do viewers (interviewees) assign to diagrams on the basis of the formal qualities of diagrammatic elements or configuration?” A problem with the data about the why question, which should be noted before I continue, is that not so many interviewees were able to give reasons geared toward the provided context, either the context of a science textbook or of persuading legislators. In a considerable number of cases, they simply explained why a certain diagram and a certain element in it are effective for communication or convincing in general, rather than gearing their answers toward the provided context. In other cases, they attributed their choice to the contents of a chosen diagram.⁵³ Thus, my reporting of the findings about the why question is not comprehensive in the sense that it is limited to the cases in which interviewees recognized the context they were given, their answers were geared toward the provided context, and their choice was made based on the formal qualities of a chosen diagrammatic element.

Under the context of a science textbook, it was when they chose a line graph as appropriate for a science textbook, and identified “line graph as a type” as an element that makes the line graph appropriate for the context that interviewees best verbalized reasons for their choice. In the following comment, P15 identified “line graph as a type,” and found visual qualities, such as simplicity and clarity, in the element.⁵⁴ His last comment, “It’s kind of more like what I’ve seen in textbooks though,” shows that not only the association

⁵³ Interviewees’ choice of diagrams was more influenced by the content of the sampled diagrams when interviewees were asked to choose diagrams appropriate for persuading legislators than when they were asked to choose diagrams appropriate for a science textbook. It is because they were asked to choose diagrams appropriate for the argument (the globe is warming or CO₂ emission is caused by humans) and the counterargument (the globe is not warming or CO₂ emission is not caused by humans) each, and thus, the content was an important factor to consider.

⁵⁴ P15 is an International Trade major.

between the formal qualities of “line graph as a type” and a science textbook, but also frequent adoption of the element in such a context have created visual convention that a science textbook should contain diagrams composed of that kind of element. Because of such a visual convention, we have a particular expectation about what a diagram in a science textbook should look like, and P15 chose DS2 under the influence of the visual convention.

Jae Young: Well, what is it about the visual qualities of this diagram that makes it appropriate for a science textbook? (DS2)

P15: The visual qualities? Like the other ones, just very simple, clear, you know, it tells me the information quite simply and I have to look at this a little bit more in detail by what it exactly is telling me, but from just a glance at it, I figure if I look at what the information was on the bottom, I'd be able to deduce just relatively quickly what information they're trying to get out very fast and have a clear understanding. Because of the lines and then the numbers on each side indicating concentration or deviations that are. It's kind of more like what I've seen in textbooks though.

P25's comment in the following also shows that his choice of DS2 was influenced by visual convention of a science textbook.⁵⁵ As P15 did, he also identified “simplicity” and “seriousness” as a visual quality associated with the line graph, DS2. It is interesting to note that he attributed the source of seriousness to absence of pictures. In other words, “the way that data is displayed” in a line graph verbalized by P25, refers to the overall visual structure

⁵⁵ P25 is a computer science major.

of a line graph composed of two axes and a line (or lines), which lacks pictures, that I labeled as “line graph as a type.”

Jae Young: Okay. Okay then um...which one would be the most appropriate for a college science textbook?

P25: I believe this one. (DS2) I feel like this is something I would see in a textbook.

Jae Young: So what is it about the visual qualities of this one that makes it most appropriate for a science textbook?

P25: It's just a simple ... a simple line graph...and I believe line graphs are, you know, the most easy to read.

(omitted)

P25: I think just the simplicity of this (DS2) and um...you know it's (DS2) a more serious picture. They (DS2) don't have a map in the background (pointing out the world map in DS38). It's just a ... it's a straightforward picture.

Jae Young: So, where does the seriousness of this diagram (DS2) come from?

P25: Ah, it's just a ... it's just a graph and just a plain diagram.

Jae Young: Including no picture?

P25: Yeah, I think this ... this picture in the background (the world map in DS38) makes it look less official just because they try to make it look nice.

Jae Young: Um hmm...

P25: And you know, and I believe, for a scientific textbook, it's not exactly necessary to do all that (including pictures such as world map).

(omitted)

P25: And um...I guess this is more...this is more...this (DS2) is the actual data...

This is actual data, whereas this (DS10) is ... I'm not sure about these numbers (10, 20, 85% in DS10). Yeah.

Jae Young: I think these are actual data, too, but there must be something .. something that...

P25: Something about it that makes me want to pick that one (DS2) out?

Jae Young: Yeah. Can you explain that?

P25: It's ... I guess...maybe I think...I just...I believe line graphs more.

Jae Young: Why?

P25: Because of the way that data is displayed. I guess just um...because I believe that it's just a more proper way to display data.

P29 also identified “line graph as a type,” mentioning basic diagrammatic elements of a line graph, line, x-axis, and y-axis.⁵⁶ He said that his choice was based on his personal preference of a line graph over other types of diagram, and I further asked if the choice was purely made by his personal preference or if there was any influence of his major on the choice. He admitted that his major might have influenced the choice. As P25 did, P29 also differentiated the simplified form of a line graph with the image-driven diagram, contrasting DS1 with DS14.

⁵⁶ P29 is a Mechanical Engineering major.

Jae Young: Okay. What is it about the visual qualities of this diagram that makes it more appropriate than the others for a science textbook? (DS1)

P29: I'm definitely a visually oriented person. So, I love graphs and I especially like this one (DS1) because it's very straightforward. It shows what year it was and what the temperature was that year. Very straightforward ... very simple to understand data, but it's also very accurate, I would say.

(omitted)

Jae Young: Um hmm. So, you just said that you love graphs?

P29: Yes.

Jae Young: By graphs, do you mean line graphs particularly?

P29: Line graphs are nice because they can show trends, and usually there are time lapse.

Jae Young: So, you like line graphs best.

P29: Yeah. Line graphs, probably my favorite.

(omitted)

P29: But, I like graphs because you can see a trend over time. You have some sort of y versus ... some of sort of x-axis you're comparing to because you see a trend measured against that X-axis. So, that's why I really like to look at...

Jae Young: Okay.

P29: Definitely enjoy looking at graphs, and line graphs are the most straightforward. So, that's my reasoning for definitely wanting to look at those.

Jae Young: So, is it ... is it your personal preference or do you believe that many science majors would prefer these line graphs over other types of diagrams or pictures?

P29: I would say ... especially, and like science or engineering or pretty well-educated um... we use graphs all the time to portray data. So, we're very good at looking at graphs. So, I guess, it'll become very natural for me to see a graph showing some data. That would be absolutely nothing out of the ordinary for me. So, for me I can very quickly look at and read it, whereas suppose ... like ... say for example, one of these guys (DS14) over here.

Jae Young: Um hmm...

P29: I don't really need to see arrows of radiation coming down, bouncing off of an ice cap. Well, it's a cute little picture. It doesn't really do much to help me. These (DS1, DS2, and DS3) give more information in the same visual space.

Although it was not mentioned as frequently as “line graph as a type,” some interviewees verbalized reasons for their choice of “bar graph as a type” after selecting a bar graph as appropriate for a science textbook, and identifying “bar graph as a type” as an element that made the bar graph appropriate for the context of a science textbook. For example, P1 chose DS38 along with a couple of other line graphs as appropriate for a science textbook, and identified “bar graph as a type” as an element that made DS38 appropriate for the context of a science textbook. In the following comment, P1 pointed out the main quality DS38, “standardized,” and indicated that it is the reason that made DS38 suited for textbooks

rather than magazines. I asked him what of DS38 and a couple of other line graphs made them standardized, and thus, suited for a science textbook. He then answered that “It has graphs. It has charts. It has lines.” This answer implies that the overall visual structure of a line graph or a bar graph, which I labeled as “line graph as a type” or “bar graph as a type”, is the reason that made the diagrams all suited for textbooks rather than magazines. From his comment that “These are something that you would find in more of a textbook, right?”, I inferred that his choice was influenced by visual convention of what a diagram in a science textbook should look like. He also contrasted the unique visual structure of a line/bar graph with an image-driven diagram, DS14, characterized by “a lot of pictures.”

P1: And these (DS26, 27, 28, 30, 38, 40, 52, and 53) seem a little bit more academic.

Jae Young: Okay. So could you tell me what about this diagram (DS30) makes it academic?

P1: It’s very standardized one, bar graphs, pie charts. So, it’s easier to follow and separated into regions.

(omitted)

Jae Young: Okay. So, you said that this one (DS30) has standard looking and what about this one (DS28)?

P1: Yeah, same as these (DS26, 27, 28, 30, 38, 40, 52, and 53). These are something that you would find in more of a textbook, right? Like it seems like these (DS26, 27, 28, 30, 38, 40, 52, and 53) would be more accurate, too, because you have the data, and it’s over a certain period of time or you have the proportions (pointing the bar

graphs in DS30) and you could sit down and try to make some implications or assumptions based on this, right? ... whereas this (DS14) is just sort of usual. It (DS14) seems like it's more for entertainment.

Jae Young: Okay. And the chosen ones are all standard looking?

P1: Well, I mean it seems like more suited for textbooks rather than like magazines.

Jae Young: So, I am trying to understand why you think that way. So you said things like...

P1: It (DS26, 27, 28, 30, 38, 40, 52, and 53) has graphs. It has charts. It has lines.

Jae Young: But this one (DS14) also has graphs, right?

P1: Yeah, but it (DS14) has a lot of pictures, too. And I think this (DS30) gives you a lot more information than say just this (the CO₂ line graph in DS14) and this (the global temperature line graph in DS14). I mean this sort of you can figure out.

As shown in the following comment, the reason that P23 chose DS38 as appropriate for a science textbook is because it is a bar graph. However, while the reasons P1 verbalized are geared toward the context of a science textbook, the reasons P23 verbalized seem to have less to do with the context.

Jae Young: And so any visual elements of this one (DS38) makes you think that it is easy to understand and appropriate for a science textbook?

P23: I think it's because it's a bar graph and bar graphs are very easy to read. And um ... so you can ... I mean clearly look at this and not even really have to know the

scale model to see the difference between the US emissions and Bangladesh emissions. So I think it's very easy to read right off the bat because it's just ... it's so clear.

While majority of the interviewees preferred line graphs over image-driven diagrams for the context of a science textbook, frequently identifying “line graph as a type,” some interviewees chose image-driven diagrams, such as the ice images in DS11 and DS31. For example, P3 selected DS11 and DS31, accompanying the realistic ice images, as appropriate for a science textbook, and identified “use of a realist image” as an element that made the two diagrams appropriate for a science textbook. The reason for her choice was that she could “rely on” the ice images in them because of the realistic nature of the images. In other words, reliability associated with the realistic nature of the images was the quality that P3 thought necessary for a science textbook.

Jae Young: Why did you choose this diagram (DS11) for a science textbook?

P3: Same with this one (DS31).

Jae Young: Okay.

P3: It (the ice images in DS11) looks more realistic than any other diagrams because I don't know if it's real from the satellite picture. I don't know if it's real, but it looks more realistic than others ... And I felt more, I don't know, like I felt more like I could rely on this because again it looks more realistic.

P18 chose DS31 as appropriate for a science textbook, and then, identified “decrease in area size on a map” as an element that made DS31 appropriate for the context. He indicated that the noticeable difference in the ice size created striking visual impact and facilitated instant visual perception without even asking him to read the text. In other words, visual impact and instant perception enabled by the decrease in the ice size are the qualities that P18 thought necessary for a science textbook.

Jae Young: Okay. You chose this one (DS31). Can you tell me why? What is it about the visual qualities of this diagram that make it appropriate for a science textbook (DS31)?

P18: Because it looks like the earth and the earth is visually striking and then it's very easy to just look at the pictures and compare them and notice differences and the polar cap or whatever this is, sea ice coverage. So it's really easy to see the differences from the point of this picture. You don't even need to look at the graph. You can just look at this (the two photos).

Jae Young: So why do you think that this diagram (DS31) is particularly appropriate for a college science textbook?

P18: Because it's just easy for the student to see the comparative two pictures without reading the bunch of long detailed text.

According to P28's comment in the following, we can assume that the factors that encouraged him to choose DS31 as appropriate for a science textbook and identify “decrease

of area size on a map” and “use of a realistic image” as elements that made DS31 appropriate for the context are his personal preference of pictures and the idea that accuracy would be assured by using a realistic image. To put it another way, the reasons P28 verbalized are his personal preference and the idea that accuracy would be necessary for a science textbook.

Jae Young: So, why did you choose this one (DS31) as appropriate for a college science textbook?

P28: Well, um, I like pictures (laughing), but, um I guess this is like a polar ice cap. So, I’m assuming this is probably like a satellite picture or something or probably more or less something accurate. So, you can definitely visually see that there’s a significant reduction.

Jae Young: Uh-hmm...

P28: And then that ... along with the fact that, you know, (we) can see the ... again a trend line (in the line graph in between the ice images) talking about how it has reduced and by how much...and fairly consistently to ... ah ... I think was just ... just seemed like it would be appropriate for a college textbook.

On the other hand, there were cases in which interviewees chose a diagram and identified an element in it in order to simply differentiate from the typical forms of diagram that a science textbook usually contain. To put it another way, their choice of a certain diagram and an element in it is not purely based on the formal qualities of diagrammatic elements, but on other factors. For example, P28 chose DS14 as most appropriate for a

science textbook. Unlike other science majors who mostly chose line graphs as appropriate for a science textbook, he exceptionally chose the image-driven diagram, DS14. In order to figure out the reasons for his choice, I asked him what criteria he had in his mind when he was choosing one. As shown in the following comment, he chose it because he wanted to see a readable and visually appealing diagram, which can make a distinction from typical types of diagram such as a line graph.

Jae Young: What criteria did you have in your mind when I asked you to choose some diagrams for the specific context of science textbook?

P28: I wanted it to be something that which I myself would want to look at because there are a lot of good graphs that I think in science textbooks which I don't bother to look at or don't have the initiative to look at. So if someone is going to make a point about the greenhouse effect, then I want that diagram to be something that is to me readable and appealing.

P22's choice of DS31 is another anomalous case. She argued that she was aware of the visual convention that a science textbook usually include typical type of diagram, such as graphs or computer images, rather than image-driven diagrams, but she wanted to choose something that stands out in order to differentiate from the typified types. Thus, again her choice of the diagram and the element in it was made not purely based on the formal qualities of diagrammatic elements, but on other factors.

Jae Young: Then, why do you think that this type of diagram (DS31) is more appropriate than these computer images?

P22: I think it's just because when I saw all of them compared to each other, when I had to choose, the majority of the pictures are graphs and diagrams and computer images, and there was this one (DS31), real big pictures, and so it was just on the basis of thinking that if this book has all of these (all the diagrams except DS31) and then there's this (DS31), I'll pay attention to this (DS31) because it's different and stood out.

For the context of persuading legislators, most interviewees did not specifically mention why they chose a certain diagram and identified an element in it, since they presumed that the elements mentioned frequently, such as “upward trend of line,” “downward trend of line,” “spike in line trend,” and “decrease in area size on a map” contain in themselves contents that are exclusively appropriate for supporting particular arguments (or counterarguments), such as “the globe is warming,” “the globe is not warming,” and “the global warming is caused by CO₂.”⁵⁷ During interview, they focused more on identifying an element that made a diagram appropriate for persuading legislators than explaining why they chose the element for the context. Besides, elements, such as “downward trend of line” in DS1 and “correlation between lines by similar line trends or line overlap” in DS3, were chosen exclusively for persuading legislators into believing the counterargument that the globe is not warming, since the contents of the diagrams support the counterargument. Thus,

⁵⁷ For example, mostly, elements, such as “upward trend of line” or “spike in line trend,” are appropriate for supporting the argument that the globe is warming.

there were not many cases that provided useful data that enabled me to analyze what their choices meant in terms of the formal qualities of diagrammatic elements.

Under the context of persuading legislators, it was when they chose the image-driven diagrams, the ice images in DS11 and DS31, as appropriate for the context, and identified “decrease of ice size on a map” and “use of a realistic image” as elements that made the diagrams appropriate for persuading legislators that interviewees best verbalized reasons for their choice. P19, P26, and P27 gave reasons for choosing DS11 for the context in terms of its formal qualities. In the following comment, P19 argued that he preferred the ice size reduction diagram and the Florida map-based diagram to the “abstract and mathematical” line graphs in DS11 because of their visceral quality that brought things before our eye. He thought that the visceral quality associated with the image-driven diagrams would be necessary for persuading legislators.

Jae Young: What is it about the visual qualities of this diagram (DS11) that makes it appropriate for persuading legislators?

P19: Well, I would point to this diagram (the diagram about the ice size reduction in DS11), which easily shows you that ice is melting and as I said before it kind of connects to people’s concern for the world itself, and then this one (the diagram about Florida in DS11) brings it closer to home where you become concerned that our homes or our cities may actually be....

Jae Young: You mean this map (the Florida map)?

P19: Yeah, right.

Jae Young: What about these two? (the first line graph about temperature rise in DS11 and the third line graph about sea level rise in DS11)

P19: I guess when I see them they make sense, but I guess ... I guess going back to your question from before maybe for this topic, the abstract and mathematical diagrams are less effective for me.

Jae Young: Why?

P19: I guess it doesn't give me a clear idea of the severity of the problem. Just because temperature has changed almost 3 degrees (pointing the first line graph about temperature rise in DS11), I don't really know why that is not normal or why I should be concerned. This one (the third line graph about sea level rise in DS11), I guess, is better. It shows a clear trend and when we talk about sea level rising, I guess I can understand that, but then again if the sea level rises 80 cm, I don't really know that that's concerning, but when I see a state coming under water, then that's more effective.

Jae Young: So, you are choosing this one (the center series of diagrams in Meltdown!) because of these two (the glacier photos & the Florida map)?

P19: Yeah, primarily, yeah.

P27 also chose DS11 for persuading legislators for similar reasons. What she added to P19's discussion is that pictures like the ice images in DS11 should be used to appeal to legislators who are not scientifically-minded, while line graphs be used to appeal to scientists.

P27: I would have picked this (DS11) (for persuading legislators), but again, I picked it mostly because of this part (the glacier size reduction diagram). And I didn't know what was going on here (the Florida map-based diagram) area. Yeah, like, "Oh no, we're going to be flooded. You're going to lose your business over here," but mostly ... of these things (all the diagrams in DS11) I will pick the stereotypical glacier picture.

Jae Young: Uh-hmm. Not really these (the 1st line graph about temperature and the 3rd line graph about sea level rise, and the Florida map-based diagram)?

P27: For more scientific evidence, you need to pick these (the 1st line graph about temperature and the 3rd line graph about sea level rise).

Jae Young: Uh-hmm.

P27: But to appeal to the legislators who typically aren't more scientifically minded, I would pick this (the diagram about the ice size reduction in DS11).

P2, P5, P20, P26, and P27 chose DS31 for persuading legislators, and verbalized reasons for the choice in terms of its formal qualities. P5 indicated that legislators, the people whom he was supposed to persuade, are not very knowledgeable about the issue of global warming and have limited time. P5 thought that DS31 would be most appropriate for satisfying such a condition, and gave the following reasons. First, DS31 does not demand any specific knowledge about reading it, since laymen can understand what it means by simply comparing the size of the ice. For that reason, DS31 is appropriate for persuading laymen such as legislators. Second, DS31 facilitates quick communication whereas line graphs ask

viewers to process them for a relatively longer time. Since, image-driven diagrams, such as DS31, can bring about an immediate reaction, DS31 is appropriate for persuading people who have limited time, such as legislators.

Jae Young: Why did you choose this one (DS31) as appropriate for persuading legislators with the pro argument (the globe is warming)?

P5: Well, just visually I think this (DS31) is the most effective one, you know. You can look at this and immediately see what the difference is, you know. I mean this is such a stark contrast. You really don't even pay any attention to the chart in the middle because the image alone is quite effective, you know. You have, what is this? ... almost a 25-year difference and it's at least a third gone and you don't have to have any difference I was making earlier, layman versus someone who has any kind of knowledge about this. You don't need any kind of specific knowledge to see what this is saying, you know. This is saying clearly there is a major, major change.

(omitted)

Jae Young: So, why did you choose this one (DS31) as most appropriate for persuading legislators with the pro argument?

P5: (looking at DS31) If you are lobbying to Congress, you've got a lot of people who are not necessarily experts on climate change and who have extremely limited time, you know. And if we want to promote it quickly and get an immediate reaction, then I think this image will get a much more sudden reaction than a chart (pointing at DS1).

P26 also chose DS31 as appropriate for persuading legislators, and verbalized reasons for the choice in terms of its formal qualities. Not only P5 but also P26 assumed that legislators would not be good at reading line graphs, since this type of diagram might ask them to estimate trends over time or read variations. She thought that image-driven diagrams, such as DS31, would be clearer than, and not as complicated as, line graphs, and thus, image-driven diagrams, such as DS31, would be more appropriate for persuading legislators. I assume the difference between image-driven diagrams and line graphs, indicated by P26, is originated from the different formal qualities of the two, one mainly based on the size difference of the before and after image, and the other based on line trend.

P26: So, I think if you want to convince the senator, what you need to do is you need to hope that it's not too complicated. So, I think that the icecaps (in DS31) are very convincing because you can really clearly see that all that ice is lost.

Interviewer: Um hmm...

Interviewee: And ... you know ... it (pointing at the line graph in the middle) seems very clear, too, about what's going on. Actually, this graph (the line graph in the middle) may be not as clear as the actual pictures (the two ice pictures).

Jae Young: Um hmm...so you find these two pictures more appropriate for convincing legislators than the line graph (in the middle)?

P26: Yeah, I do because it's hard for people to estimate trends over graphs, sometimes. I feel that we're not very good at it. And, like ... I think it's (the trend of the line graph in the middle) going down, but then ... you know ... there's a lot of

variation...maybe it's changed. But I think just showing before (pointing at the upper ice picture) and after (pointing at the lower ice picture)... such a huge difference...makes sense.

7.3. Cross-analysis of the Findings from the Rhetorical Analysis and from the Two Qualitative Interviews

In this section, I integrate the results from the rhetorical analysis and from the two qualitative interviews in order to answer the main research question, “what rhetorical significance do viewers assign to diagrams on the basis of the formal qualities of diagrammatic elements or configurations?” First, the number of how many times each diagrammatic element was identified as an element to which viewers are likely to assign rhetorical significance revealed through the rhetorical analysis does not serve as a criterion for judging whether interviewees are more (or less) likely to assign rhetorical significance to each element, since the sampled diagrams used for the rhetorical analysis might accidentally have included one element more than the other. Even though I tried to include as various elements as possible and to make the number of each element as similar as possible in the sampling process, the number of each element was randomly determined by availability. On the other hand, the range of the diagrammatic elements and configurations identified through the rhetorical analysis, to a certain extent, introduce the diagrammatic elements and configurations that circulate in the culture and the context of global warming that could be used to inform interviewees of rhetorical significance. However, we cannot make a conclusion from the result of the rhetorical analysis that interviewees are more likely to

assign rhetorical significance to elements, such as red color and upward trend of line, just because they were identified as an element to which viewers are likely to assign rhetorical significance more frequently than other elements.

Thus, the result from the rhetorical analysis provided me with a ground on which I selected 24 out of the total 56 diagrams that I later used for the first and second interviews, and informed me of the range of diagrammatic elements and configurations that circulate in the culture and the context of global warming. Although I acknowledged that we could not guarantee that interviewees would be likely to assign more rhetorical significance to a certain element just because it was identified more than others through the rhetorical analysis, I had an assumption that interviewees might assign rhetorical significance to certain elements, such as red color and upward trend of line, more frequently than to others because of our preconception that they are popular visual elements that circulate frequently in mass media, and effective in persuading interviewees into believing that the globe is warming. I have been aware of this assumption that I had had since the start of collecting diagrams about global warming, and tried to see if this assumption is confirmed or not, trying not to bias the result of this study.

Second, in order to find out the diagrammatic elements to which interviewees actually assigned rhetorical significance frequently in the first and second interviews from the entire set of elements, I integrated the three percentages from the three columns under “%” in Appendix 8 by adding them up, and made a new appendix, Appendix 9. Appendix 9 shows the total percentages that integrates the three percentages from the phase 1B, from the context of a science textbook in the phase 2, and from the context of persuading legislators in

the phase 2.⁵⁸

In terms of the integrated percentage, the elements scored over 50% (highlighted with green color in Appendix 9) are “upward trend of line (55.4%),” “downward trend of line (53.2%),” “fluctuation in line trend (62.8%),” “a spike in line trend (76.5%),” “correlation between lines by similar line trends or line overlap (50.5%),” “upward trend of bars (93.3%),” “decrease in area size on a map (91.3%),” “use of a realistic image (73.2%),” and “pictogram size (103.3%).” The ones over 40% (highlighted with yellow color in Appendix 9) are “contrast between different line trends in a line graph (46.5%),” “manipulation of y-axis scale (40%),” “narrow range of uncertainty reducing fluctuation of line trend (46.7%),” “sharper angle of upward line created by making starting and ending point of x-axis closer (40%),” “downward trend of bars (48.3%),” “color coding (49.2%),” and “coloring a particular area with red color on a map for attention (40%).”

On the basis of the integrated percentages, I argue that interviewees actually assigned rhetorical significance to most of the elements listed above frequently. However, there are some cases in which it is difficult to decide whether the high score is purely caused by the formal qualities of diagrammatic element or by other reasons, such as the nature of data being presented in a diagram. For example, “a spike in line trend” is employed to show a rapid change in line trend. In cases like this, using a certain diagrammatic element might not be designer’s choice of the way that data is displayed out of many possibilities, but an

⁵⁸ The integrated percentages are simply used to roughly figure out how frequently interviewees actually assigned rhetorical significance to each of the diagrammatic elements or configurations. I will continue to discuss the results of the interviews with the Appendix 8 that shows the three percentages separately later again, since the integrated percentages do not give us detailed information about what percentage a certain element scored in what interview.

inevitable choice that should have been made to visualize the data. Thus, we cannot attribute the high score to the formal qualities of a spike. “Correlation between lines by similar line trends or line overlap,” “no correlation between two lines,” “contrast between different line trends” are also similar to the case of “a spike in line trend.”

There are some other elements that are appropriate for representing a particular nature of data, such as “upward trend of line” (increase in data) “downward trend of line” (decrease in data), “fluctuation in line trend” (fluctuation in data), “upward trend of bars” (increase in data), “downward trend of bars” (decrease in data), and “relative height of bars” (comparison in data). They are also cases in which it is difficult to decide whether the high score is purely caused by the formal qualities of diagrammatic element or by the nature of data being presented in a diagram. For example, “fluctuation in line trend” is an element that can best describe a fluctuating line trend, but it might be seen as a choice of an element that makes the trend in the data apparent. Actually, we can see where the ups and downs are in the line by reading the fluctuation. Hence, in these cases, I attribute the high score both to the formal qualities of each element and to the nature of data.

The first salient thing to note about the result regarding the elements scored over 50% (highlighted with green color in Appendix 9) is that many interviewees assigned rhetorical significance to “decrease in area size on a map (91.3%)” and “use of a realistic image (73.2%). It is interesting to mention that they are the two representative diagrammatic elements usually employed in image-driven diagrams, such as DS11 and 31.

If we look at the three percentages across the three columns in appendix 8, “decrease in area size on a map,” “use of a realistic image,” “upward trend of line,” “downward trend

of line,” “fluctuation in line trend,” “spike in line trend,” and “correlation between lines by similar line trends or line overlap” were all identified both in the first and second interview, and for the two different contexts in the second interview well. I argue that “decrease in area size on a map” and “use of a realistic image” are the diagrammatic elements to which interviewees actually assigned rhetorical significance. However, because of the fore-mentioned reasons about the nature of data, I am not sure whether interviewees actually assigned rhetorical significance to the other elements or not.

The second salient pattern discovered from the result is that, if we compare the percentages of the above-mentioned elements for the two different contexts in the second interview, in all seven cases, the scores for persuading legislators are higher than that for a science textbook. This distinct pattern is interesting to note, but it does not enable me to claim that interviewees actually assigned rhetorical significance to the above-mentioned diagrammatic elements more frequently under the context of persuading legislators than under the context of a science textbook, since the nature of data again might have influenced interviewees when they were choosing diagrams appropriate for the given context and identifying a diagrammatic element in them. Therefore, with the two elements among the above-mentioned elements, “decrease in area size on a map” and “use of a realistic image,” I can make a claim that interviewees actually assigned rhetorical significance to them more frequently under the context of persuading legislators than under the context of a science textbook. On the other hand, I cannot make the same claim about the other elements, such as “upward trend of line,” “downward trend of line,” “fluctuation in line trend,” “spike in line

trend,” and “correlation between lines by similar line trends or line overlap,” since the nature of data might have played a role as a confounding factor.

In a good contrast to the two elements more frequently identified for the context of persuading legislators (“decrease in area size on a map” and “use of a realistic image”), “line graph as a type” and “bar graph as a type” were identified only for the context of a science textbook. Through contrasting typical line graphs with image-driven diagrams such as DS14, the interviewees, who mentioned the two elements, identified the overall structure of a line or a bar graph, composed of x-y axis, scale, and lines/bars, as a whole, as appropriate for a science textbook. According to the interviewees’ comments, not including non-abstract forms, such as pictures or arrows, was also an important characteristic that distinguishes line graphs and bar graphs from image-driven diagrams.

“An upward trend of bars” scored highest in the first interview, and then, scored 13.3% for the context of persuading legislators only in the second interview. On the other hand, it was not identified for the context of a science textbook. As discussed earlier, this result does not enable me to claim that interviewees assigned rhetorical significance to this element only under the context of persuading legislators, since the nature of data again might have played a role as a confounding factor.

On the other hand, “downward trend of bars” falls under the second category in terms of the integrated percentage, which ranges between 40 and 50%, scoring 48.3%. After scoring 40% in the first interview, which is in a high range of the percentage spectrum, the element scored 8.3% for the context of persuading legislators only in the second interview, while not being identified for the context of a science textbook. It is interesting to note that

both upward trend of bars and downward trend of bars scored 0% under the context of a science textbook. It is also interesting to note that the integrated percentage of “downward trend of bars” (48.3%) is slightly lower than that of “downward trend of line (53.2%).”

Another surprising result is that “pictogram size” scored highest (103.3%) among the integrated percentages in Appendix 9. It is not a very popular diagrammatic element in terms of frequency of use. Even in my rhetorical analysis, it was identified only once from DS30, the one and only diagram accompanying this element, among the 56 diagrams in the original set of diagram samples. Unlike my assumption that interviewees would not be likely to assign rhetorical significance to this element frequently, the score is the highest. Based on the result, I cannot explain why the score is the highest. I can only assume that the unexpected high score might have been partially caused by the way it persuades interviewees. “Decrease in area size on a map,” scored high as well (91.3%) and “pictogram size” (103.3%) are similar in that both of them persuade interviewees through difference in size of something, which effectively persuade them by aiding their immediate understanding of what is being visualized. This result does not allow me to claim that interviewees assigned rhetorical significance most to the set of the two diagrammatic elements, since the sampled diagrams did not show interviewees the same information in a variety of forms. Because they did not present comparable things in different forms, I can only make a claim that interviewees actually assigned rhetorical significance to the two elements that employ such a similar mode of visual persuasion frequently.

Another surprising result is that interviewees actually did not assign rhetorical significance to colors as much as I expected. Among the color-related diagrammatic elements,

only “color coding” scored 49.2% in terms of the integrated percentage, while others, except grey color, scored lower than 20%. A pattern found in the low scores is that interviewees identified grey color most frequently, red color next, and then, green color. I assume that the interviewees might not have been able to identify every single use of red color, while there are so many diagrams that employ the element. Since the total number of using red color is larger than that of using other colors, the percentage might be significantly low. Anyway, my original assumption that interviewees would be likely to assign rhetorical significance to colors, especially red color, frequently, was disconfirmed, since the scores at large are very low.

Unlike other color-related diagrammatic elements that scored low, color coding scored 49.2% in terms of the integrated percentage (Appendix 10). It is a diagrammatic element to which interviewees actually assigned rhetorical significance frequently, since the integrated percentage slightly falls short of 50%. This element was relatively evenly identified for the first and the second interview and for the two contexts in the second interview. An interesting thing about this element is that it is one of few diagrammatic elements that scored higher percentage for the context of a science textbook (10.7% in Appendix 8) than for the context of persuading legislators (7.4% in Appendix 8). However, I cannot make a claim that, on the basis of the formal qualities of the element, color coding, interviewees assigned rhetorical significance to the element more frequently under the context of a science textbook than under the context of persuading legislators. Such is the case because the nature of data or other factors might have influenced interviewees when

they were choosing diagrams for the given context and identifying a diagrammatic element in them.

One of the elements that form the second group, ranging between 40 and 50% in terms of the integrated percentage, is “narrow range of uncertainty reducing fluctuation of line trend (46.7%).” Range of uncertainty is a diagrammatic element that can be employed only in a line graph. However, it is not about a trend of a line itself, but about the range that the trend of a line can be uncertain. In other words, the wider the range of uncertainty is, the more uncertain the trend of a line is. It is a unique diagrammatic element that either can make a line trend trustworthy and visually more salient when it is narrow, or can make a line trend unreliable and visually less salient when it is wide. This element was not identified through the rhetorical analysis as an element to which interviewees are likely to assign rhetorical significance, but scored high (46.7% in Appendix 9) in terms of the integrated percentage. If we look across the three percentages in the three columns in Appendix 8, it scored high (40%) in the first interview, and then, scored 6.7% again for the context of persuading legislators in the second interview.

“Sharper angle of an upward line created by making starting and ending point of x-axis closer (40%)” is a diagrammatic element that can be employed only in a line graph as well. However, it is not about a trend of a line itself, but performs an assisting role of making an upward line look more dramatic by reducing the distance between the starting and ending point of the x-axis. This element also was not identified through the rhetorical analysis as an element to which interviewees are likely to assign rhetorical significance, but scored high in

terms of the integrated percentage. A notable thing about this element is that it was not identified in the second interview.

“Manipulation of y-axis scale” (40%) is a unique diagrammatic element through which someone can minimize or conceal something negative by decreasing the scale or exaggerate something positive by increasing the scale. It is an element that can be employed both in a line graph and in a bar graph. This element also was identified once from DS30 through the rhetorical analysis as an element to which interviewees are likely to assign rhetorical significance. Then, it was identified as convincing twice from both the line graphs and from the bar graphs in DS30 in the first interview, and scored high (40%) in terms of the integrated percentage. A notable thing about this element is that it was not identified in the second interview.

The last diagrammatic element that scored over 40% in terms of the integrated percentage is “coloring a particular area with red color on a map for attention (40%).” As a diagrammatic element that combines the two elements, “use of map” and “red color,” it was identified once from the Florida map in DS11 through the rhetorical analysis as an element to which interviewees are likely to assign rhetorical significance. Then, it was identified again for the context of persuading legislators in the second interview only. It is interesting to compare this element with “filling up most areas on a map with red or similar colors,” since they are similar in that they combine the two elements, “use of map” and “red color.” I originally assumed that interviewees would be likely to assign rhetorical significance frequently to “filling up most areas on a map with red or similar colors,” since it is a visually dramatic element. On the other hand, I assumed that interviewees would be unlikely to assign

rhetorical significance frequently to “coloring a particular area with red color on a map for attention,” since the range of color application is narrower than in “filling up most areas on a map with red or similar colors.” Based on the score of “coloring a particular area with red color on a map for attention” (40% in Appendix 9) and the score of “filling up most areas on a map with red or similar colors” (23.3% in Appendix 9), I can claim that interviewees assigned rhetorical significance to the two elements frequently.

Then, the diagrammatic elements that form the third group, ranging between 20 and 30% in terms of the integrated percentage, are “relative height of bars in a bar graph (38%),” “relative sector size in a pie chart (32.8%),” “two way arrows” (28.3%),” “no correlation between two lines (27.1%),” and “showing the most dramatic increase of line trend selectively (20%).” “Relative height of bars in a bar graph” is one of few diagrammatic elements that scored higher percentage for the context of a science textbook (20% in Appendix 8) than for the context of persuading legislators (8% in Appendix 8). “Relative sector size in a pie chart” is a diagrammatic element only employed in a pie chart. Through the rhetorical analysis, it was identified from the diagrams that accompany pie charts (DS29, DS30, and DS39) among the sampled diagrams as an element to which interviewees are likely to assign rhetorical significance, and interviewees also identified it as convincing in the first interview and identified it for the two contexts in the second interview. “Two way arrows” is an element employed for the flow chart, DS14, in order to visualize the multiple cause and effect relationship in global warming. It is not a very popular diagrammatic element in terms of frequency of use, but I identified it as an element to which interviewees are likely to assign rhetorical significance, and then, interviewees identified it as appropriate

for persuading legislators in the second interview. The integrated score of this element is pretty high (28.3%). “No correlation between two lines” scored lowest (27.1%) among the diagrammatic elements related to line trend. In the first and second interviews, many interviewees misinterpreted DS2, the only diagram with the element. They misunderstood the lines in DS2 as having a relationship with each other, and I assume that this was the main reason that this element scored low. One more plausible reason is that it might have been more difficult for the interviewees to identify lack of relationship between the lines in DS2 than to identify the relationship between the lines in DS3. Thus, the fore-mentioned reasons might have caused the low score. “Showing the most dramatic increase of line trend selectively (20%)” is a diagrammatic strategy that enhances persuasive power of an upward line trend, since it selects and shows only the most dramatic part of a trend. Among the elements that belong to the third group, ranging between 20 and 30%, it is the only one that was not identified as an element to which interviewees are likely to assign rhetorical significance through the rhetorical analysis. Although it scored lower than other similar diagrammatic elements, such as “manipulation of y-axis scale,” “narrow range of uncertainty,” “sharper angle of upward line created by making starting and ending point of x-axis closer,” the score is 20% (Appendix 9).

While the third sub-question of this study contains “why” question, and interviewees’ answers to the question provided me with additional data to answer the main question, the second sub-question used for the first interview (phase 1B), “to what element or configurations of diagrams do viewers actually assign rhetorical significance?” does not. Its goal was to purely identify diagrammatic elements or configurations to which interviewees

actually assigned rhetorical significance. Thus, there is nothing to compare in terms of the “why” question and answers to the question.

CHAPTER 8. CONCLUSION AND DISCUSSION

In this section, on the basis of the previous cross-analysis, I address the main research question, “what rhetorical significance do viewers (interviewees) assign to diagrams on the basis of the formal qualities of diagrammatic elements or configurations?” I discuss what patterns have been identified after integrating the results from the rhetorical analysis (phase 1A) and from the two qualitative interviews (phase 1B and 2), and what they speak to the main research question.

The appendix 10 shows the diagrammatic elements and configurations identified through the rhetorical analysis on the left column, and the ones identified through the two qualitative interviews on the right column with the integrated percentages showing which element was identified more times than others. The appendix 10 compares the diagrammatic elements and configurations identified through my rhetorical analysis in phase 1A, as an element or configuration to which interviewees are likely to assign rhetorical significance, and the ones identified by interviewees through the first and second qualitative interviews in phase 1B and 2. Ultimately, it allows me to see how they are similar or different. The elements identified through the rhetorical analysis, but not identified by the interviews, are highlighted with blue color on the left column, while the ones identified by the interviews, but not through the rhetorical analysis with red color on the right column.

The elements identified through the rhetorical analysis, but not identified by the interviewees, are the three in the following.

- “stagnancy in line trend”
- “red color as signifying the sun”
- “visual salience of an area cluster on a map”

I argue that interviewees did not assign rhetorical significance to the three elements. On the other hand, the elements identified by the interviewees, but not through the rhetorical analysis, are the 17 in the following.

- “fluctuation in line trend”
- “showing the most dramatic increase of the line trend selectively”
- “long range of time span on x-axis”
- “narrow range of uncertainty”
- “sharper angle of an upward line created by making starting and ending point of x-axis closer”
- “just straight line with no fluctuation”

- “arrows pointing the starting and ending point of the line”
- “proportions in a bar graph”
- “disparity between high and low bars”
- “red color for making the trend more obvious”
- “dark blue color on top of blue for emphasis”
- “black and white color only”
- “use of world map in the background”
- “use of black background”
- “maps of countries in proportion to the size”
- “use of circles signifying cyclical nature”
- “horizontal arrangement of things being compared”

Although there seems to be discrepancy between the results from my rhetorical analysis and the results from the interviews at a glance because of the existence of the fore-mentioned 17 elements, most of the ones newly identified through the interviews scored low, which implies that only a few interviewees identified them. It is important to note that most

of the elements and configurations that scored high in the interviews overlap with the results from the rhetorical analysis. Therefore, the 17 elements do not undermine my argument about the overlap. In addition, although “fluctuation in line trend” scored high (62.8%), it scored that high mainly because the interviewees interpreted DS1 as having a fluctuating line trend, and chose it as appropriate for persuading legislators because of the content that the line describes.⁵⁹ Besides, as discussed earlier, DS1 is one of few diagrams that could be used to support the counterargument (the globe is not warming), and the score might have been high because many interviewees chose DS1 from very limited choices, DS1, DS2, and DS3. Thus, the high score of this element is unlikely to mean that interviewees actually assigned rhetorical significance to the element on the basis of its formal qualities. In addition, when interviewees identified “fluctuation in line trend,” “just straight line with no fluctuation,” and “disparity between high and low bars,” the nature of data might have been a decisive factor for them to choose the elements, since each of them is an optimized element for visualizing a particular nature of information rather than designer’s choice over multiple possibilities. Therefore, on the basis of the above discussion, I argue that the diagrammatic elements identified through the rhetorical analysis and the ones identified through the interviews significantly overlap.

The next step that should be taken to answer the main research question is to figure out whether I can make a claim that interviewees assigned rhetorical significance to the diagrammatic elements and configurations both identified through the rhetorical analysis and through the interviews on the basis of their formal qualities. Based on the findings and the

⁵⁹ While I analyzed DS1 as having a downward trend of line, some interviewees interpreted it as having a downward trend of line, and others (more interviewees) as showing fluctuation in line trend.

results reported so far, I can only answer to the main research question, “what rhetorical significance do viewers assign to diagrams on the basis of the formal qualities of diagrammatic elements or configurations?” in a somewhat qualified manner. Such is the case because I do not have enough data to determine whether interviewees assigned rhetorical significance to some of the overlapping diagrammatic elements and configurations (“upward trend of line,” “downward trend of line,” “fluctuation in line trend,” “spike in line trend,” “correlation between lines by similar line trends or line overlap,” “contrast between different line trends,” “no correlation between two lines,” “upward trend of bars,” “downward trend of bars,” “relative height of bars,” “disparity between high and low bars,” and “relative sector size in a pie chart”). The findings and the results do not provide me with enough data to determine whether the formal qualities of the above-mentioned diagrammatic elements were the factor that encouraged interviewees to identify them as convincing (in the first interview) or identify them as appropriate either for a science textbook or for persuading legislators (in the second interview), or there were other confounding factors, such as the nature of the given data and suitability of a certain diagrammatic element for accomplishing a certain purpose under a certain context.

Indeed, another confounding factor might have been the content of the sampled diagrams. Interviewees’ choice of a certain diagram and identification of a certain diagrammatic element might have been based on the idea that the element is suitable for describing a particular content. In the coding procedure, I did not code when interviewees verbalized that they selected a diagram and identified a certain diagrammatic in it because of its content, since the focus of the main research question was on the formal qualities of

diagrammatic elements and configurations. However, there might have been other cases in which interviewees selected a diagram and identified a diagrammatic element in it because of its content, but did not verbalize it.

Therefore, I do not have enough data to make a claim that interviewees assigned rhetorical significance to some of the overlapping diagrammatic elements and configurations (“upward trend of line,” “downward trend of line,” “fluctuation in line trend,” “spike in line trend,” “correlation between lines by similar line trends or line overlap,” “contrast between different line trends,” “no correlation between two lines,” “upward trend of bars,” “downward trend of bars,” “relative height of bars,” “disparity between high and low bars,” and “relative sector size in a pie chart”). In order to be able to make the claim with these diagrammatic elements and configurations, I need to gather more data.

On the other hand, I argue that interviewees assigned rhetorical significance to “line graph as a type” and “bar graph as a type” on the basis of their formal qualities, frequently under the context of a science textbook, although some of the interviewees admitted that they were influenced by their knowledge about visual convention concerning what type of diagram a science textbook should contain. I think that our knowledge about the visual convention of a science textbook has resulted over a long period of time from our repetitive exposure to the formal qualities of diagrams that science textbooks usually contain. Thus, even though interviewees’ choices of line or bar graphs and identification of “line graph as a type” or “bar graph as a type” were made under the influence of the visual convention, the hidden factor that actually encouraged them to make these choice were the formal qualities recognized as conventional in a science textbook. To put it another way, the formal qualities

of line graphs or bar graphs are at the heart of such a visual convention. Thus, I argue that interviewees assigned rhetorical significance to “line graph as a type” and “bar graph as a type” on the basis of their formal qualities.

In addition, I can make a claim that interviewees assigned rhetorical significance to the other overlapping diagrammatic elements and configurations on the basis of the formal qualities of diagrammatic elements and configurations. The other overlapping diagrammatic elements and configurations are “showing the most dramatic increase of line trend selectively,” “long range of time span on x-axis,” “manipulation of y-axis scale,” “narrow range of uncertainty, reducing fluctuation of line trend,” “sharper angle of upward line created by making starting and ending point of x-axis closer,” “arrows pointing the starting and ending point of the line,” “proportions in a bar in a bar graph,” “red color,” “red color for making the trend more obvious,” “blue color,” “dark blue color on top of blue for emphasis,” “green color,” “grey color,” “red versus green,” “green versus grey,” “color coding,” “black and white color only,” “use of map,” “decrease in area size on a map,” “filling up most areas on a map with red or similar colors,” “coloring a particular area on a map with red color for attention,” “use of world map in the background,” “use of black background,” “maps of countries in proportion to the size,” “use of a realistic image,” “two way arrows,” “use of circles signifying cyclical nature,” “cyclical arrangement of circles,” “pictogram size,” “thickness of line,” and “horizontal arrangement of things being compared.” However, the findings do not allow me to make a further claim that “interviewees assigned more rhetorical significance to one diagrammatic element than to another,” since the sampled diagrams do not present comparable data, but simply various data in different forms.

Now, I go back to the 17 diagrammatic elements identified by the interviewees, but not through the rhetorical analysis, especially paying attention to the three elements that scored exceptionally high among the 17 elements that scored low over all. I argue that interviewees assigned rhetorical significance to the 17 diagrammatic elements, but not very frequently, except the three elements (“Showing the most dramatic increase of the line trend selectively” (20% in Appendix 10), “narrow range of uncertainty” (46.7% in Appendix 10), and “sharper angle of an upward line created by making starting and ending point of x-axis closer” (40% in Appendix 10)) to which I think they assigned rhetorical significance frequently. The three elements are meaningful ones, not only because of the fact that they scored high, but also because they open up new interpretive possibilities in the analysis of the diagrams, encouraging me to analyze the diagrams accompanying the elements from a fresh perspective. It is also interesting to note that the three elements are similar in the sense that they help a line trend look more dramatic.

Thus, based on the findings and the results, I argue that interviewees assigned rhetorical significance to the following diagrammatic elements and configurations on the basis of formal qualities; “showing the most dramatic increase of line trend selectively,” “long range of time span on x-axis,” “manipulation of y-axis scale,” “narrow range of uncertainty, reducing fluctuation of line trend,” “sharper angle of upward line created by making starting and ending point of x-axis closer,” “arrows pointing the starting and ending point of the line,” “proportions in a bar in a bar graph,” “red color,” “red color for making the trend more obvious,” “blue color,” “dark blue color on top of blue for emphasis,” “green color,” “grey color,” “red versus green,” “green versus grey,” “color coding,” “black and

white color only,” “use of map,” “decrease in area size on a map,” “filling up most areas on a map with red or similar colors,” “coloring a particular area on a map with red color for attention,” “use of world map in the background,” “use of black background,” “maps of countries in proportion to the size,” “use of a realistic image,” “two way arrows,” “use of circles signifying cyclical nature,” “cyclical arrangement of circles,” “pictogram size,” “thickness of line,” and “horizontal arrangement of things being compared.” In order to know whether interviewees assigned rhetorical significance to the other diagrams that were not mentioned above but are on the right column of Appendix 10, I need to gather more data. I need data that enables me to determine if it was the formal qualities of the diagrammatic elements and configuration that encouraged interviewees to identify them, or there were other confounding factors.

There are other interesting patterns that should be noted from the result of the findings. First, interviewees did not assign rhetorical significance to colors as much as I expected prior to interview. The literature about rhetoric of color that I reviewed for the rhetorical analysis showed that rhetorical function of colors is significant, and thus, prior to interview, I assumed that interviewees would assign rhetorical significance frequently to colors. To be more specific, I assumed that interviewees would assign rhetorical significance frequently to red or green colors, frequently used under the context of global warming, but the score for red color (18.9% in Appendix 10) and for green color (14.8% in Appendix 10) were not as high as I expected. Based on the result of the findings, I do not have enough data to explain why interviewees did not assign rhetorical significance to colors as much as I expected. In order to investigate this, I need more data. Among the color-related elements,

the score of color coding (49.2% in Appendix) is highest, which implies that interviewees assigned rhetorical significance frequently to the element.

Another interesting pattern observed from the result of the second interview is that the interviewees assigned rhetorical significance differently, depending on the context provided and the rhetorical goals they were supposed to accomplish. This claim should be made for some of the diagrammatic elements and configurations in Appendix 10, which are not especially suitable for accomplishing a certain purpose under a certain context, and thus, do not predispose interviewees to choose them for a particular context over another. For example, the elements, such as “proportions in a bar graph,” “red versus green,” “color coding,” “use of world map in the background,” “use of black background,” “maps of countries in proportion to the size,” “thickness of line,” and “horizontal arrangement of things being compared” were identified frequently for the context of a science textbook, implying that interviewees assigned rhetorical significance to the elements frequently under the context of a science textbook. On the other hand, other elements, such as “long range of time span on x-axis,” “narrow range of uncertainty, reducing fluctuation of line trend,” “arrows pointing the starting and ending point of the line,” “red color,” “blue color,” “dark blue color on top of blue for emphasis,” “green color,” “black and white color only,” “use of map,” “decrease in area size on a map,” “filling up most areas on a map with red or similar colors,” “coloring a particular area on a map,” “use of a realistic image,” “two way arrows,” “use of circles signifying cyclical nature,” “cyclical arrangement of circles,” and “pictogram size” were identified frequently for the context of persuading legislators, implying that

interviewees assigned rhetorical significance to the elements frequently under the context of persuading legislators.

Depending on the gap between the percentage for the context of a science textbook and the percentage for the context of persuading legislators, there are context-sensitive diagrammatic elements and less context-sensitive ones. The elements, such as “green color,” “color coding,” “use of map,” “cyclical arrangement of circles,” and “pictogram size” are less context-sensitive ones, since the gap between the two percentages is small. On the other hand, the elements, such as “proportion in a bar in a bar graph,” “filling up most areas on a map with red or similar colors,” and “coloring a particular area on a map” are context-sensitive ones, since they were identified under one context only, while not being identified at all under the other context.

Another point to discuss is that “pictogram size,” only identified once in DS30 by the rhetorical analysis, was identified most frequently by interviewees, scoring the highest (103.3% in Appendix 10). Thus, I claim that interviewees assigned rhetorical significance frequently to this element on the basis of its formal qualities. I tried to figure out why the interviewees identified this element most frequently, exploring if there is any similar element that scored high as well in the inventory of the diagrammatic elements identified through this study, and found that “decrease in area size on a map” that scored high as well (91.3%) is similar to this element in that both persuade interviewees through difference in size of something, which effectively persuade interviewees by aiding their immediate understanding of what is being visualized. The only thing that I can assume about the unexpected result is that there might be something about the similar mode of visual persuasion, based on the basic

perception of size difference. However, in order to figure out if this is the actual reason that caused the high score, I need to gather more data.

There is another important point to note from the result of the findings, in relation to the issue of the relationship between representational style and rhetorical significance, which was previously raised in the object review and adopted as a useful lens with which I can explore the rhetoric of diagrams. Closing the chapter about the object review, I argued that varying diagrammatic forms determined by various categories of images that are likely to be used in diagrams, such as photographic, pictorial, cartographic, and geometric images, can have implications for the way diagrams have rhetorical significance. If I connect the result of the findings with the argument, the contrast between data-driven diagrams and image-driven diagrams, repeatedly mentioned by a lot of interviewees throughout the interviews, can be boiled down to the contrast between geometric images and photographic images, the two types of image that I put into Doblin's ladder of abstraction (Figure 54) as the upper and lower extreme.

If we go back to the Appendix 10, the score for "decrease in area size on a map" (91.3% in Appendix 10) and for "use of a realistic image" (73.2% in Appendix 10), usually employed in image-driven diagrams, are higher than the scores of most of the diagrammatic elements used in line or bar graphs. This result, however, does not enable me to argue that interviewees assigned rhetorical significance more frequently to the two elements usually employed in image-driven diagrams than to other elements usually employed in data-driven diagrams, such as a line graph or a bar graph. Accordingly, I do not have a ground on which I can argue that there is a relationship between representational style and the extent to which

interviewees assigned rhetorical significance. Such is the case because we cannot guarantee that the result is purely based on the formal qualities of the diagrammatic elements and configurations. The reason that we cannot guarantee it is because of the fore-mentioned reasons, such as the nature of data and suitability of a certain diagrammatic element for accomplishing a certain purpose under a certain context. Therefore, I do not have enough data that can help me pursue the question.

Although the findings from the “why” question that was asked in the second interview (phase 2) was not satisfactory in terms of enabling me to better address the main research question, it provided some useful data with which I gain insight into the mind of the interviewees. Thanks to the additional data gathered by asking the why question, I was able to understand what pattern recurred in many of the interviewees. What I discovered is that many interviewees recognized that diagrams are divided into two groups, data-driven diagrams that are composed of geometric images, such as x-y axes, lines, bars, and etc. and do not contain pictures (DS1, 2, 3, 26, 27, and 28) versus image-driven diagrams that contain a lot of pictures (DS14). This contrast played an important role when interviewees read and interpreted the sampled diagrams and identified diagrammatic element that are convincing or that are appropriate for each of the two contexts. The recognition of the contrast shared by many of the interviewees might serve a significant role in a follow-up study about rhetoric of diagrams.

In conclusion, although I was able to make some claims based on the findings of this study, I have learned that I cannot fully answer the main research question, “what rhetorical significance do viewers assign to diagrams on the basis of the formal qualities of

diagrammatic elements or configurations?” I also have realized that I need to gather more data in order to better address the main question. Nevertheless, through this study, I have learned that studying the rhetoric of diagrams, especially studying the relationship between formal qualities of diagrammatic elements or configurations and rhetorical significance, is such a complex issue that involves more factors than I expected when I initiated this study. In that sense, interviewees’ answers to the why question gathered from the second interview are inspiring, since they clearly showed that multiple factors, such as contents of a diagram, unique characteristics of a target audience, context in which a diagram will be used, and visual convention grounded under a given context (such as a science textbook), are all involved within the issue of the rhetoric of diagrams. The findings of this study might serve as a useful starting point for a follow-up study of the rhetoric of diagrams.

Closing the conclusion of this study, I would like to mention implications of the study findings in two respects. First, the study findings have implications for diagram design practice, since they inform diagram designers of some strategies that can be adopted in their design practices. For example, when they attempt to design diagrams in order to persuade university students or similar groups of people on issues of global warming, they might employ some of the diagrammatic elements or configurations to which interviewees assigned rhetorical significance on the basis of their formal qualities. The study findings may also inform diagram designers of some interesting tendencies shown by many interviewees. First, many interviewees recognized the sampled diagrams as being divided into two groups, data-driven diagrams composed of geometric images, such as x-y axes, lines, bars, and etc. and do not contain pictures versus image-driven diagrams that contain many pictures or realistic

images. Second, many interviewees identified the diagrammatic elements based on size difference, such as “pictogram size” and “decrease in area size on a map” more frequently than others.

The study findings have significant implications for the central theoretical frameworks that underpin the study, such as visual argument and the rhetoric of neutrality. Through the rhetorical analysis, I showed that some of the sampled diagrams are visual arguments, and also demonstrated that visual argument was a useful concept for identifying diagrammatic elements and configurations to which interviewees are likely to assign rhetorical significance. Especially, out of the total 56 sampled diagrams, specific types of diagrams, such as line graphs and bar graphs, best fit the concept of visual argument that I constructed for the context of diagram, since they contained propositions (subject + verb) that could be easily reconstructed to arguments. Those diagrams function as visual arguments at two different levels. First, as I discussed earlier with the notion of diagrammatic enthymeme, diagrams visualize something to argue for their own veracity through transparency strongly attached to them. At this level, diagrams are visual arguments for their own neutrality. Second, as shown through the rhetorical analysis of the sampled diagrams, each diagram has its own argument composed of a proposition and a reason, such as “sea surface temperature has been falling.” Although the rhetorical analysis focused on analyzing the second level argument, diagrams make not only arguments composed of a proposition and a reason, but also arguments about their own neutrality.

The study findings have significant implications for the notion of the rhetoric of neutrality as well. For example, the fact that interviewees assigned rhetorical significance to

“line graph as a type” and “bar graph as a type” under the context of a science textbook only implies that they assigned objective, neutral, and scientific meanings to the line graphs and the bar graphs. This finding provides empirical corroboration for the notion of the rhetoric of neutrality that I tried to explore through this study. Follow-up studies of the same topic will enable us to further explore the notion of the rhetoric of neutrality.

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APPENDICES

Appendix 1. Institution Review Board Approval

North Carolina State University is a land-grant university and a constituent institution of The University of North Carolina

**Office of Research
and Graduate Studies**

NC STATE UNIVERSITY

Sponsored Programs and
Regulatory Compliance
Campus Box 7514
2701 Sullivan Drive
Raleigh, NC 27695-7514

919.515.7200
919.515.7721 (fax)

From: Joseph Rabiega, IRB Coordinator
North Carolina State University
Institutional Review Board

Date: December 2, 2008

Project Title: Rhetorical Intent in Diagrammatic Forms and Viewers' Visual Criticality

IRB#: 616-08-12

Dear Jae Young Lee:

The research proposal named above has received administrative review and has been approved as exempt from the policy as outlined in the Code of Federal Regulations (Exemption: 46.101.b.2). Provided that the only participation of the subjects is as described in the proposal narrative, this project is exempt from further review.

NOTE:

1. This committee complies with requirements found in Title 45 part 46 of The Code of Federal Regulations. For NCSU projects, the Assurance Number is: FWA00003429.
2. Any changes to the research must be submitted and approved by the IRB prior to implementation.
3. If any unanticipated problems occur, they must be reported to the IRB office within 5 business days.

Please provide a copy of this letter to your faculty sponsor.

Sincerely,

Joseph Rabiega
NCSU IRB

Appendix 2. The Sampled Diagrams

DS 1.

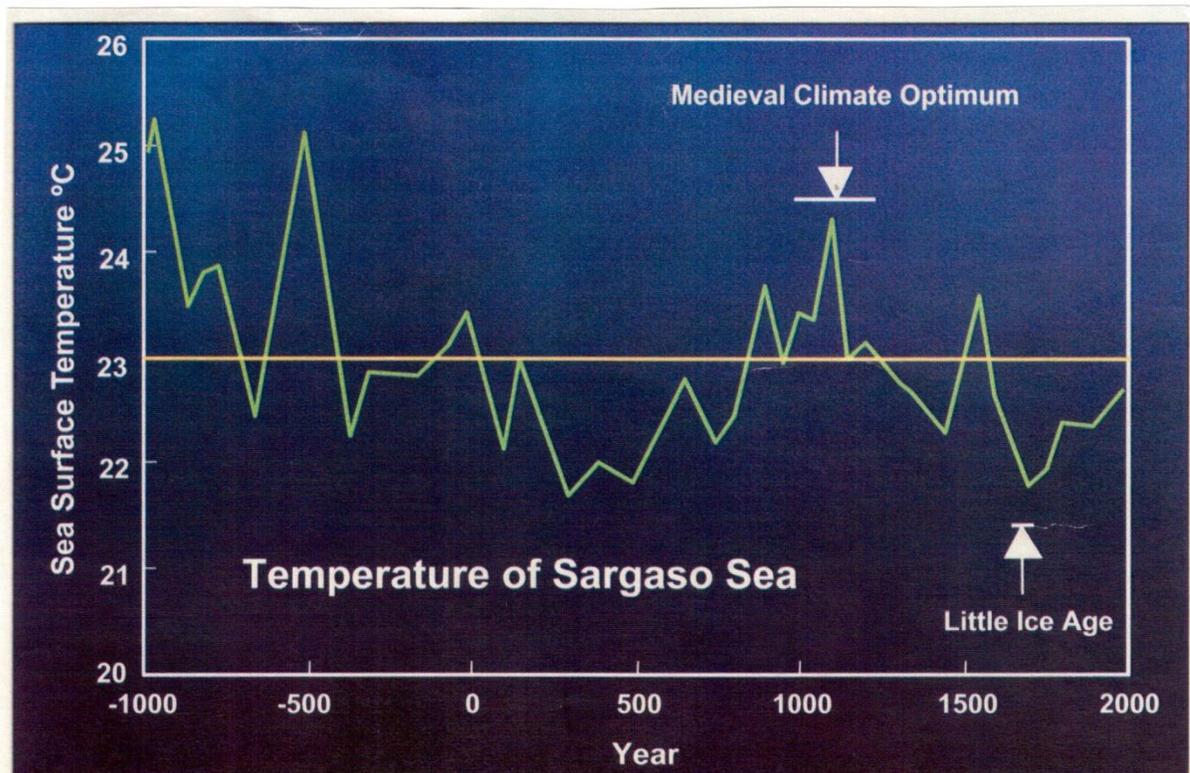


Figure 1: Surface temperatures in the Sargasso Sea, as determined by isotope ratios of marine organism remains at the bottom of the sea, show that today's temperatures are not unusually warm for the last 3,000 years. This data, which is similar to other studies of various world locations, shows a period of higher temperatures 1,000 years ago ("Medieval Climate Optimum") and lower temperatures 300 years ago ("Little Ice Age"). The horizontal line is the average temperature for the 3,000-year period.

DS 2.

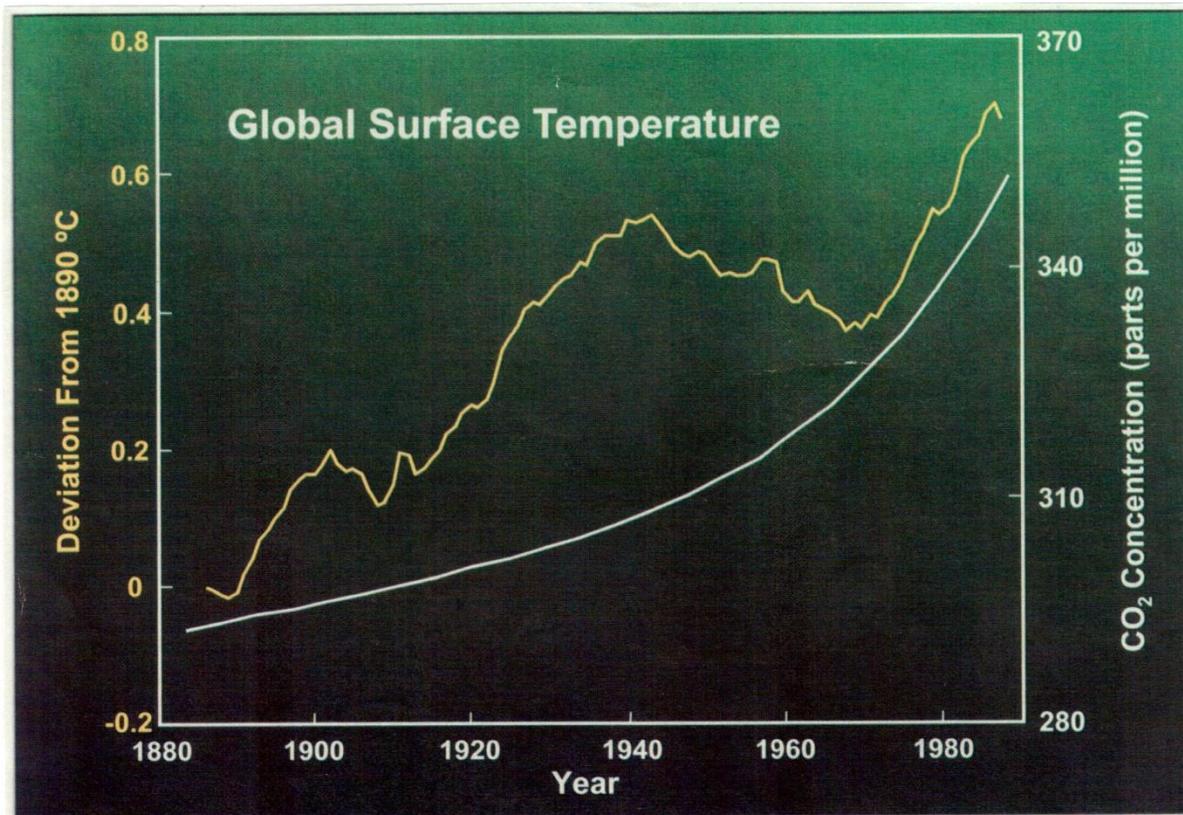


Figure 2: It is true that the amount of CO₂ in the atmosphere has been increasing for more than a century (white line). But this increase could not have caused the slight warming that occurred during the same time period (yellow line, based on 11-year moving average). The presumed effect must come after the cause. Yet, as this Figure clearly shows, most of the temperature increase had occurred by 1940, before most of the CO₂ increase had occurred.

DS 3.

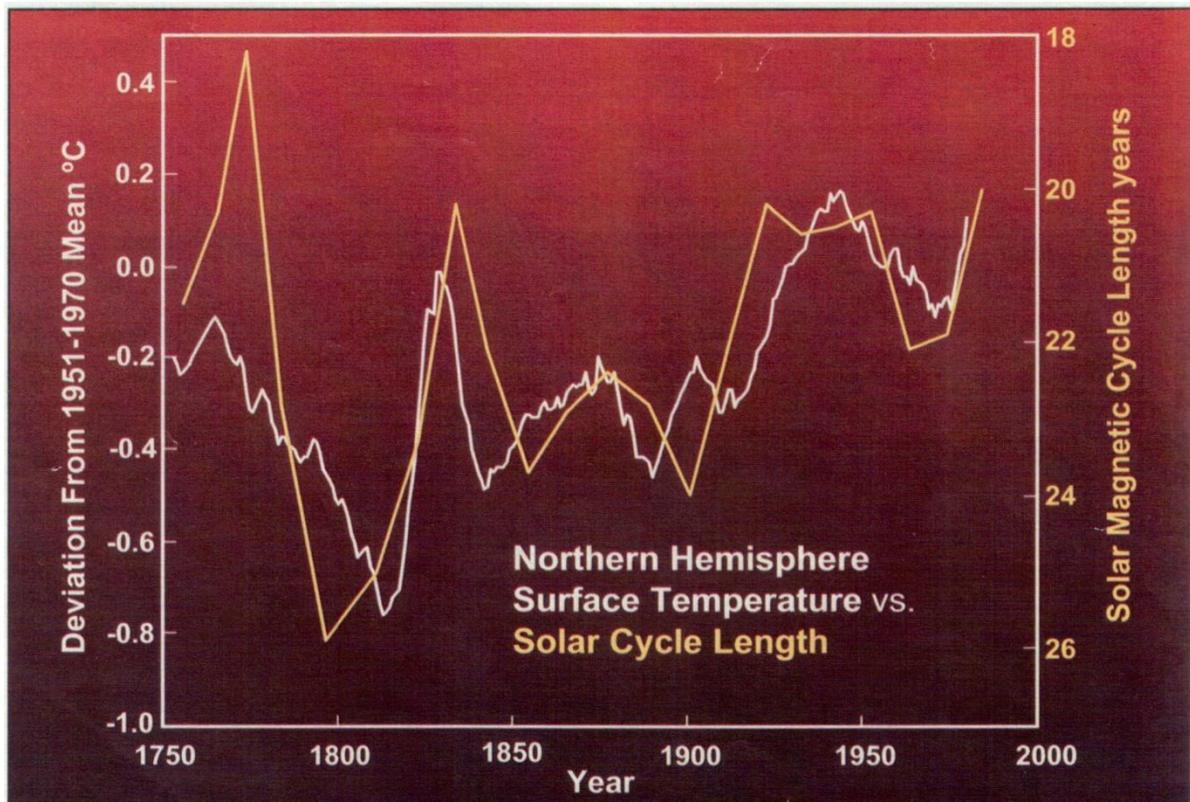
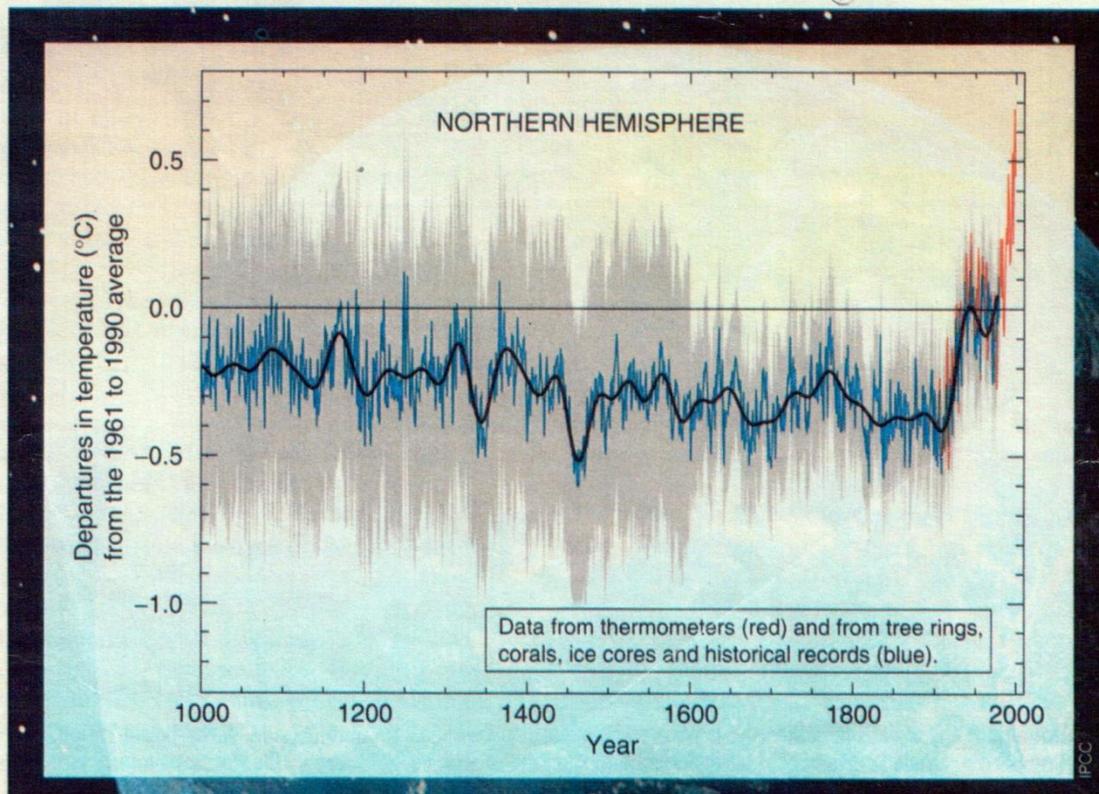


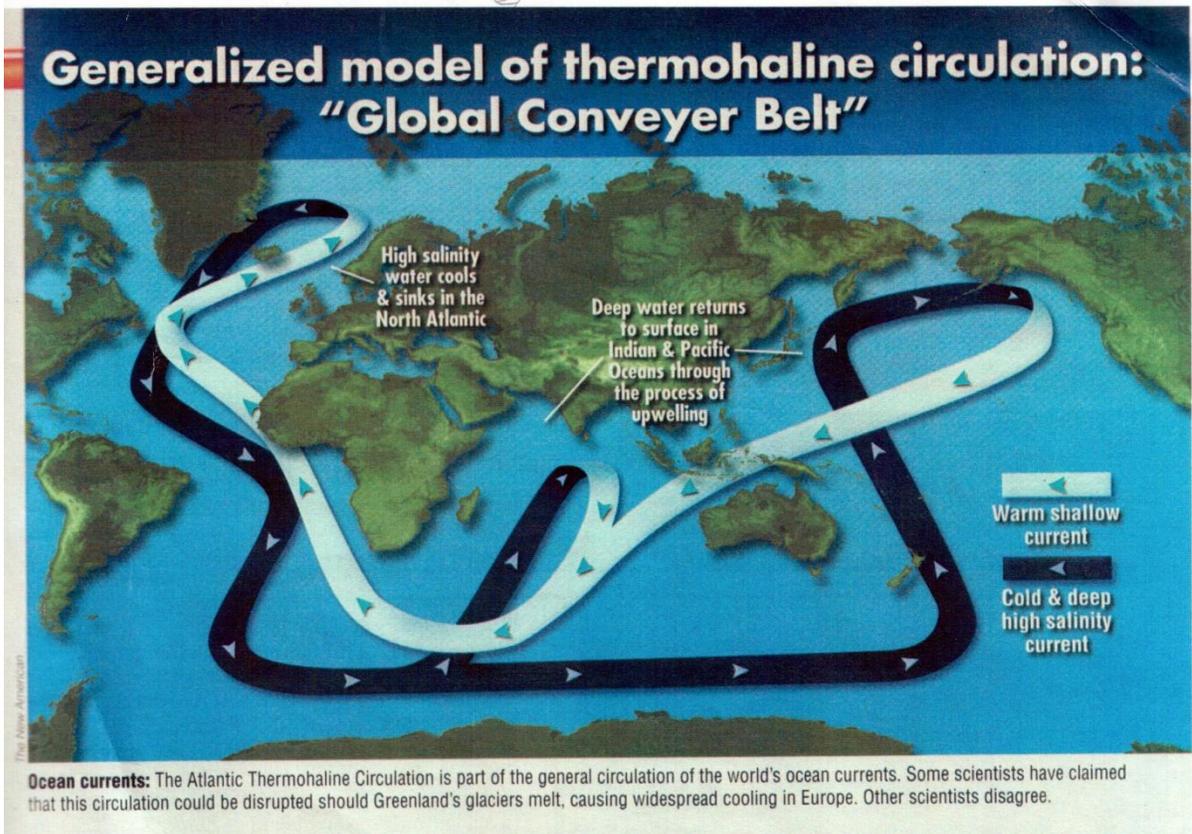
Figure 3: The Northern Hemisphere surface temperature (white line, based on 11-year moving average) closely tracks the solar intensity of the sun (yellow line), as measured by the solar magnetic cycle length; the shorter the magnetic cycle length, the more active, and hence brighter, the sun. This Figure makes quite clear that the ordinary warming and cooling cycle of the sun is the principal controller of the Earth's temperature.

DS 4.

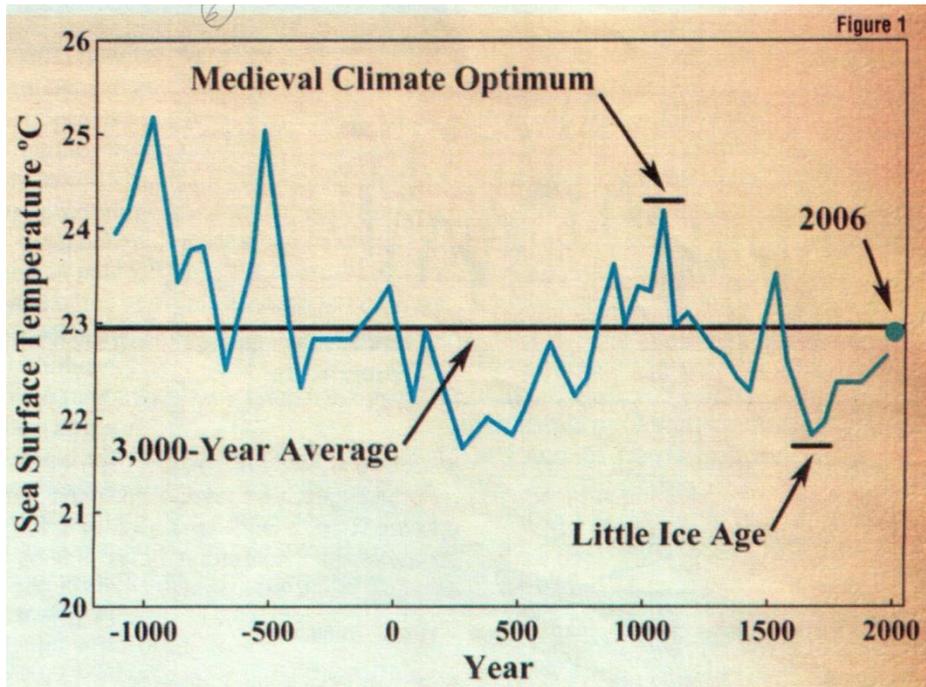
Misleading graph: The so-called "hockey stick" graph shows that temperatures are warmer now than at any time in the past. Other records, however, indicate that the Medieval Warm Period was at least as warm, if not warmer than the present. In fact, Canadian professors Ross McKittrick and Stephen McIntyre have pointed out that the hockey-stick graph was created using flawed statistical methods. (4)



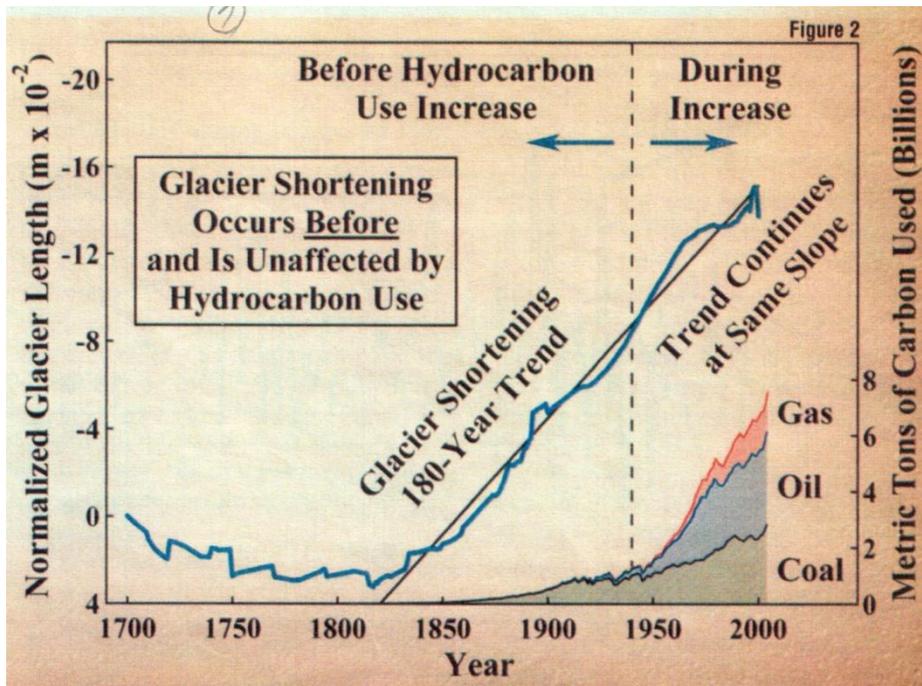
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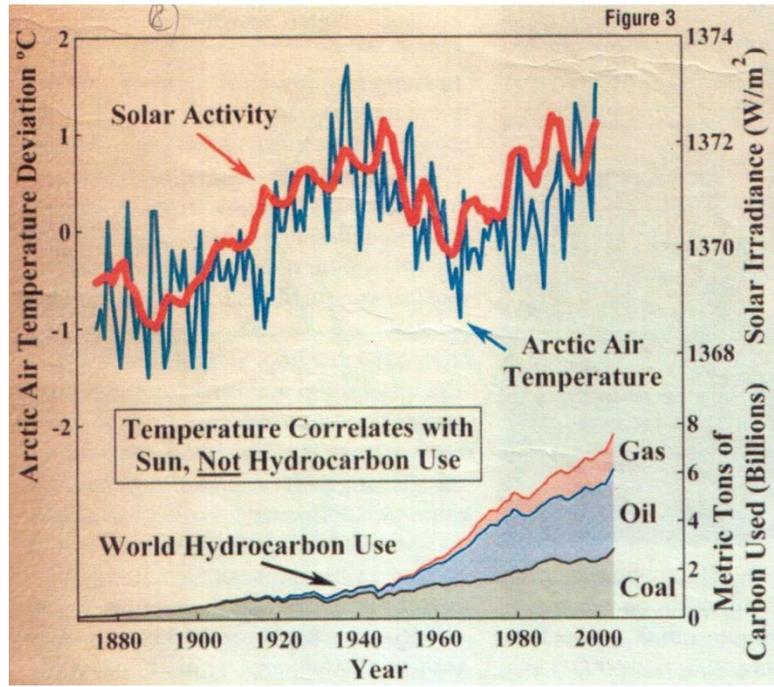
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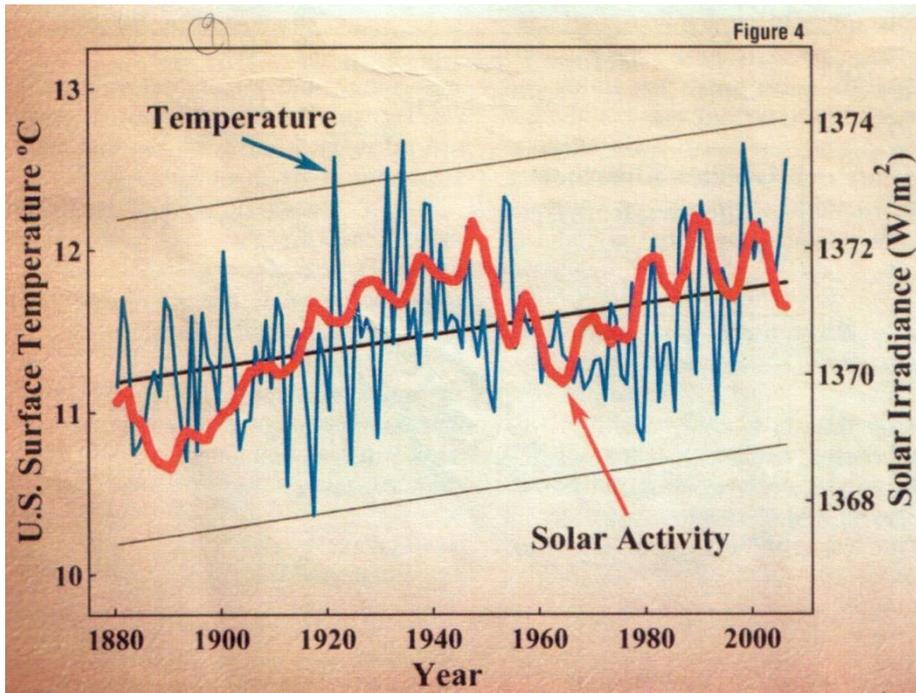
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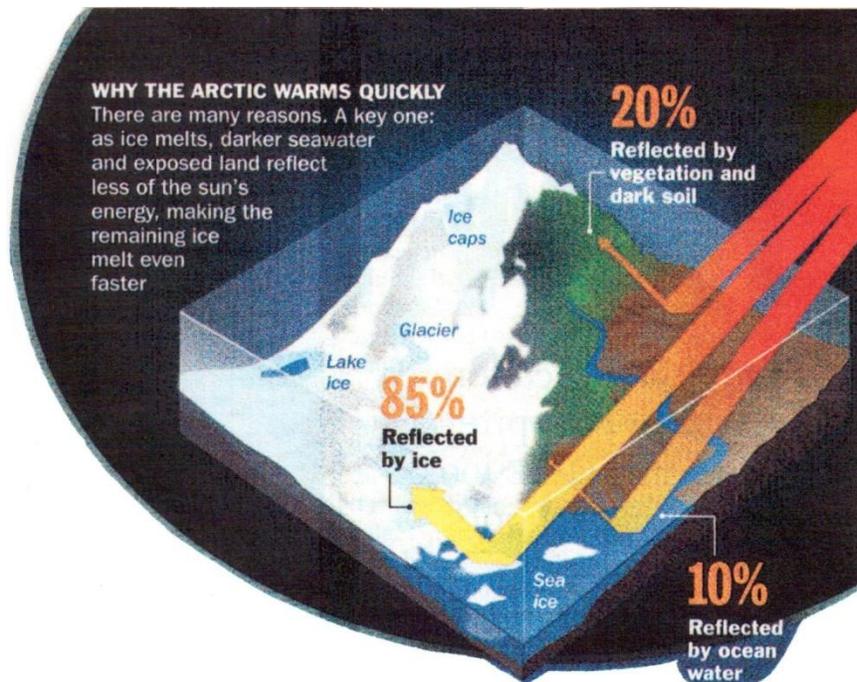
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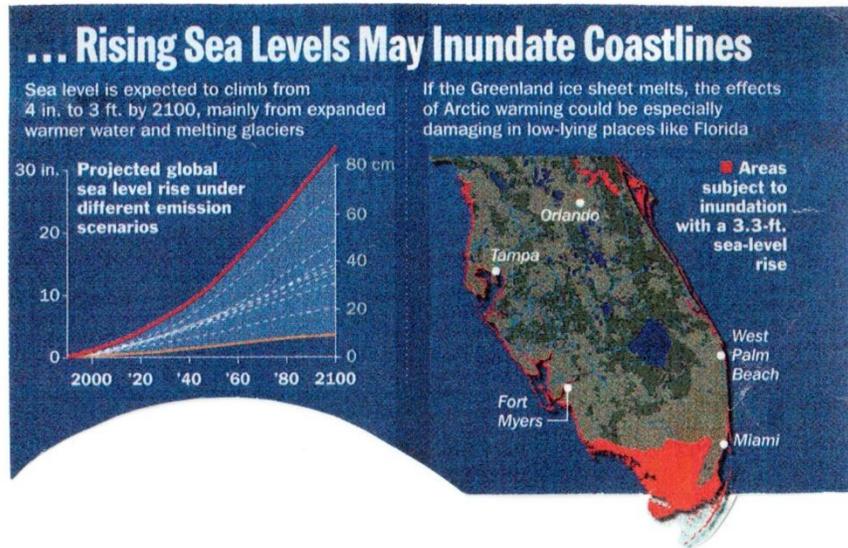
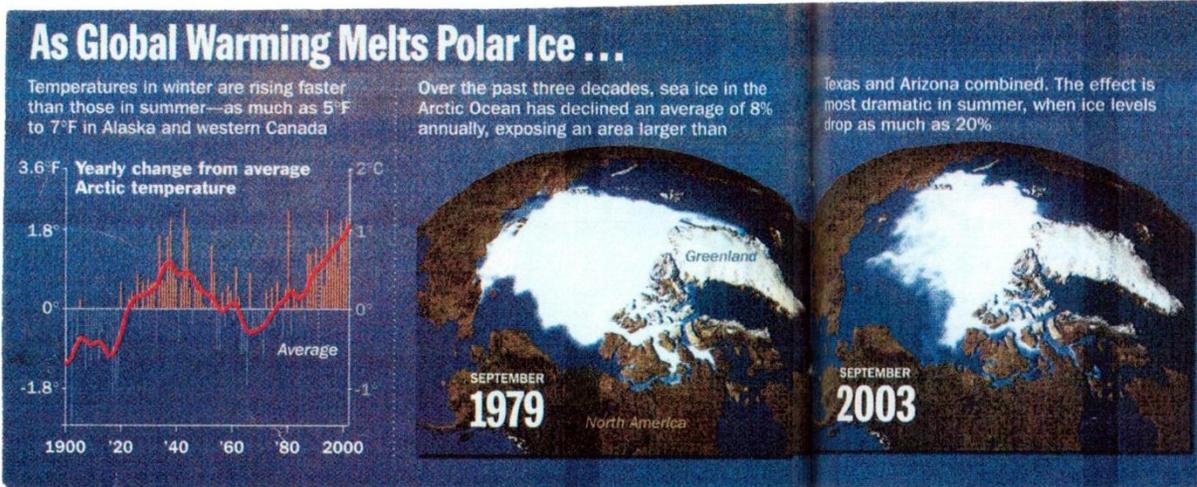
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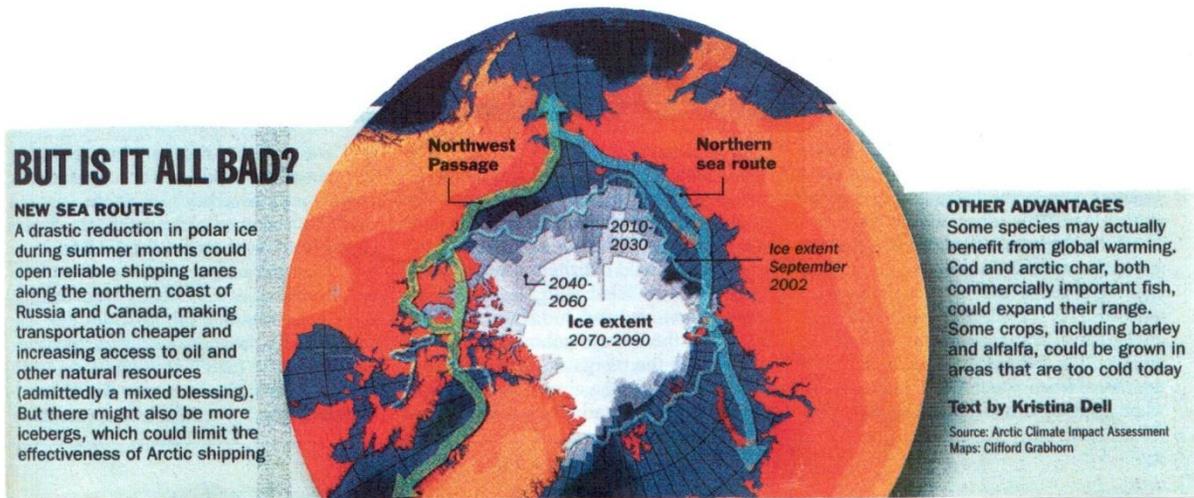


DS 10.



DS 11.





ENVIRONMENT

Is Europe Due For a Big Chill?

By shutting down ocean currents, global warming could actually cool things off

By MICHAEL D. LEMONICK

EVEN IN THE DEAD OF WINTER, LONG stretches of subzero temperatures are pretty rare in London. It may come as a surprise, therefore, to learn that the capital of Britain lies nearly 400 miles farther north than Montreal—or that Paris is farther from the equator than Fargo, N.D. The relatively balmy climate of much of Western Europe suggests that many countries in that region should lie well south of where they actually are, and that's all thanks to the Gulf Stream, a gigantic river of tropical water that flows up and across the Atlantic, warming the waters that lap figuratively against Europe's western shores. Turn it off, and the region's temperatures could plunge disastrously.

That was precisely the specter raised last week when scientists from Britain's National Oceanography Center reported in *Nature* that a component of the oceanic current system that drives the Gulf Stream has slowed by 30% since 1992. The likely, paradoxical cause? Global warming. While climate experts around the world caution that the data are too preliminary to be definitive, "the result," writes University of Hamburg climatologist Detlef Quadfasel in a commentary on the study that also appears in *Nature*, "is alarming."

It's also not entirely unexpected. Back in the 1960s, Wallace Broecker, a geophysicist at Columbia University's Lamont-Doherty Earth Observatory, was trying to understand why temperatures in Greenland had plunged dramatically several times over the past 70,000 years. His theory: fresh water, perhaps from melting glaciers, might have diluted the ocean's salinity, making it harder for cooling water to sink and return southward to pick up more heat. That could shut off the entire "conveyor belt" of water that keeps Europe temperate. It's hard to determine precisely what would have caused such a big thaw 70,000 years back, but we do know that today global warming is causing more meltwater to stream into the North Atlantic from glaciers and older sea ice, which is lower in salt. Could the conveyor belt stop again?

Climate experts are not sure—and some have serious reservations about the new paper—mostly because the observed change is happening too fast. Computer models predict that it should take at least 100 years to weaken the ocean conveyor belt. What's more, nobody was even measuring those currents before 1957. Says Broecker: "We don't know how much the flow bounces around normally."

Clearly, pieces are still missing from the equation, so even the scientists who wrote the study counsel against panic. Rather than be worried, says co-author Stuart Cunningham, "people should be more interested and concerned. The ocean seems to have changed in a large enough way to be detectable." It's something, in other words, to keep an eye on. —*Reported by Michael Bruneau/London*

GLOBAL WARMING
Increased rainfall as well as the melting of sea ice, glaciers and the Greenland ice sheet could add enormous amounts of freshwater to the Atlantic currents, reducing their salinity enough to slow the sinking of cooler water and shut down the heat conveyor.

THE GULF STREAM
As the currents move warm surface water from the equator to the north, the water releases its heat into the atmosphere and cools. That heat loss makes the water saltier and very dense. By the time it reaches north of Iceland and east of Labrador, it becomes dense enough to sink.

SINKING WATER
In wintertime the cold, salty, dense water that originates in the Gulf Stream plunges down into the deep ocean, beginning the return of the conveyor belt. The deep current slowly flows back across the equator and into the Pacific, Indian and Southern oceans.

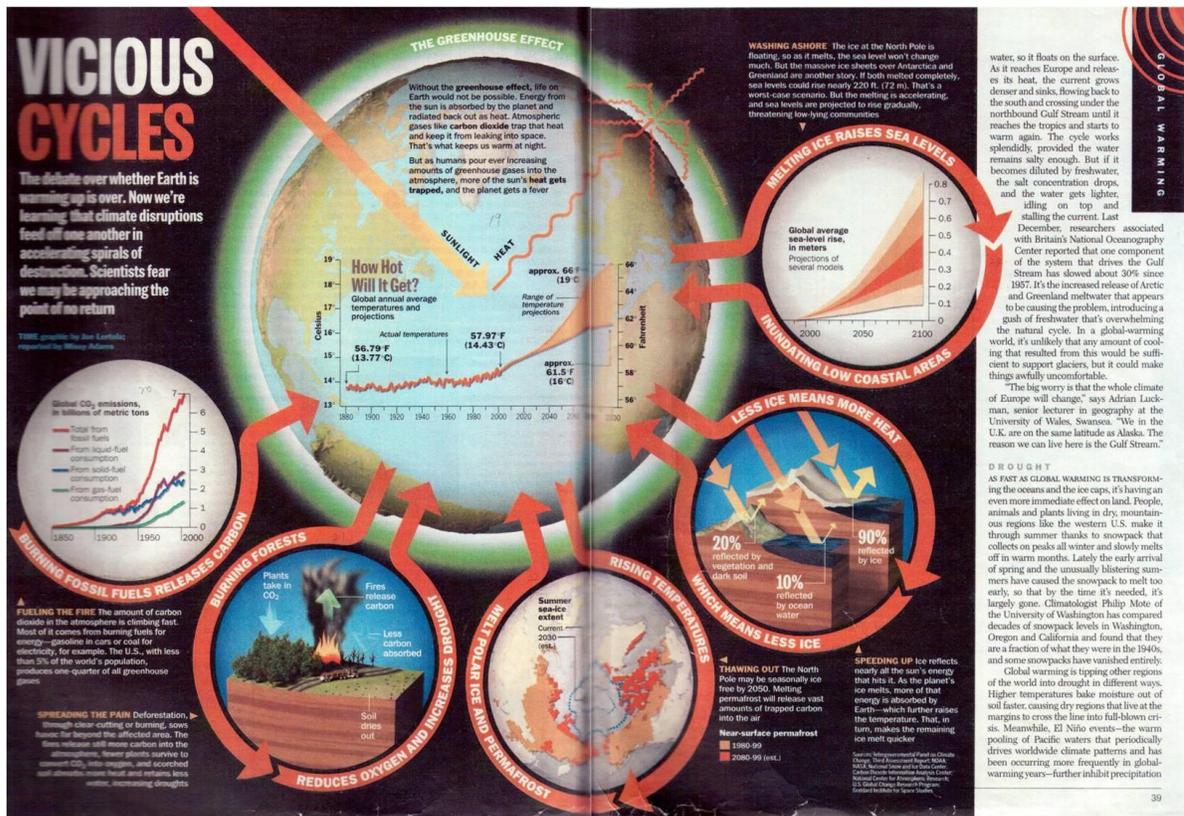
MID-ATLANTIC CIRCULATION
The addition of fresh, less salty water in the northern hemisphere essentially blocks the flow of new warm water from the Tropics. That water heads east and south instead of pursuing the northward part of its normal route.

POOR CIRCULATION
Recent findings suggest that the Atlantic Ocean currents that warm Northern Europe are weakening as a result of global warming and may ultimately mean frigid weather for Europe.

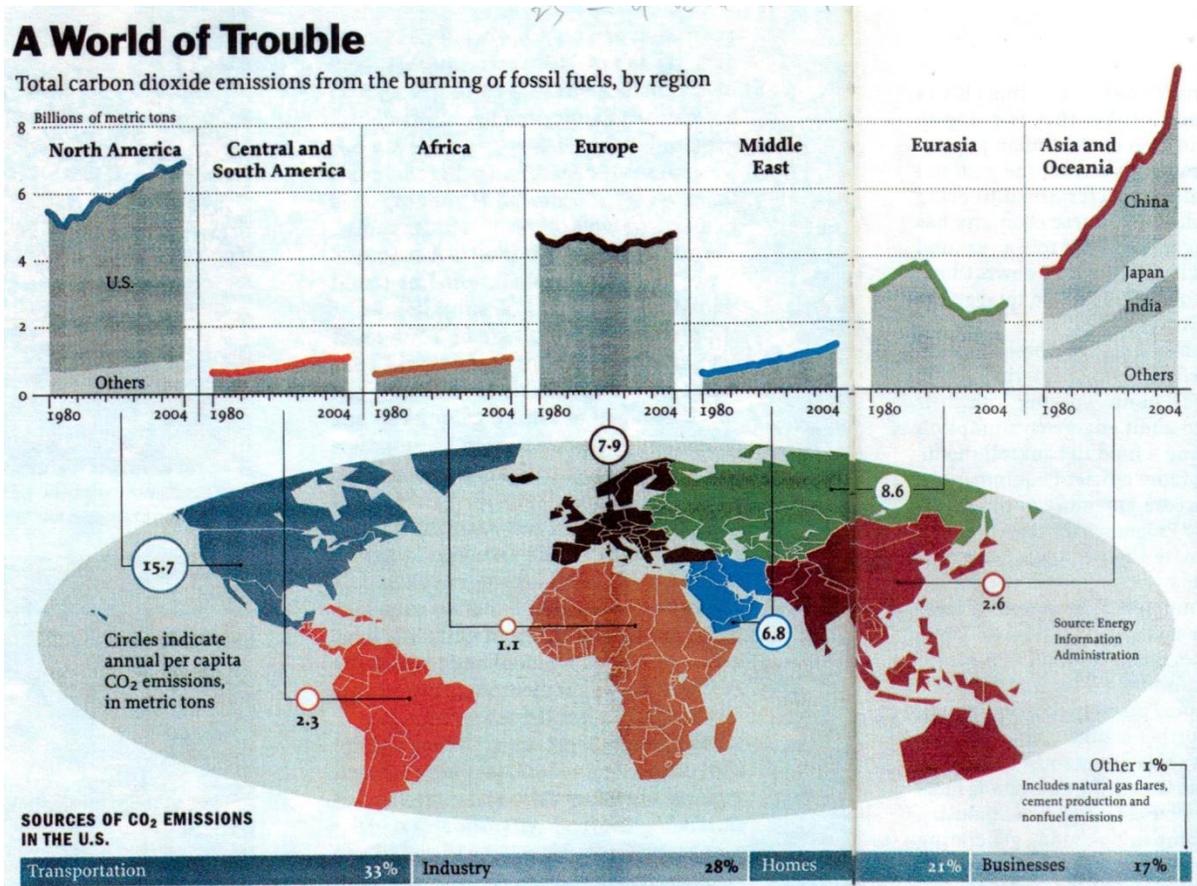
HOW THE MEASUREMENTS WERE TAKEN
In spring 2004, scientists deployed 22 moorings across a strip of the Atlantic about 25° north. Each mooring was equipped with numerous instruments that gathered all types of information, from temperature and salinity to current speed and direction.

Temperature (°F)
40 50 60 70 80

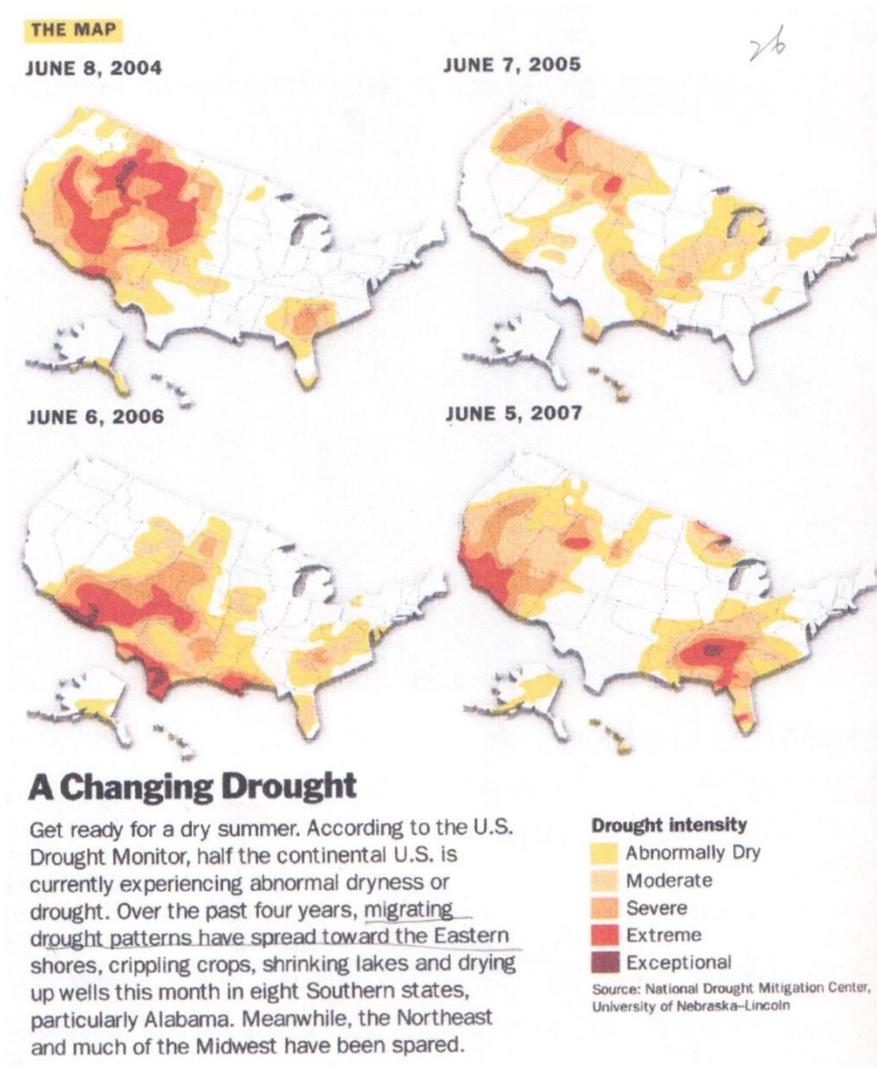
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Source: *Nature*; Professor Harry Bryden, University of Southampton, MAIA, 2007



DS 15.



DS 16.



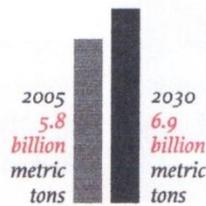
GOING GREEN

Cutting a Climate Deal. What the big players want at the upcoming talks on global warming

The science has been settled. Now we have to do something about global warming. From Dec. 3 to 14 on the island of Bali, environmental ministers will meet to try to hash out the start of a successor to the Kyoto Protocol, which expires in 2012. The world will be represented, but the shape of any deal will be decided by a few major carbon emitters.
—BY BRYAN WALSH

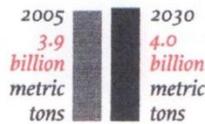
U.S.

President George W. Bush has long been against Kyoto and any form of mandatory carbon-emissions cuts, making the U.S. a roadblock at past U.N. climate meetings. But a Democratic Congress and increasing green action at the local level could mean a more cooperative U.S. at Bali.



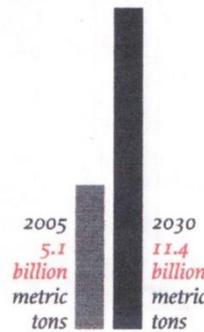
European Union

Supporters of Kyoto, the E.U. nations have worked aggressively to control their greenhouse-gas emissions and have even established a carbon market. E.U. Environment Commissioner Stavros Dimas will look to establish hard caps on carbon emissions—at least for developed nations—as part of any deal.



China

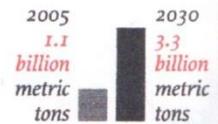
The bad news: China is set to break all records on greenhouse gases, yet its leaders refuse to consider emissions caps. The good news: they might be willing to adopt some lesser limits, like mandatory improvements in energy efficiency.



India

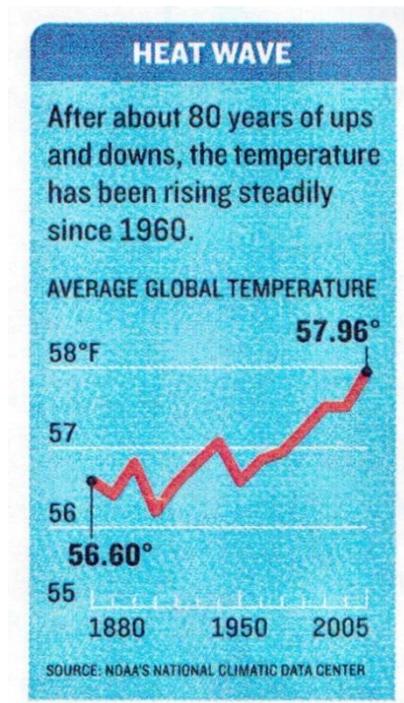
Like Beijing, New Delhi insists that since developing countries have just begun putting greenhouse gases in the atmosphere, they shouldn't be required to accept mandatory limits. Unfortunately, the vast majority of future carbon will come from developing countries, but don't expect India—where only half the nation is on the grid—to budge.

Source: International Energy Agency



GETTING HOTTER
Carbon emissions, especially in the developing world, will increase drastically unless restrained

DS 18.

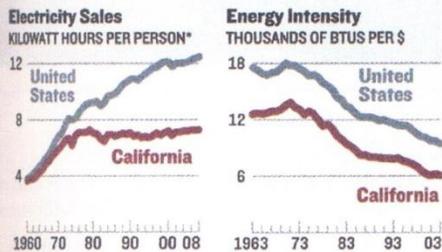


Turning Down the Heat Out West

Long in the vanguard of ecofriendly policies, California has been one of the country's greenest states for decades. With Governor Schwarzenegger at the helm, the state is further boosting its environmental performance.

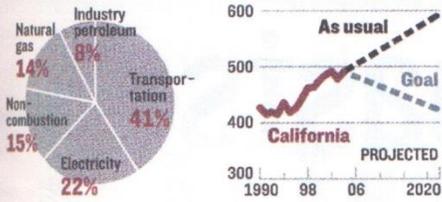
The Trailblazer

While the nation's appetite for electricity has steadily grown, California has become a model of energy efficiency.



CLEAN MACHINE: Arnold under the hood of an Ethanol FlexFuel Chevy Tahoe

CO₂ Emissions in California Come From Many Sources



How California Is Facing the Future

By 2020, California wants to reduce emissions by 174 million metric tons—more than a third of its 2004 levels—from multiple areas. A breakdown of how the state intends to do it:

Clean cars: 28 percent of the total reduction will come from a more efficient auto fleet. Beginning in '09, the state wants to improve fuel economy by 33 percent.

Forestry: A range of programs aimed at sequestering carbon dioxide in forests will make up 20 percent of California's targeted cuts.

Energy efficiency: Initiatives such as frequent updates of efficiency standards for

buildings will help lower emissions by nearly 30 million metric tons.

Smart growth: 26 million tons will be cut with condensed land use and growth in areas with public transportation, which allow residents to reduce car usage.

Renewable energy: California wants at least 20 percent of its electricity to come from renewable sources, making up 10 percent of the targeted reductions.

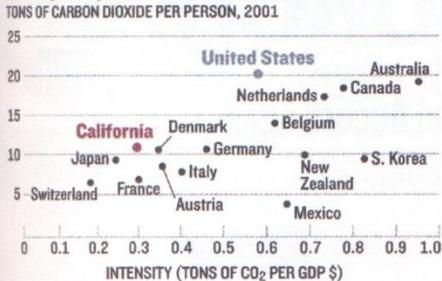
Power plants: New gas-fired plants are cleaner than the old ones. As California upgrades its stock, clean power will account for 9 percent of its cuts.

Other: 4 percent will come from other initiatives, such as capturing methane released from landfills and reducing leaks in oil and gas systems.

—MARC BAIN

*2005 TO 2008 ARE FORECAST DATA.
SOURCES: ARTHUR H. ROSENFELD, CALIFORNIA ENERGY COMMISSION; UNIV. OF CALIF., BERKELEY; PACIFIC GAS & ELECTRIC CO.

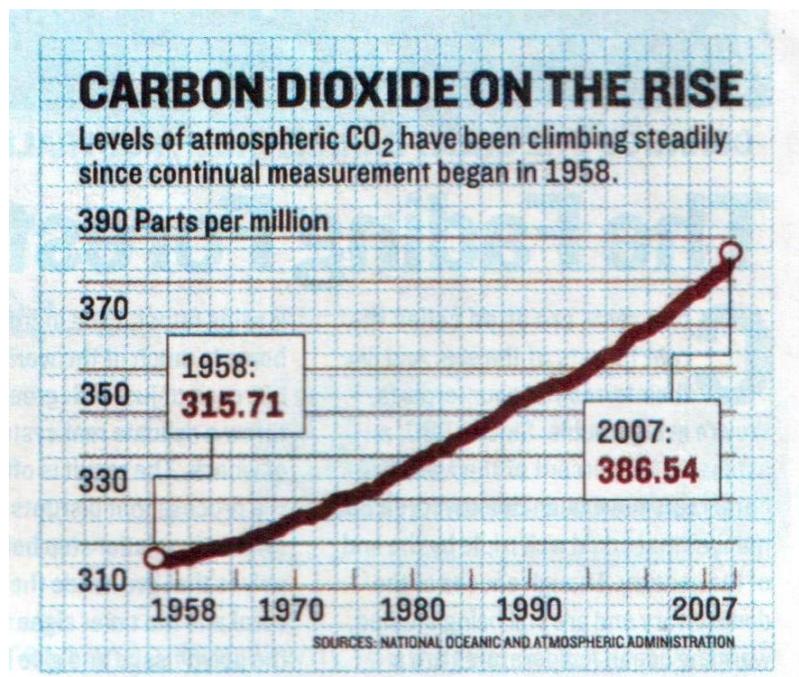
Global per Capita Carbon Dioxide Emissions



MIKE BAER—THE SACRAMENTO BEE, ICONS BY CHRISTOPH BLUMRICH

APRIL 16, 2007 NEWSWEEK 57

DS 20.



ENVIRONMENT AND LEADERSHIP

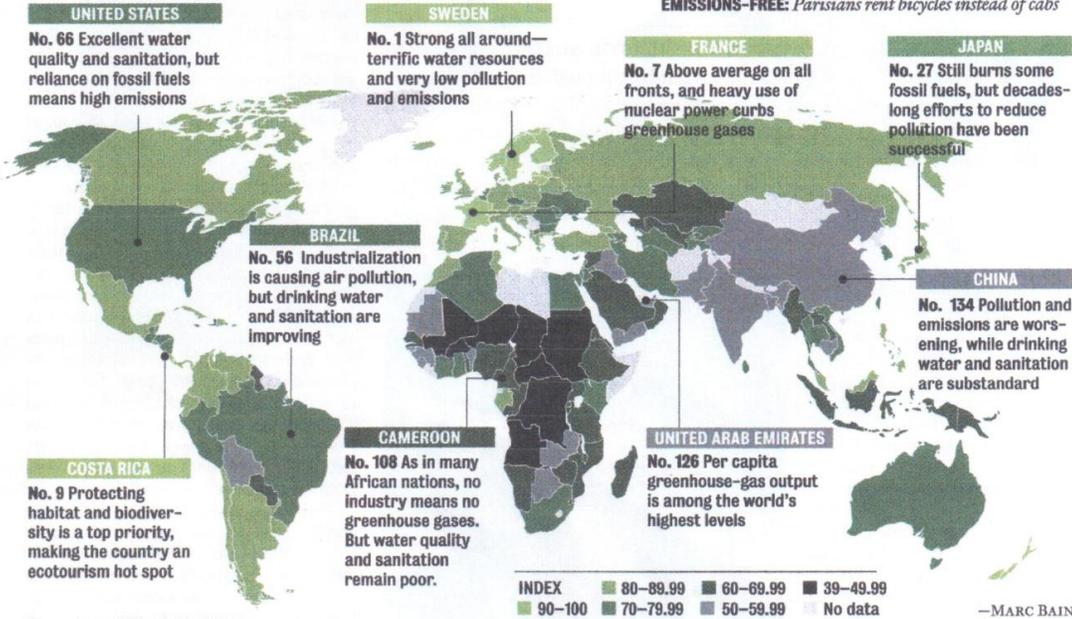
Green and Not So Green

With the help of Yale and Columbia universities and LinkedByAir, NEWSWEEK compiled this index of environmental performance, which scores countries on factors including greenhouse-gas emissions, quality of water resources and habitat protection. A look at those nations that have excelled, and those lagging behind:



EMISSIONS-FREE: Parisians rent bicycles instead of cabs

Leaders and Loafers COUNTRY/RANK



Country Rankings*

RANK	COUNTRY	SCORE
1.	Sweden	94.8
2.	Switzerland	94.7
3.	Norway	94.5
4.	Lithuania	92.0
5.	Latvia	91.8
6.	Finland	91.6
7.	France	91.2
8.	New Zealand	90.6
9.	Costa Rica	90.5
10.	Denmark	89.6
11.	Iceland	89.3
12.	United Kingdom	88.9
13.	Colombia	88.9



RECYCLE: Tires in Jakarta



REUSABLE: Bags in China

14.	Germany	88.7
15.	Austria	88.7
16.	Portugal	88.5
17.	Slovenia	88.4
18.	Ecuador	88.4
19.	Hungary	88.3
20.	Ireland	87.5
21.	Italy	86.9
22.	Slovakia	86.9
23.	Canada	86.8
24.	Croatia	86.6
25.	Malaysia	85.7
26.	Spain	85.6
27.	Japan	85.6

RANK	COUNTRY	SCORE
28.	Dominican Rep.	85.5
29.	Cuba	84.9
30.	Russia	84.7
31.	Estonia	84.6
32.	Venezuela	84.3
33.	Chile	85.7
34.	Albania	83.6
35.	Luxembourg	83.5
36.	Panama	83.4
37.	Belarus	83.3
38.	Tunisia	83.0
39.	Greece	82.9
40.	Georgia	82.6



SOLAR: Power in Seville



COAL: East German CO₂

41.	El Salvador	82.4
42.	Mauritius	81.3
43.	Poland	81.3
44.	Argentina	81.2
45.	Mexico	80.9
46.	Bosnia & Herz.	80.5
47.	Gabon	80.4
48.	Morocco	80.2
49.	Philippines	80.1
50.	Turkey	80.1
51.	Uruguay	80.1
52.	Netherlands	79.7
53.	Cyprus	79.5
54.	Australia	79.4

RANK	COUNTRY	SCORE
55.	Iran	79.1
56.	Brazil	79.1
57.	Macedonia	79.0
58.	Ukraine	78.8
59.	Romania	78.5
60.	South Korea	78.3
61.	Peru	78.3
62.	Belgium	78.3
63.	Armenia	78.2
64.	Israel	78.2
65.	Bulgaria	77.9
66.	United States	77.0

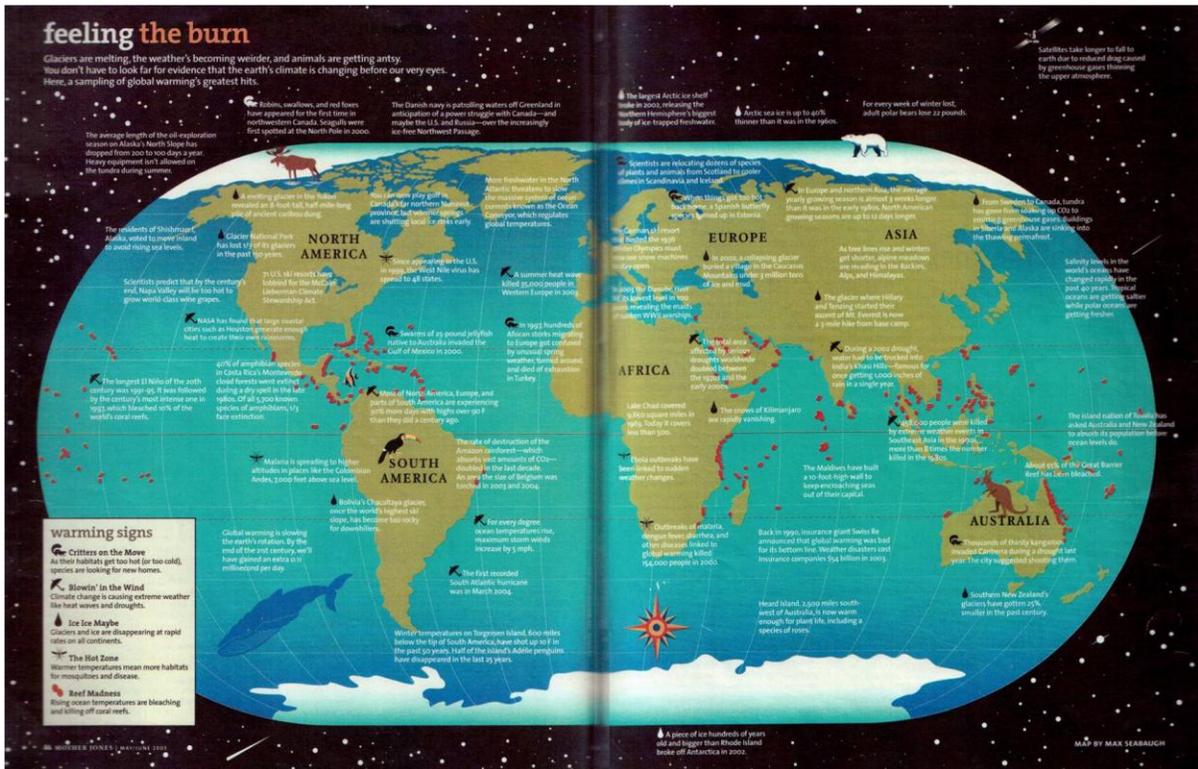
*FULL LIST NOT SHOWN. GRAPHIC BY STANFORD KAY—NEWSWEEK



HYBRID: London tour bus

CLOCKWISE FROM TOP: THOMAS COEX—AFP-GETTY IMAGES, MATT CARDY—GETTY IMAGES, SEAN GALLUP—GETTY IMAGES, DENIS DOYLE—GETTY IMAGES, CHINA PHOTOS—GETTY IMAGES, JEWEL SAMAD—AFP-GETTY IMAGES

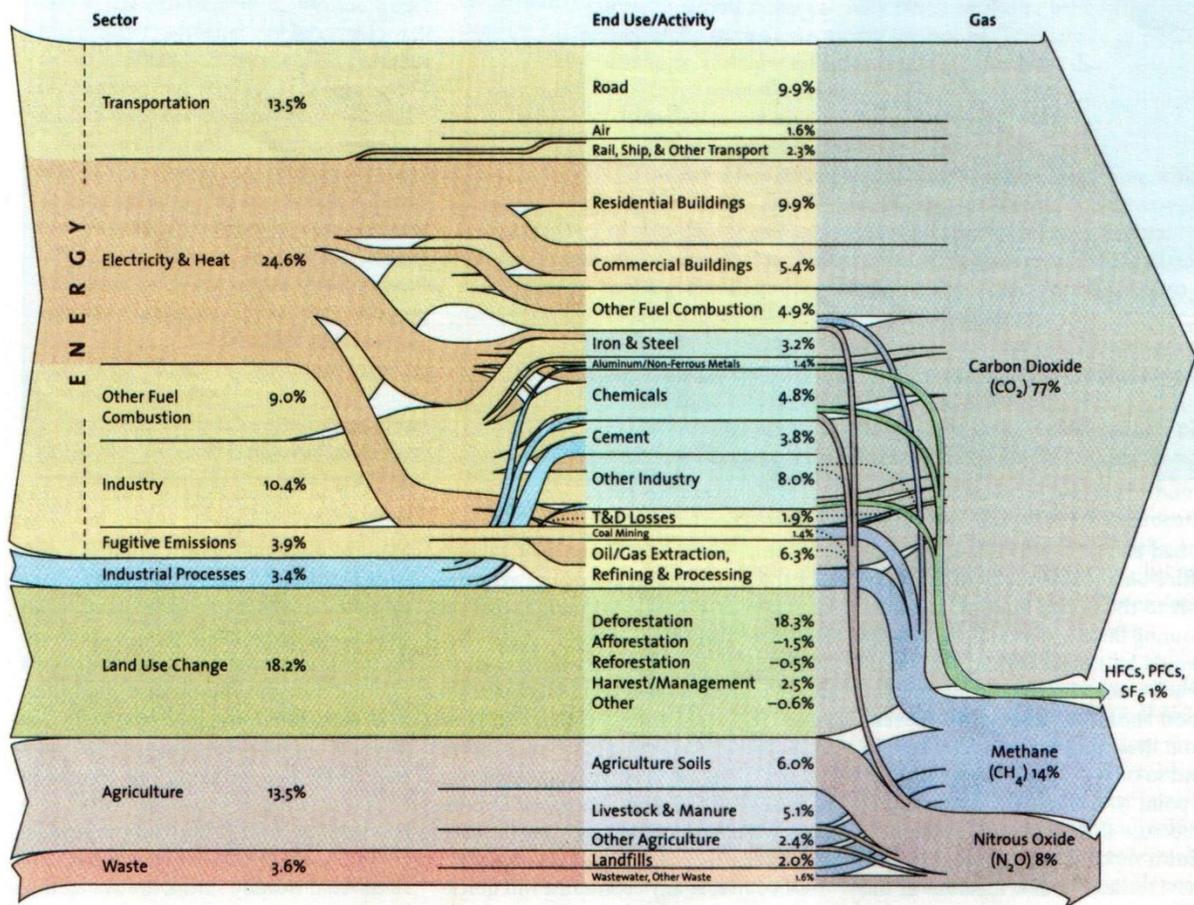




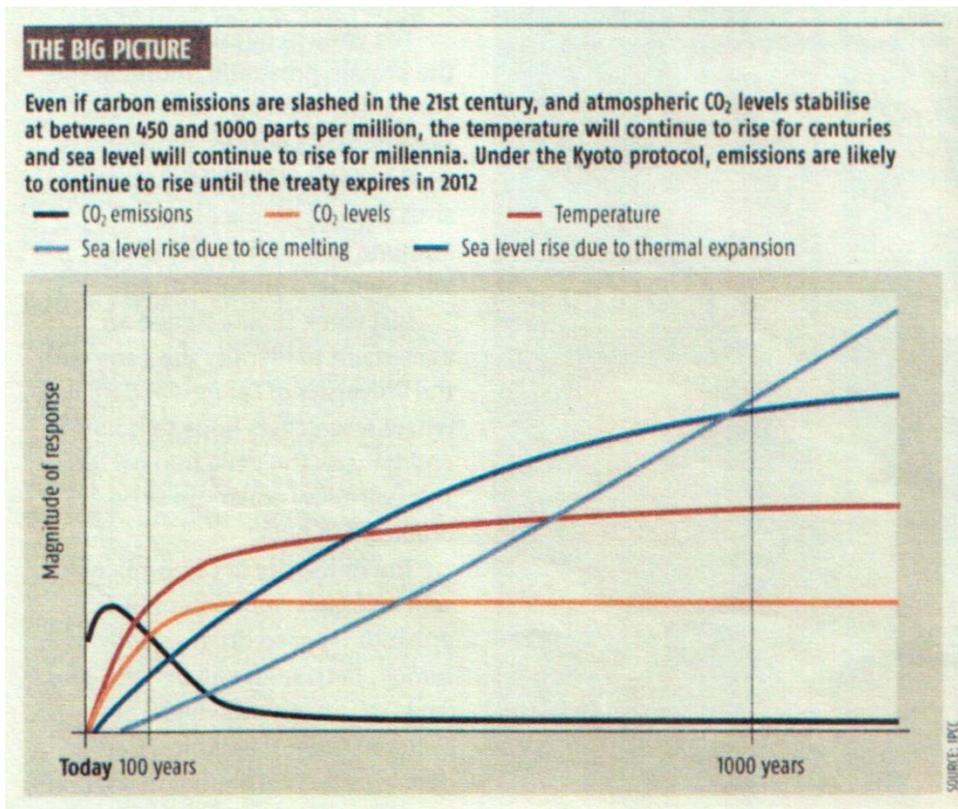
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sins of emission

WHERE THE WORLD'S GREENHOUSE GASES COME FROM



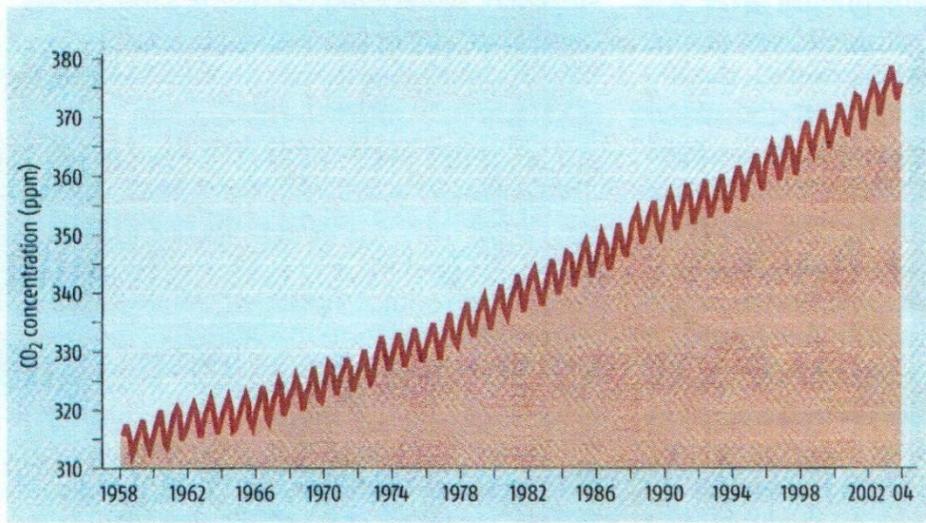
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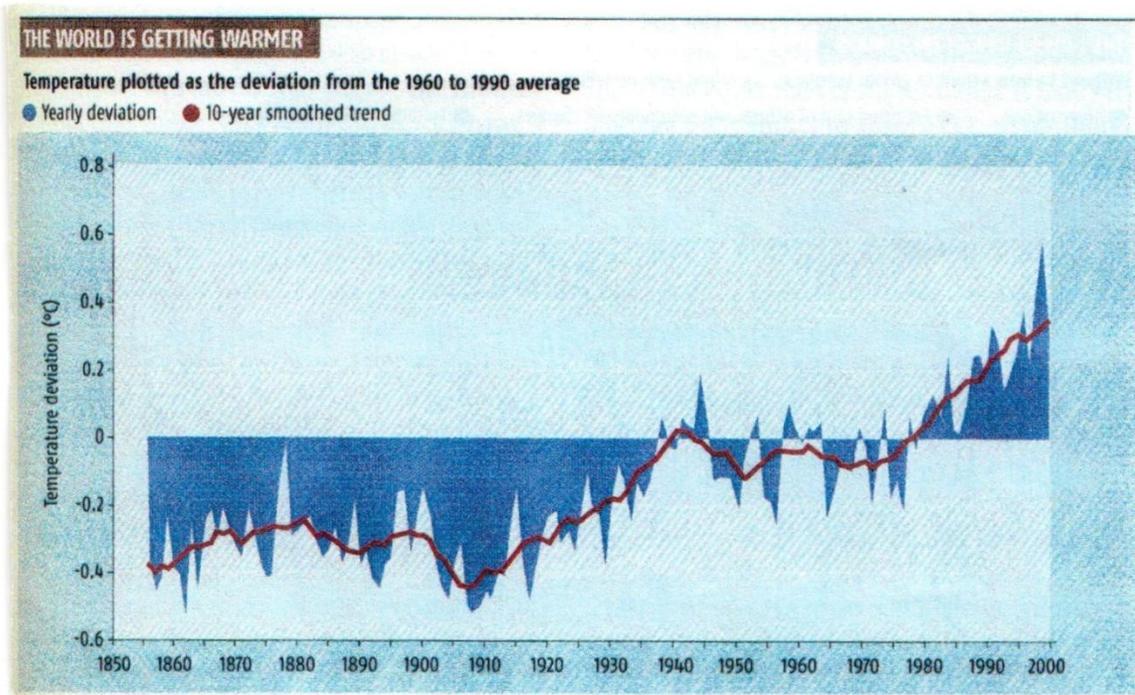
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CARBON DIOXIDE'S RELENTLESS RISE

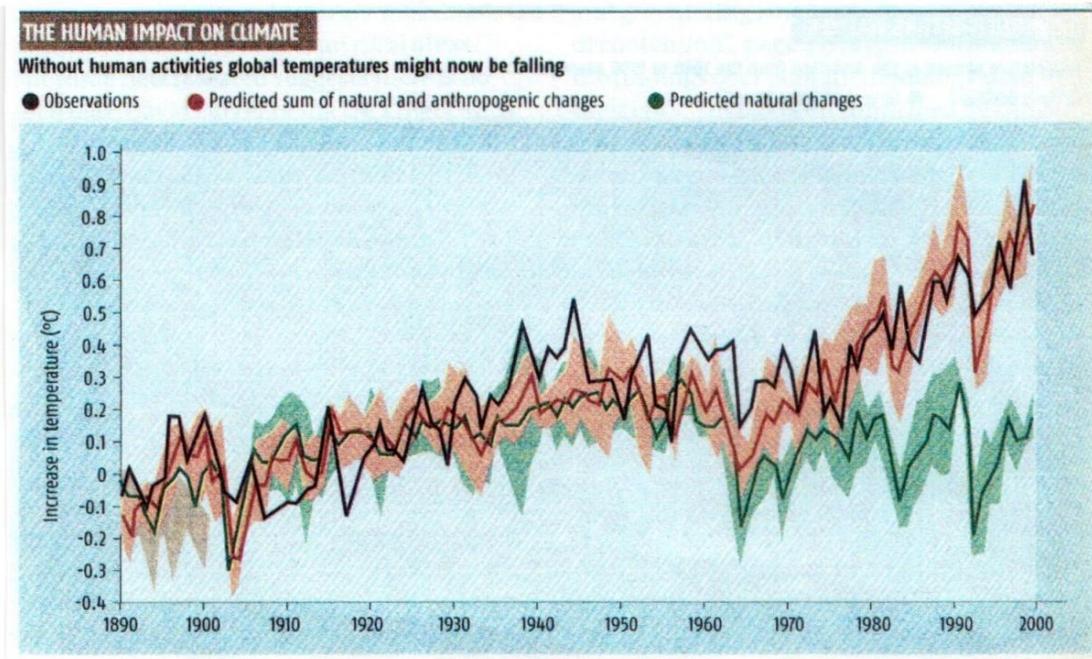
Atmospheric CO₂ concentrations are now 35 per cent higher than pre-industrial levels, as indicated by readings taken at Mauna Loa in Hawaii



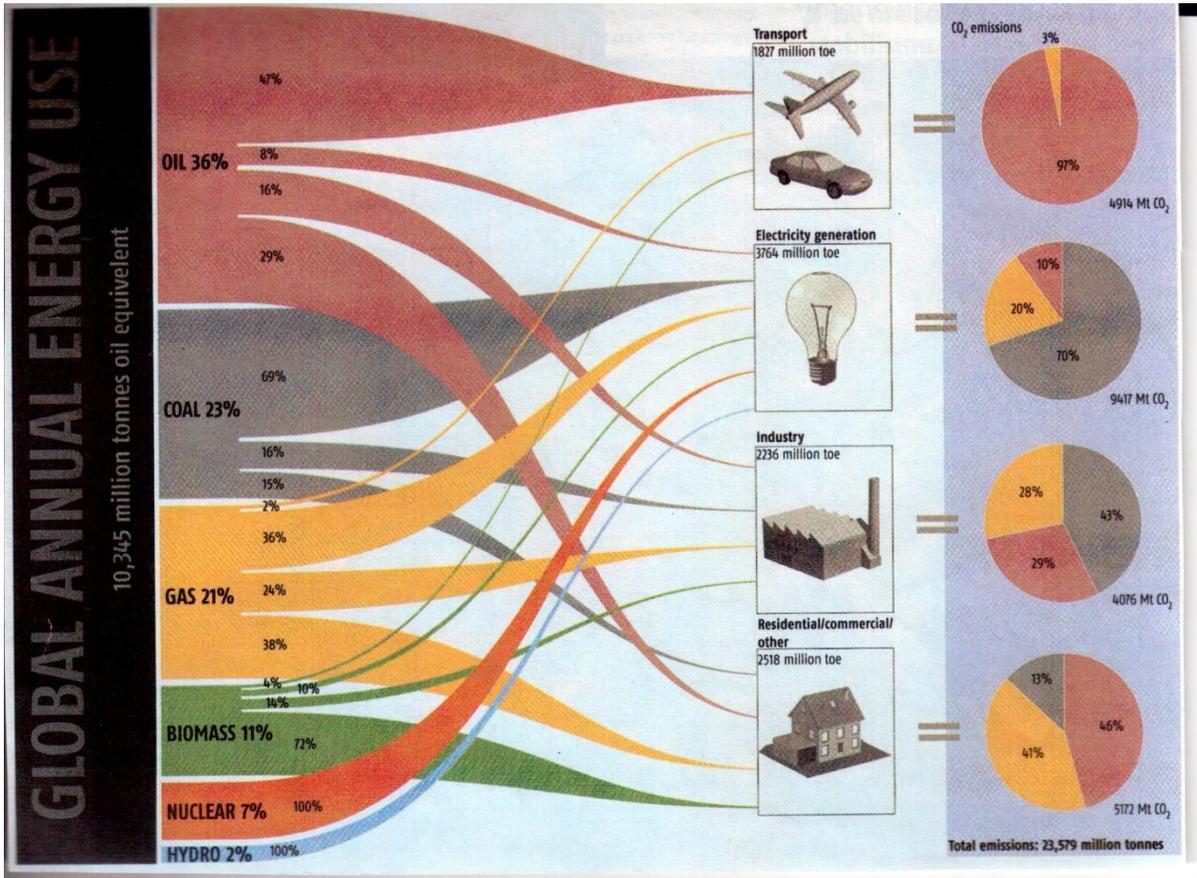
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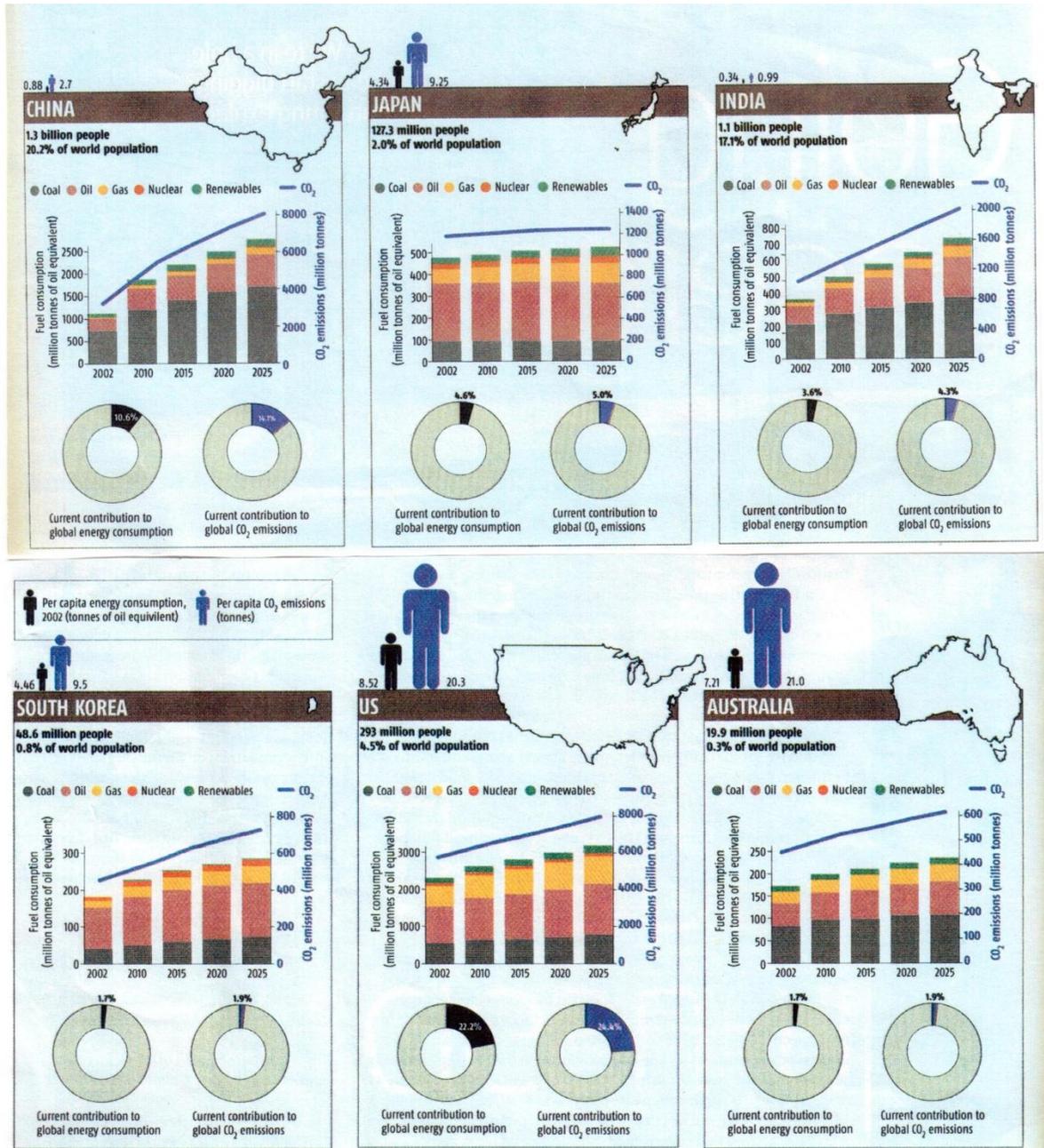
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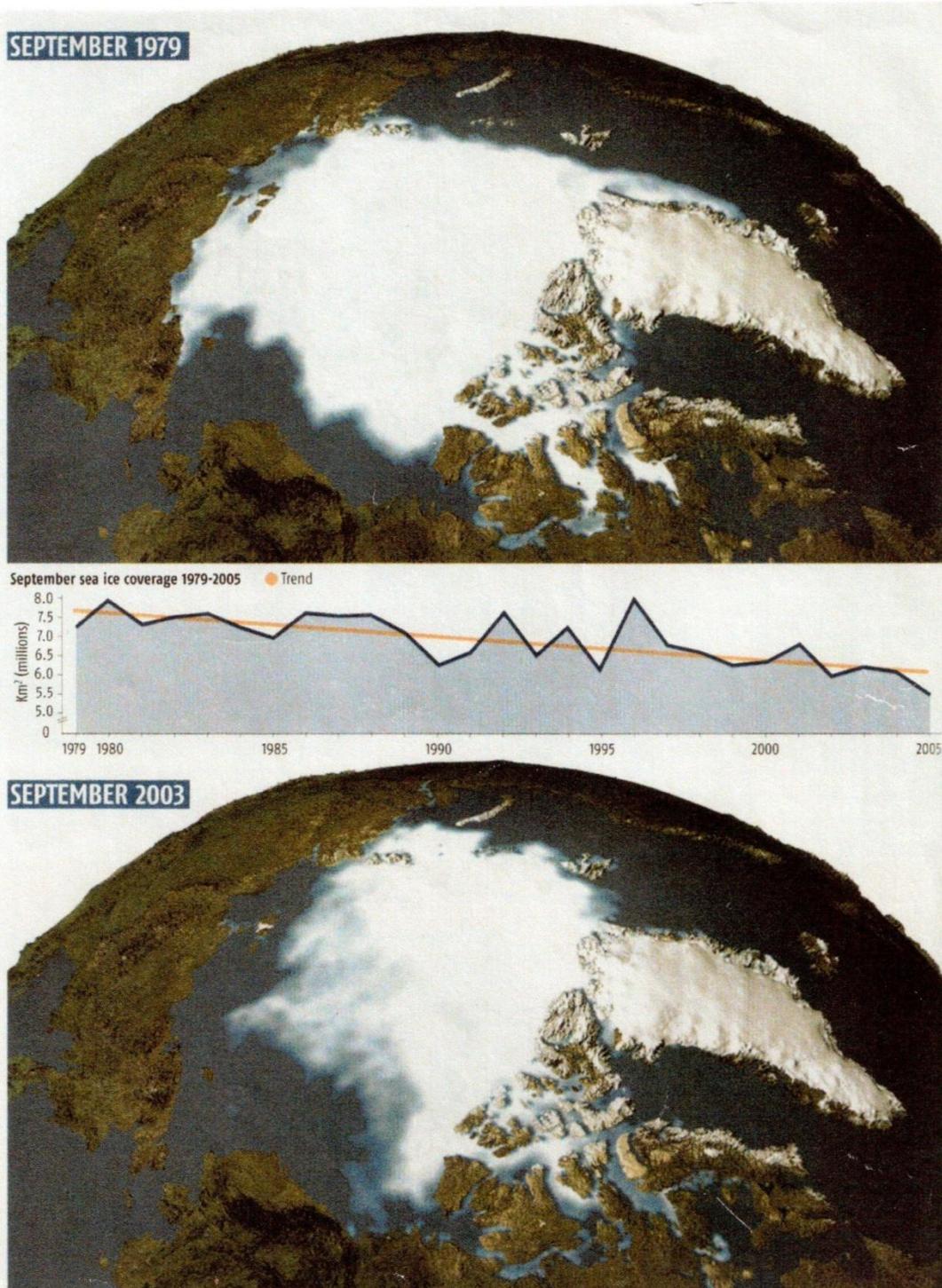


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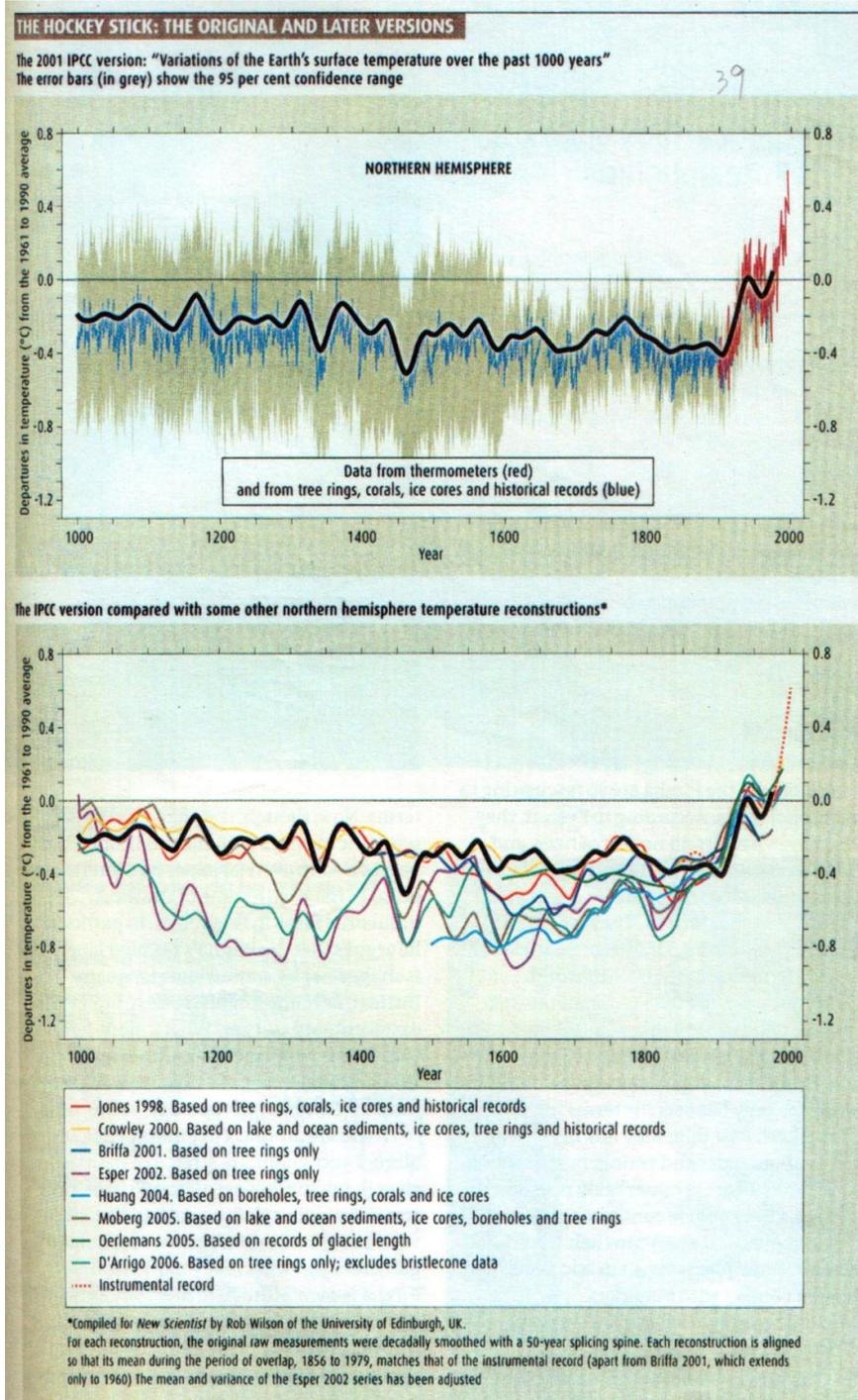


In the original diagram, the six countries are horizontally in a row.

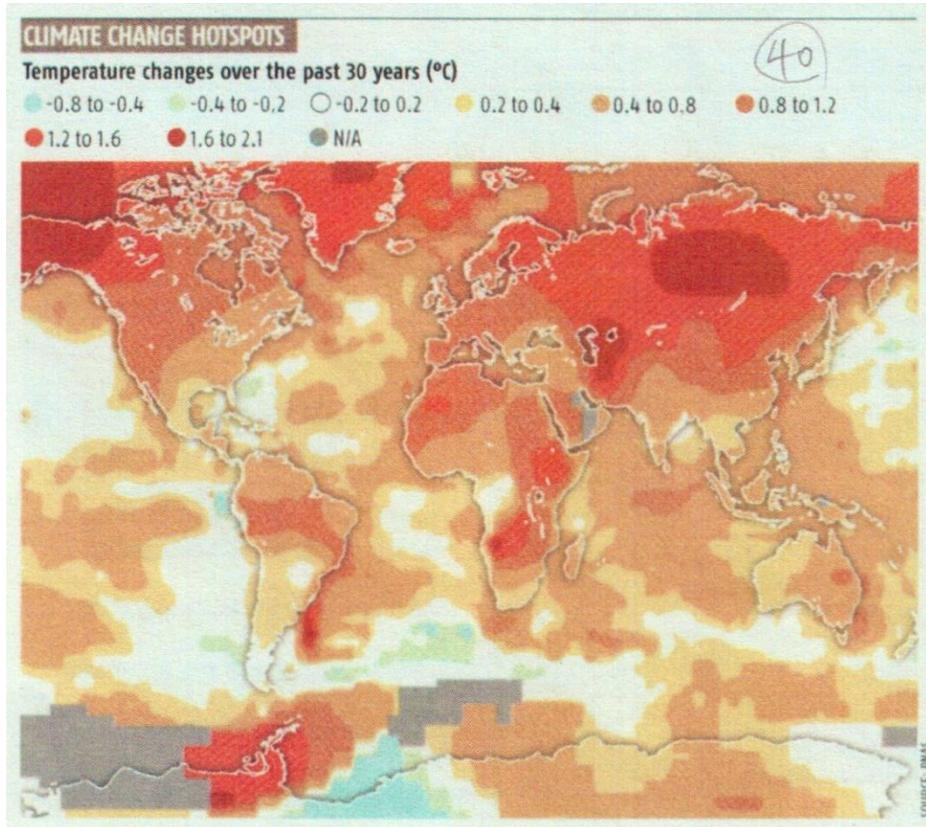
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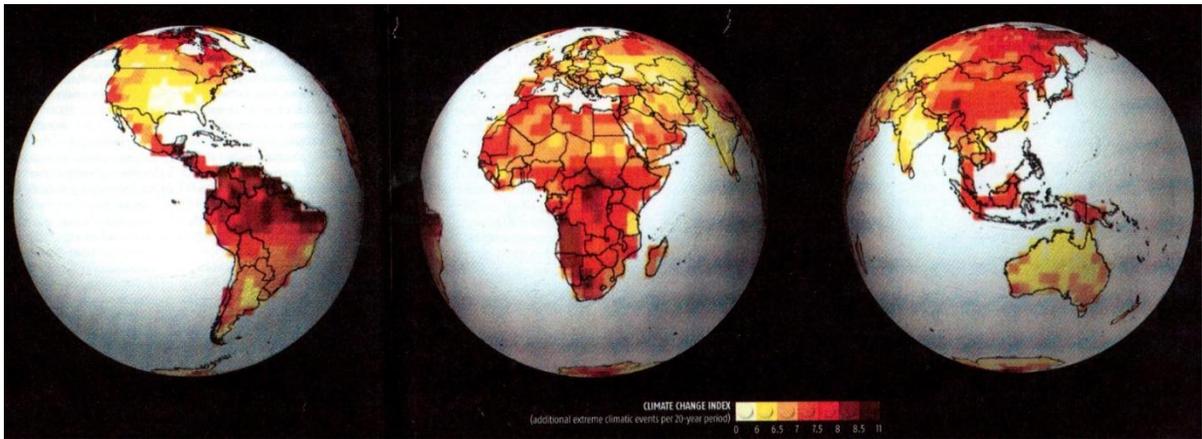
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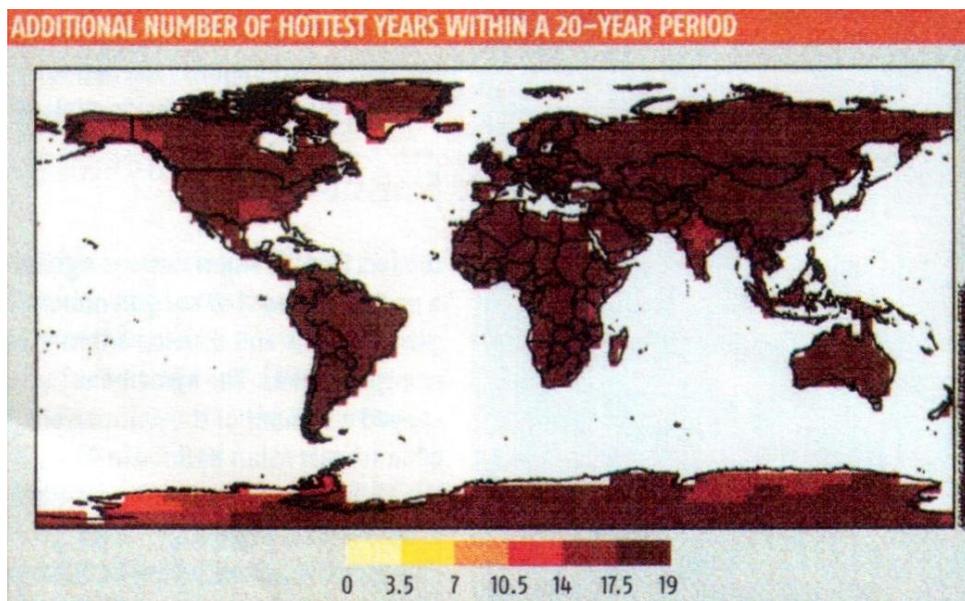
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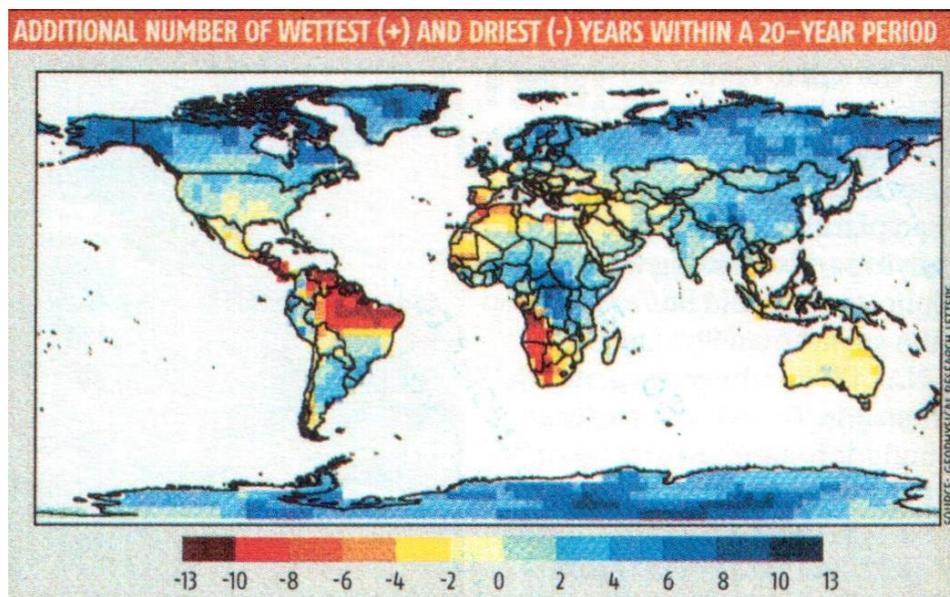
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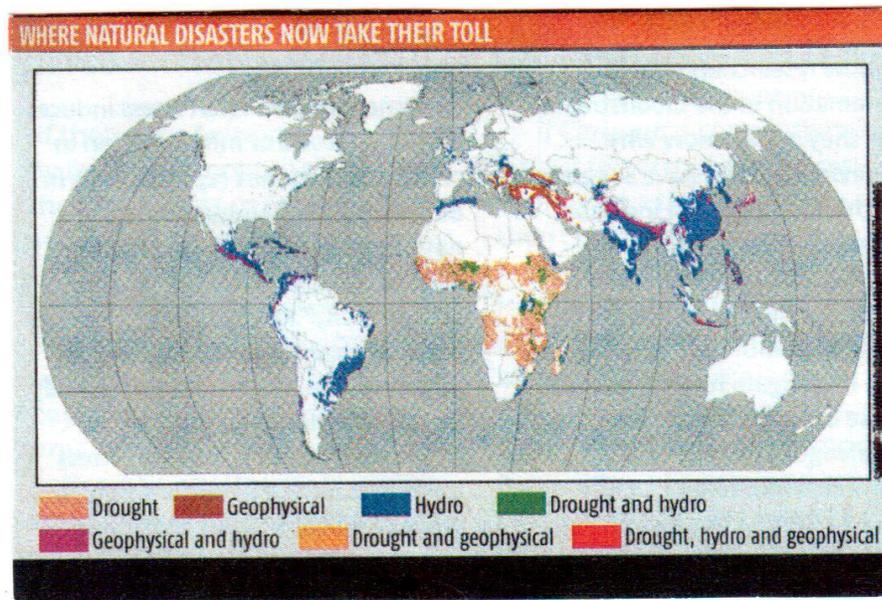
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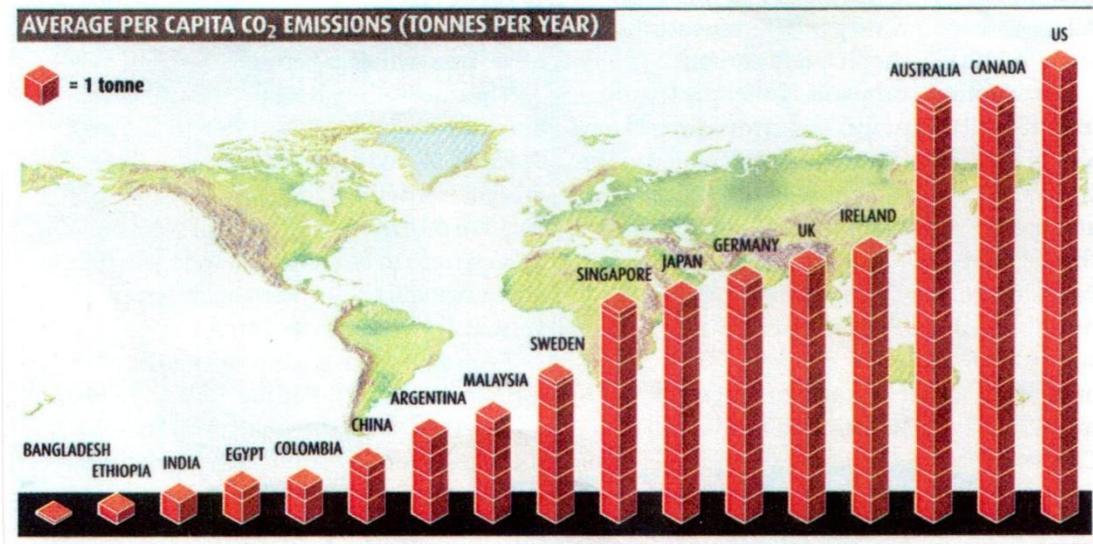
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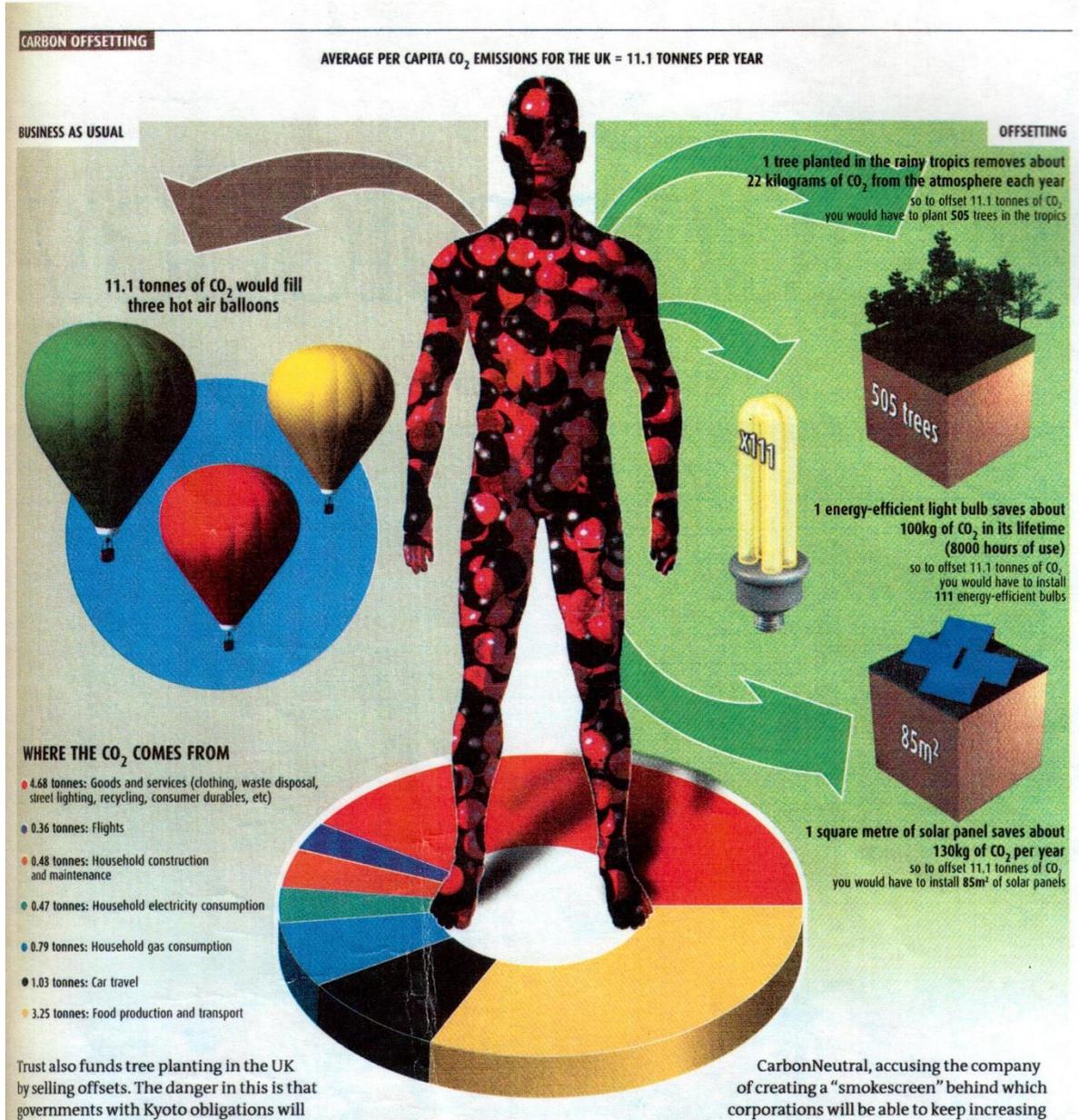
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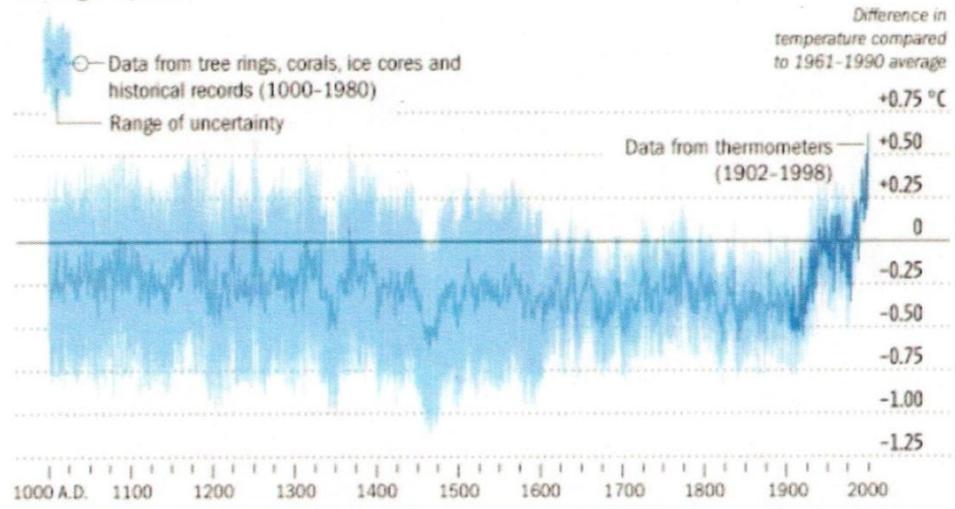
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DS 40.

Climate Icon

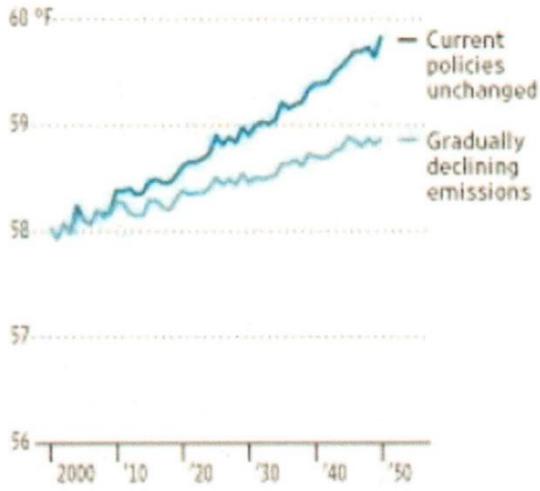
A reconstruction of average surface temperatures in the Northern Hemisphere was the highlight of a 2001 U.N. report. The graph's hockey-stick shape is cited as evidence that fossil-fuel emissions are warming the planet.



DS 41.

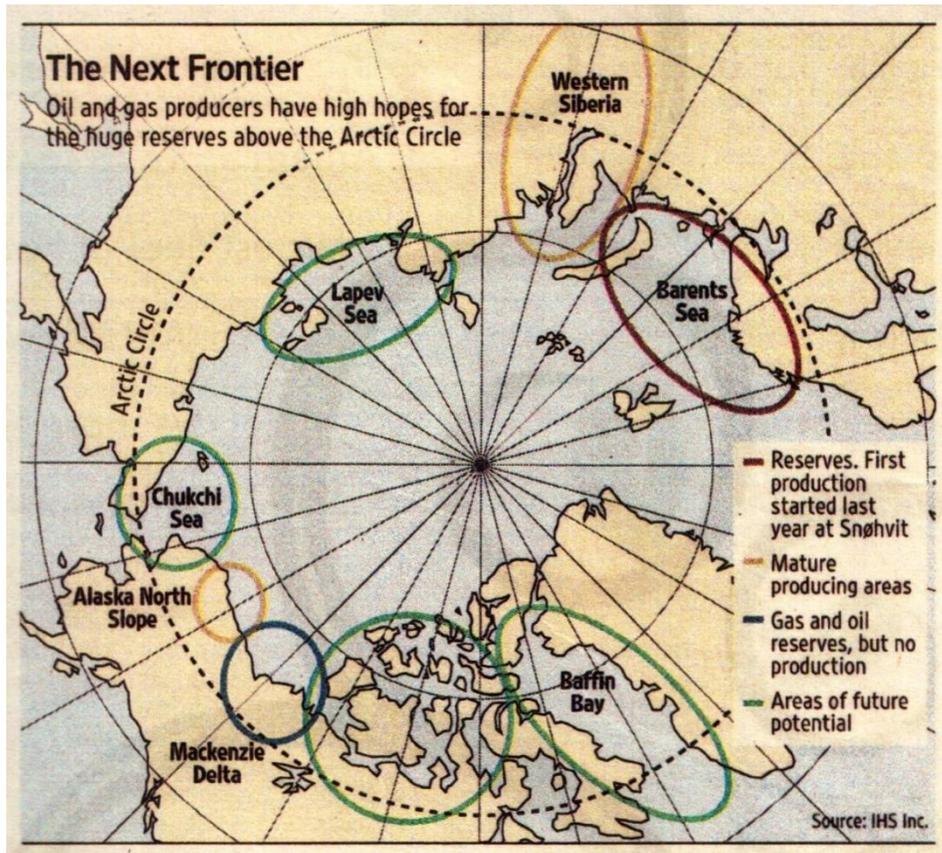
Diverging Paths

Projected global average temperatures based on two emissions scenarios

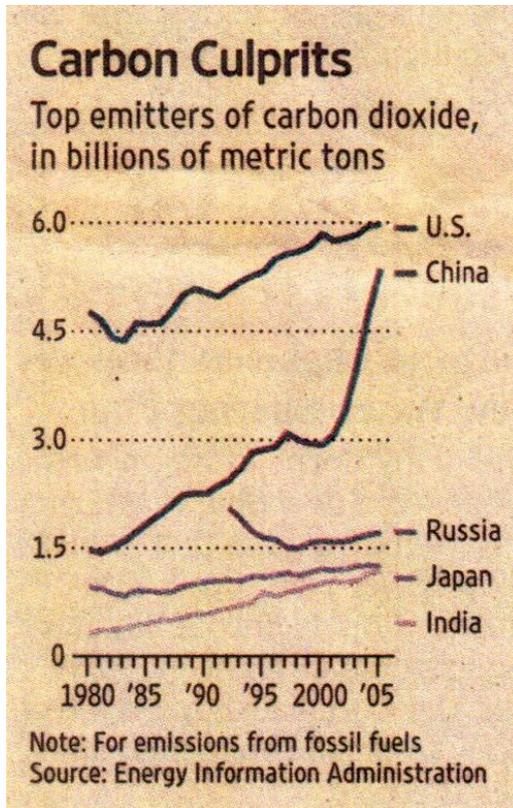


Source: Columbia University Earth Institute

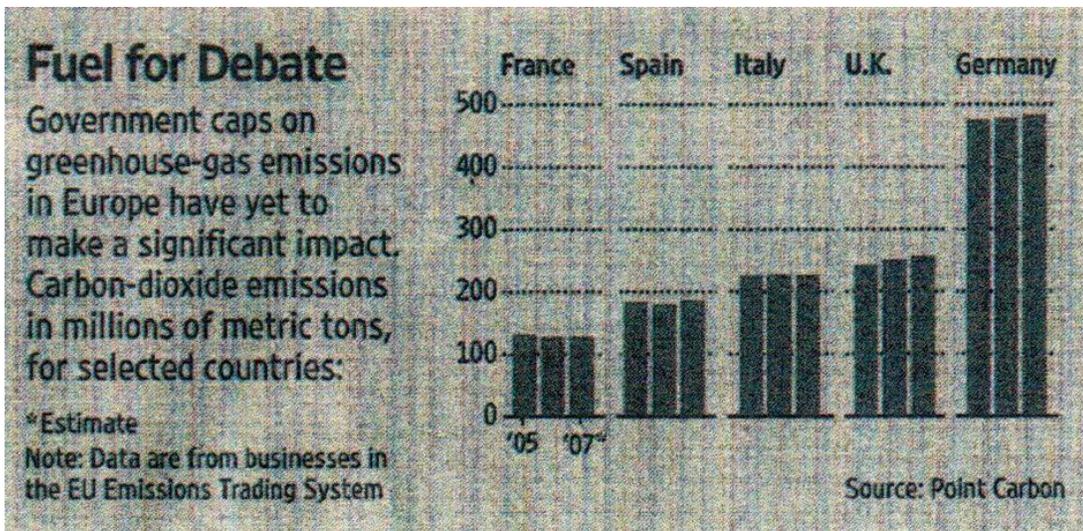
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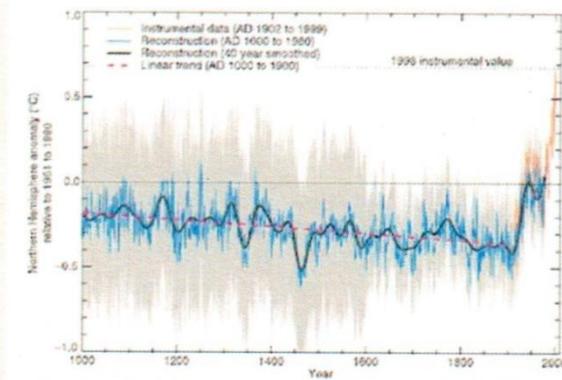
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DS 45.

How Much Variation?

(48)

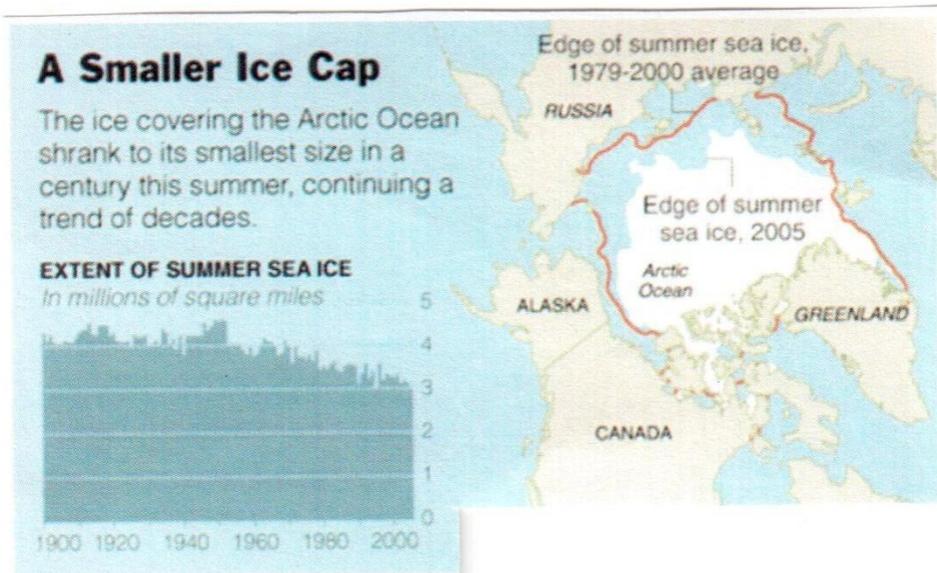


A new analysis challenges the accuracy of this “hockey stick” graph of Northern Hemisphere temperatures, left, over the last 1,000 years. The trend is relatively flat until a sharp recent warming.

The new study says past similar ups and downs may have been missed.

Source: Intergovernmental Panel on Climate Change, 2001

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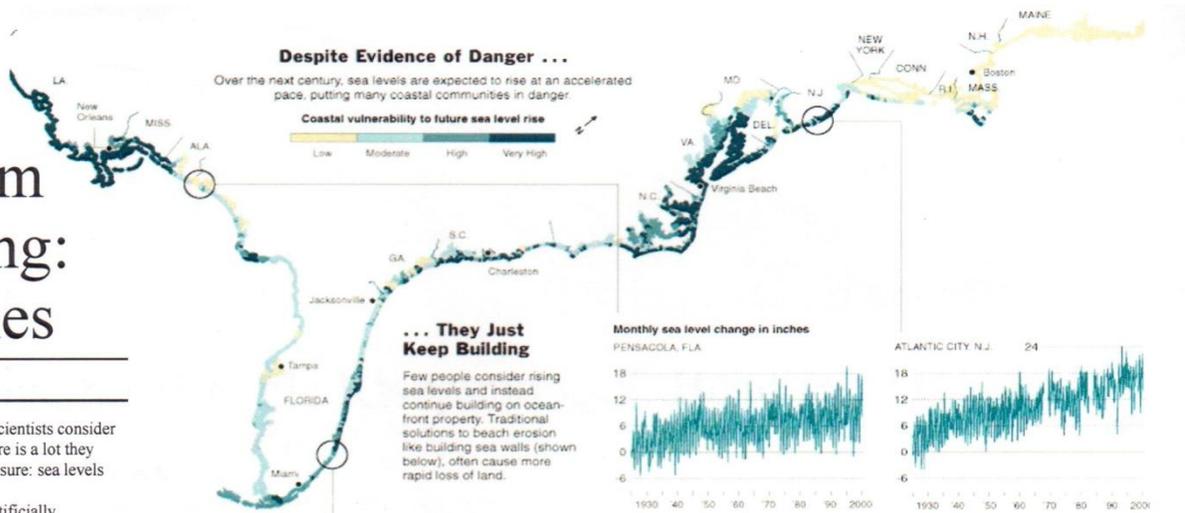
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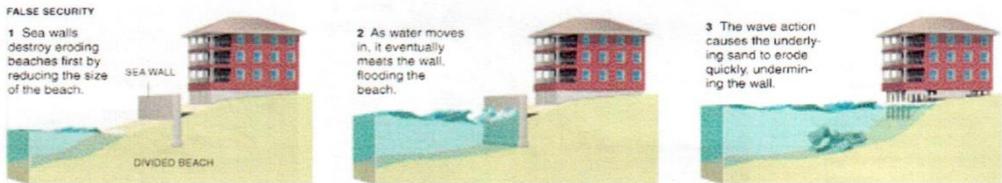
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forced them to
thousands of cubic
a has relied on this
w storm seasons,
for sea wall
ts. "If you have a
really the only



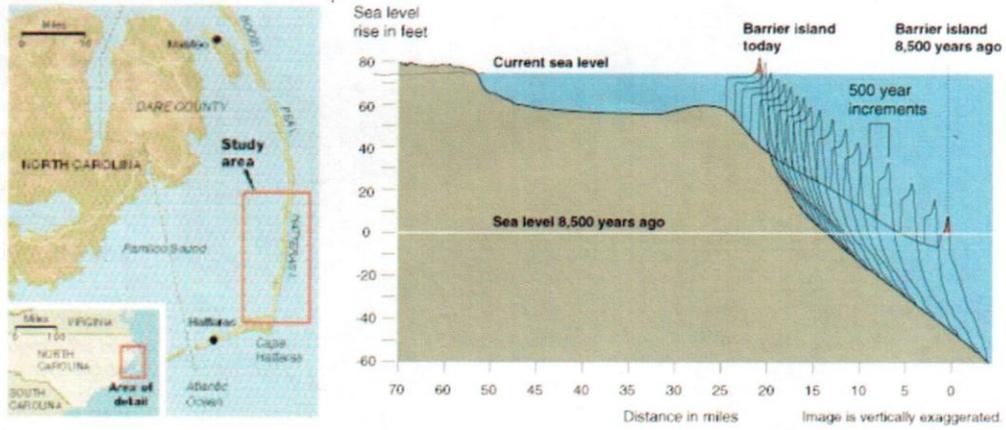
CLOSER AND CLOSER On one side of a sea wall in Palm Beach, Fla., are multimillion-dollar houses; on the other, seaweed shows encroaching high tide. *Barbara P. Fernandez for The New York Times*



Source: Permanent Service for Mean Sea Level; E. Robert Thaler, U.S. Geological Survey; "Against the Tide," by Cornelia Dean; David Costantini and Al Greenberg; The New York Times

These Islands Move ...

Barrier islands are dynamic ecosystems that are constantly changing. Waves, currents, tides, wind, sea level changes and sediment supply all cause the islands to migrate. Scientists at the U.S. Geological Survey have done a series of models to explore how a stretch of barrier island in North Carolina may have arrived at its current position. This is one model.



... but Construction Continues

Nearly every year, storms damage Dauphin Island, directly south of Mobile, Ala. Hurricane Katrina caused extensive overwash, sending sand from the ocean side of the island to the land side. Many residents are once again rebuilding.

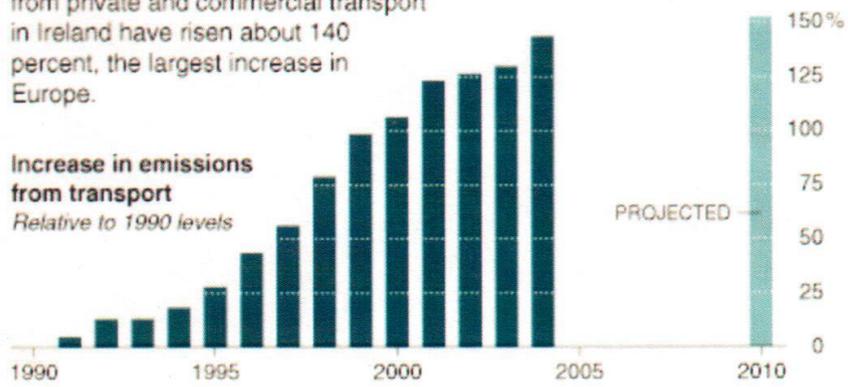


DS 49.

The Cost of Growth

Since 1990, greenhouse gas emissions from private and commercial transport in Ireland have risen about 140 percent, the largest increase in Europe.

Increase in emissions from transport
Relative to 1990 levels



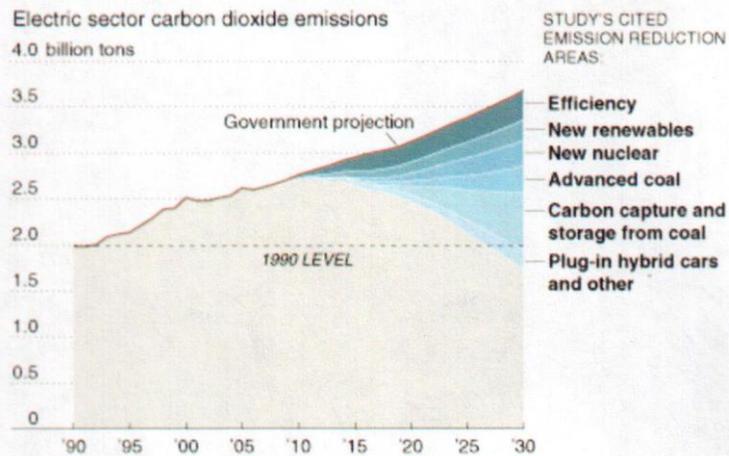
Source: European Environment Agency

The New York Times

DS 50.

A Path to Reduced Emissions

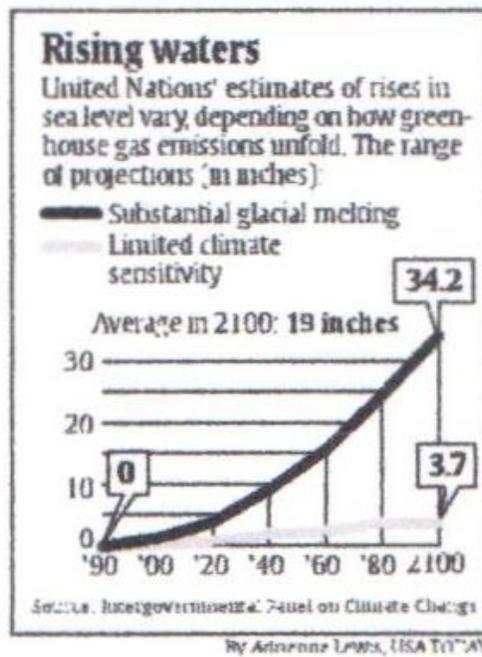
The Energy Department projects an increase in carbon dioxide emissions from electricity use over the coming decades, even with increasing energy efficiency, more wind and solar power, and other innovations. But according to a new study by the electric industry, the steps projected by the government could be bolstered and others added, resulting in cuts in total emissions to a level below that of 1990 by the late 2020s.



Source: Electric Power Research Institute

The New York Times

DS 51.



The debate's over: Globe is warming

Politicians, corporations and religious groups differ mainly on how to fix the problem

By Dan Vergano
USA TODAY

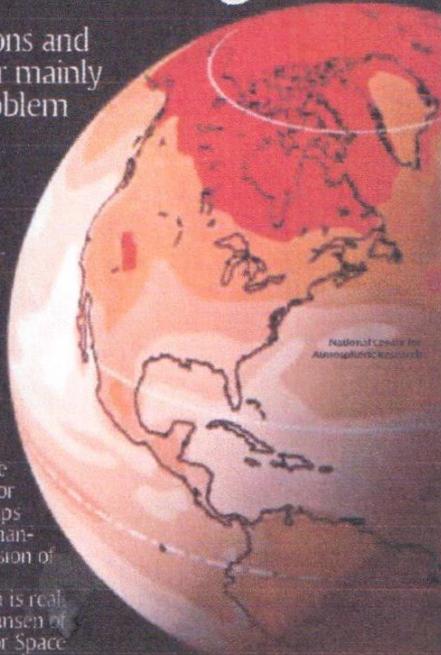
Don't look now, but the ground has shifted on global warming. After decades of debate over whether the planet is heating and, if so, whose fault it is, divergent groups are joining hands with little fanfare to deal with a problem they say people can no longer avoid.

Cover story

General Electric is the latest big corporate convert; politicians at the state and national level are looking for solutions; and religious groups are taking philosophical and financial stands to slow the progression of climate change.

They agree that the problem is real. A recent study led by James Hansen of the NASA Goddard Institute for Space Studies confirms that, because of carbon dioxide emissions and other greenhouse gases, Earth is trapping more energy from the sun than it is re-

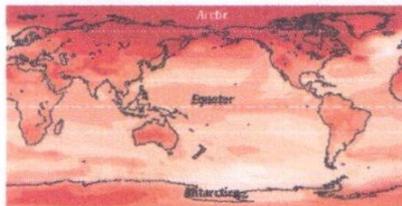
Please see COVER STORY next page ▶



A warming world

This simulation compares air temperatures near Earth's surface during the last 20 years of the 20th century with projections of temperatures during the last 20 years of the 21st century. The greatest warming occurs in the Arctic and Antarctica.

Projected temperature increase from 2000 to 2100

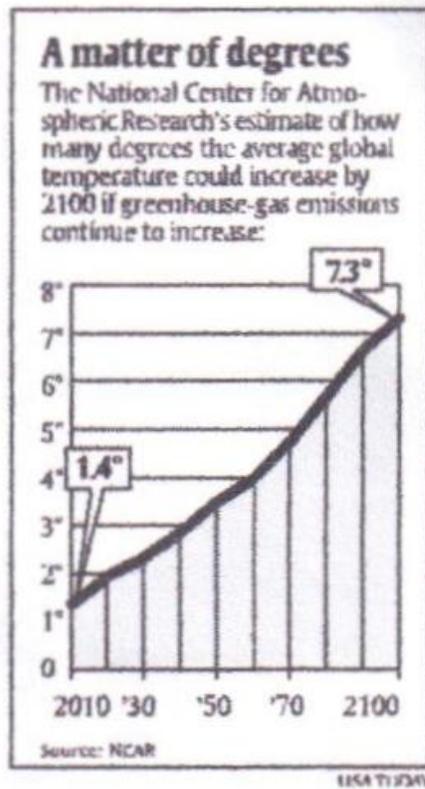


Note: The Community Climate System Model map is the product of computer simulations developed at the National Center for Atmospheric Research with input from university and federal climate scientists.

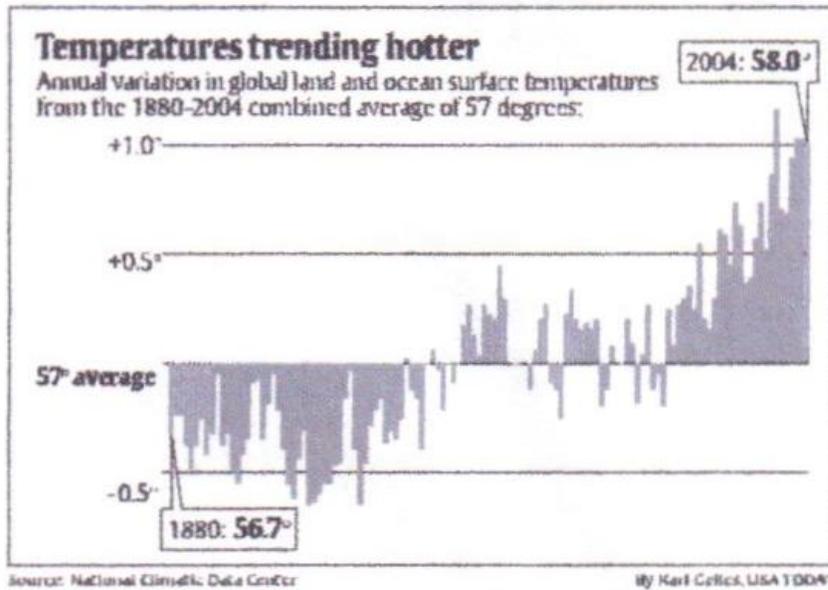
Source: National Center for Atmospheric Research

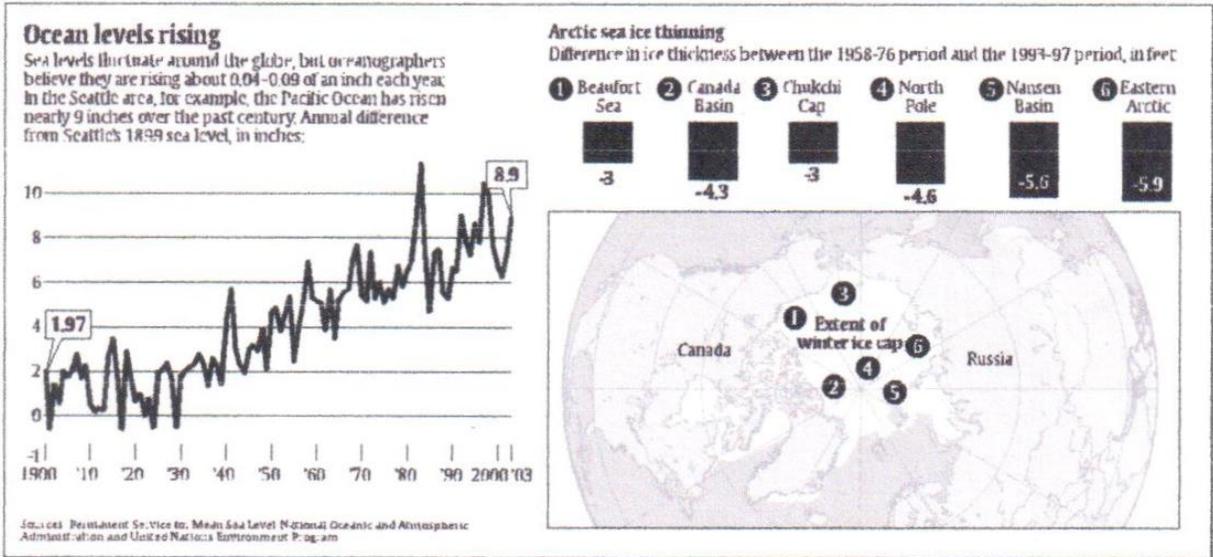
USA TODAY

DS 53.

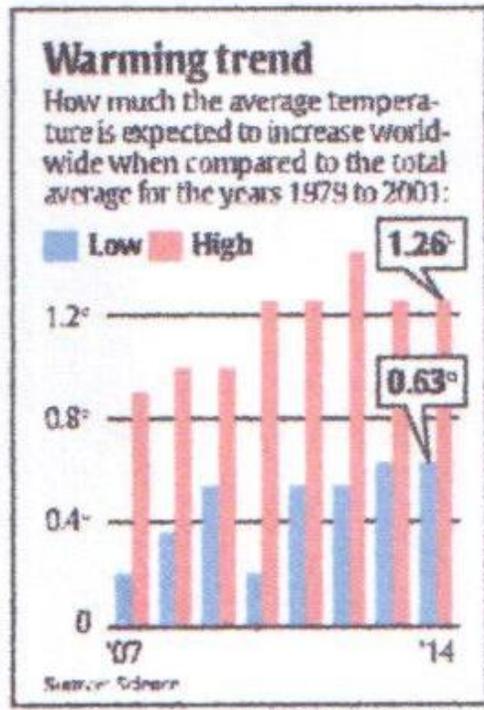


DS 54.

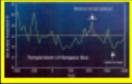
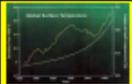


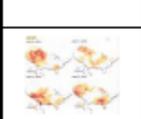
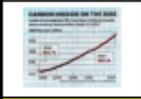
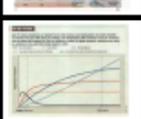
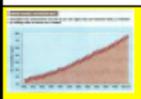


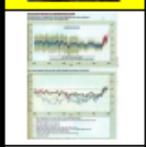
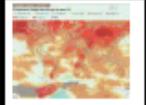
DS 56.

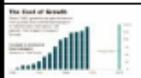
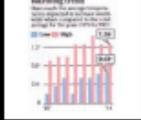


Appendix 3. A Result of the Rhetorical Analysis

		type		line trend				relationship between line trends		
		line graph as a type	bar graph as a type	upward trend of line	downward trend of line	Stagnancy in line trend	spike in line trend	correlation between lines by similar line trends or line overlap	contrast between different line trends	no correlation between two lines
		35	8	24	8	2	8	4	10	3
New American		1			1					
		1								1
		1						1		
		1					1			
										
		1			1					
		1								1
		1						1		1
		1						1		
										
										
		2		2						
										

Time									
		3		3			1		1
		1		1	1	1	1		1
									
			1						
Newsweek		1		1					
		1		1					1
		1		1					
									
Mother Jones									
									
									
		1		1	1				1
		1		1					
		1		1					

The New Scientist		1		1	1				1	
										
		1	1	1		1			1	
		1			1					
		2					2	1		
										
										
										
										
										
			1							
										
The Wall Street Journal		1					1			
		1		2				1		
										

		1		1	1		1		1	
			1							
The New York Times		1					1			
			1							
		1		2					1	
		1								
			1							
		1		1	1					
USA Today		1		2					1	
										
		1		1						
			1							
		1		1						
			1							

etc.	bar trend				relationship between bar trends					
manipulation of y-axis scale	upward trend of bars (gradual increase of bar height)	downward trend of bars (gradual decrease of bar height)	no decrease or increase in bar height (similar height)	bars that grow downward	relative height of bars in a bar graph	visual salience of exceptionally high bar	red (warming, heat or CO2: negative meaning)	red as signifying the sun (not negative meaning)	blue (cooling)	green (nature or environmental friendliness)
1	4	1	1	1	5	1	34	3	6	4
									1	
										1
							1	1		
							1		1	
							1			
								1		
								1		
							1			
							3			

							7		
							1		
							1		
					1	1			
							1		
							1		
									1
							1		
							1		
							1		

							1			1
1	1				1					
							2		1	
							1			
							1			
							1			
					1		1			
							2			1

			1		1					
							1		1	
		1					1			
	1									
							1		1	
							1			
	1									
				1	1					
	1						1		1	

colors						Maps							Pie Chart
grey or black (smoke, pollution, or environmental destruction)	brown as nature & soil	red vs. green	green vs. grey	use of prominent color for a line for attention or emphasis	color coding system	use of map	decrease in area size on a map	filling up most areas on a map with red or similar colors	Coloring a particular area with red color on a map for attention	visual salience of an area cluster in a map	map filled with small icons	slanting of maps	relative sector size in a pie chart
4	1	2	2	2	14	21	4	4	1	2	1	1	3
						1							
						1	1		1				
						1							

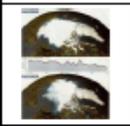
						2							
					1 (multiple lines)	1	1						
					1 (multiple lines & map)	1							
					1	1						1	
1													
<hr/>													
1	1												
1			1		1	1				1			
<hr/>													
							1					1	
<hr/>													

		1											
					1								1
					1 (proportions in bars)								1
							1						
					1	1		1					
					1	1		1		1			
					1	1		1					
					1	1							
1		1	1										1
				1									
					1	1							

						1	1						
					1	1							
						1							
				1									
					1	1		1					
						1							

Appendix 4. A Concise Version of the Result of the Rhetorical Analysis

		type		line trend				relationship between line trends		
		line graph as a type	bar graph as a type	upward trend of line	downward trend of line	Stagnancy in line trend	spike in line trend	correlation between lines by similar line trends or line overlap	contrast between different line trends in a line graph	no correlation between two lines
		35	8	24	8	2	8	4	10	3
New American		1			1					
		1								1
		1						1		
Time										
		2		2						
										
		3		3			1		1	
Newsweek										
		1		1						
		1		1						
		1		1	1				1	

New Scientist										
		1	1	1		1			1	
		1			1					
										
										
										
										
			1							
The Wall Street Journal										
		1					1			
NY Times			1							
USA Today										
		1		1						

etc.	bar trend		relationship between bar trends	colors								use of map
	upward trend of bars (gradual increase of bar height)	downward trend of bars (gradual decrease of bar height)		relative height of bars in a bar graph	red (warming, heat, sun or CO2)	red as signifying the sun (not negative)	blue (cooling or nature)	green (nature)	grey or black (smoke or pollution)	red vs. green	green vs. grey	
1	4	1	5	37	1	6	4	4	2	2	14	21
						1						
							1					
				1	1							
				1								
				3								1
												1
				7							1 (multiple lines)	1
							1	1		1	1	1
				1								
				1								
				1			1		1			

												1	
1	1		1									1 (proportions in bars)	
				1								1	1
				1								1	1
												1	1
												1	1
			1	1									
				2			1	1	1	1			
		1		1									1
				1								1	1

Maps				Pie Chart	visual style	ETC.			
decrease in area size on a map	filling up most areas on a map with red or similar colors	Coloring a particular area on a map for attention	visual salience of an area cluster in a map	relative sector size in a pie chart	use of realistic image	2 way arrows	cyclical arrangement of circles	pictogram size	thickness of line
4	4	1	2	3	2	1	1	1	3
1		1			1				
1						1	1		
			1						

				1					1
				1				1	
1					1				
	1		1						
	1								
				1					
1									
	1								

Appendix 5. Preliminary Questions for the Interviews

Preliminary Questions for the Interviews

Please fill out this form, and bring it with you to your interview.

Your Pseudo Name (Please skip this. The researcher will assign one to you):

Undergraduate / Graduate (Please circle one)

Major:

Year in School:

Please answer to the following questions.

1. Do you read any of the following magazines? Please circle the magazine(s) if you read any, and check how frequent you read it (or them).

	Regularly	Occasionally
Time		
Newsweek		
Mother Jones		
New Scientist		
The New American		

If you do not read any of the above magazines but others, please list magazine(s) that you read and check how frequent you read it (or them).

	Regularly	Occasionally

If you do not read any magazine, please check here.

I do not read magazines.	
--------------------------	--

2. Do you read any of the following newspapers? Please circle the newspaper(s) if you read any, and check how frequent you read it (or them).

	Regularly	Occasionally
USA Today		
New York Times		
The Wall Street Journal		

If you do not read any of the above newspapers but others, please list newspaper(s) that you read and check how frequent you read it (or them).

	Regularly	Occasionally

If you do not read any magazine, please check here.

I do not read newspapers.	
---------------------------	--

3. Which website(s) do you frequent to get news? Please list and check how frequent you go to the website(s).

	Regularly	Occasionally

4. Are there other media channels through which you get news? If yes, please list here.

5. How would you describe your politics?

6. Do you believe that the globe is warming from man-made causes?

Yes

No

I don't know

Appendix 6. Interview Protocol

Script for the First Qualitative Interview (Phase 1b)

Here are two articles about global warming. Please read these articles and study diagrams in them for the next 20 minutes. I will leave you alone in this room, and when I come back, we will have an interview and I will ask you some questions. The goal of this study is not to figure out your knowledge of details but your perceptions of the articles and the diagrams.

Interview Questions for the First Qualitative Interview (Phase 1b)

- 1) What did you find convincing about the diagram(s) in this article?
 - What visual elements of the diagram(s) did you find convincing?

 - What visual elements of the diagram(s) such as line, bar, photo, map, illustration and color did you find convincing?

- 2) Why did you find them convincing?

Interview Questions for the Second Qualitative Interview (Phase 2): Task 1 (Science Textbook)

Which of the diagrams on the table would be appropriate for a chapter on global warming in a college science textbook, and why would they be appropriate?

- Why did you choose this diagram as appropriate for a science textbook?
- What is it about the visual qualities of this diagram that makes it more appropriate than the other ones for a science textbook?
- What elements or configurations of this diagram make it more appropriate than the other ones for a science textbook?
- What *visual qualities* of this element (or configuration) in this diagram make it more appropriate than the other ones for a science textbook?

Interview Questions for the Second Qualitative Interview (Phase 2) : Task 2 (Social Activist)

Which of the diagrams on the table would be appropriate in a printed report from social activists or lobbyists designed to persuade legislators about issues of global warming, and why would they be appropriate? Please choose some for pro, and some for con.

- Why did you choose this diagram as appropriate in a report from social activists? (Pro first, and the Con)
- What is it about the *visual qualities* of this diagram that makes it more appropriate than the other ones for a report from social activists?
- What elements or configurations of this diagram make it more appropriate than the other ones for a report from social activists?
- What *visual qualities* of this element (or configuration) in this diagram make it more appropriate than the other ones for a report from social activists?

Appendix 7. The First Summary of the First and the Second Qualitative Interviews

	Diagrams	Elements or Configurations Identified	1A	1B	2		
					science textbook	legislator persuasion	
New American		LT line graph as a type	1		2		
		downward trend of line	1			2	
		fluctuation in line trend		1			6
		blue color	1		1	1	
		long range of time span (X-axis)					1
		LT line graph as a type	1		4		
		no correlation between two lines	1	1			1
		green color	1				1
		long range of time span (X-axis)					1
		LT line graph as a type	1		3		
		correlation between lines by similar line trends or line overlap	1	1	1	3	
		red color as signifying the sun (not negative meaning)	1				
		long range of time span (X-axis)				1	
		red color	1	1			
		LT line graph as a type	2 (temp:1, sea level:1)	2 (temp:1, sea level:1)			
		upward trend of line	2 (temp:1, sea level:1)	3 (temp:2, sea level:1)		2 (temp:1, sea level:1)	
		red color	4				
		M use of map	1	1			
		decrease in area size on a map	1	2		4	
		coloring a particular area with red color on a map for attention	1			4	
		use of realistic image	1	1	1	3	
		M use of map	1			3 (Florida map)	
			LT line graph as a type	3			

Time		 upward trend of line	3 (temp:1, CO2:1, sea level:1)	2 (sea level: 2)		3 (temp:1, CO2:1, sea level:1)
		 spike in line trend	1 (CO2)	1 (CO2)		
		 contrast between different line trends in a line graph	1	1		
		 red color	7	3 (circles:1, temp line: 1, sea level:1)	4 (circles: 1, the line in the first line graph, arrows in the reflection:1, the sea level line graph: 1)	
		 color coding for the lines in the CO2 graph	1	1		
		M use of map	1			
		 decrease in area size on a map	1	1	1	1
		 2 way arrows	1	1		1
		 use of circles signifying cyclical nature				1
		 cyclical arrangement of the circles	1		1	1
		 showing the most dramatic increase of line trend selectively			1 (temp line graph)	
		Newsweek		 green color	1	2
 grey color	1			2		
 green vs. grey	1			1		
 color coding	1			4	1	
M use of map	1			1		
 visual salience of an area cluster on a map	1					
		LT line graph as a type	1		2	
		 upward trend of line	1	3	1	2
		 red color	1			
		 showing the most dramatic increase of line trend selectively			1	
		LT line graph as a type	1		2	
		 upward trend of line	1	3	2	5
		 red color	1			

		red color for making the trend more obvious				1
		showing the most dramatic increase of line trend selectively		1		
	LT	line graph as a type	1		2	
		upward trend of (the red) line	1	1	1	2
		downward trend of (the green) line	1	1	1	1
		contrast between different line trends in a line graph	1	4	2	3
		red color	1		1	3
	green color	1		1	1	
	red vs. green	1		1		
		color coding	1		2	2
		relative sector size in a pie chart	1	1	1	
		thickness of line	1		1	1
	LT	line graph as a type	1			
	BT	bar graph as a type	1		1	
		upward trend of line	1	4		2
		stagnancy in line trend	1			
		contrast between different line trends in a line graph	1			
		upward trend of bars (gradual increase of bar height)	1	4		2
		relative height of bars in a bar graph	1	1		
		color coding (for the bars)	1	1	1	2
		relative sector size in a pie chart	1	2		3
		pictogram size	1	4	1	2
		manipulation of y-axis scale	1	2		
		horizontal arrangement of things being compared		1	1	
	proportions in a bar graph			1		
		maps of the countries in proportion to the size			1	
	LT	line graph as a type	1			
		downward trend of line	1	3	2	4
	decrease in area size on a map	1	3	6	7	

New Scientist

		use of realistic image	1	1	5	4
		green color		1		
		red color	1	1		2
		color coding	1	1	2	1
		M use of map	1	1	1	2
		filling up most areas on a map with red or similar colors	1	0		
		visual salience of an area cluster in a map	1			
		use of black background			1	
		red color	1	2		3
		color coding	1	1		1
		M use of map	1			
		filling up most areas on a map with red or similar colors	1	0		3
		color coding	1	1	1	1
		M use of map	1		1	
		color coding	1	2		
		M use of map	1			
		BT bar graph as a type	1	1	2	
		relative height of bars in a bar graph	1		5	2
		red color	1			
		use of world map in the background			2	
	horizontal arrangement of things being compared (the bars)			1		
	disparity between the high and low bars			1		
	red color	2				
	green color	1				
	grey color	1				
	red vs. green	1				
	green vs. grey	1				
	relative sector size in a pie chart	1			1	
	LT line graph as a type	1		1		

Wall Street Journal		 spike in line trend	1	4	1	6
		 narrow range of uncertainty, reducing fluctuation of line trend		2		1
		 dark blue color on top of blue for emphasis				1
NY Times		BT bar graph as a type	1			
		 downward trend of bars	1	2		1
		 red color	1	1		
		M use of map	1			
USA Today		 red color	1	3		2
		 color coding	1	3	3	2
		M use of map	1		2	1
		 filling up most areas on a map with red or similar colors	1	2		1
		LT line graph as a type	1	1	1	
		 upward trend of line	1	1	1	5
		 sharper angle of upward line created by making starting & ending point of X-axis closer		2		
		 showing the most dramatic increase of line trend selectively		1		
		 just straight line with no fluctuation				1
		 black and white color only (objective look)				1
	 arrows pointing the starting & ending point of the line				1	

Appendix 8. The Second Summary of the First and the Second Qualitative Interviews
with Number of Identification and the Percentage

Diagrams		Elements or Configurations Identified	1A		1B		2					
			No. of Identification	x 5 (no. of interviews)	No. of Identification	%	science textbook			legislator persuasion		
							No. of Identification	Total No.	%	No. of Identification	Total No.	%
Type	LT	line graph as a type	15	75	3	4	17	187	9.1	0	188	0
	BT	bar graph as a type	3	15	1	6.6	3	38	7.9	0	37	0
Line Graph		upward trend of line	10	50	17	34	5	131	3.8	21	119	17.6
		downward trend of line	3	15	4	26.7	3	37	8.1	7	38	18.4
		fluctuation in line trend	0	5	1	20	0	11	0	6	14	42.8
		stagnancy in line trend	1	5	0	0	0	10	0	0	15	0
		spike in line trend	2	10	5	50	1	23	4.3	6	27	22.2
		correlation between lines by similar line trends or line overlap in a line graph	1	5	1	20	1	11	9.1	3	14	21.4
		contrast between different line trends in a line graph	3	15	5	33.3	2	36	5.5	3	39	7.7
		no correlation between two lines	1	5	1	20	0	11	0	1	14	7.1
		showing the most dramatic increase of line trend selectively	0	20	4	20	0	52	0	0	48	0
		long range of time span (X-axis)	0	15	0	0	0	33	0	3	42	7.1
		manipulation of y-axis scale	1	5	2	40	0	10	0	0	15	0
		narrow range of uncertainty, reducing fluctuation of line trend	0	5	2	40	0	10	0	1	15	6.7
		sharper angle of upward line created by making starting & ending point of X-axis closer	0	5	2	40	0	13	0	0	12	0
		just straight line with no fluctuation	0	5	0	0	0	13	0	1	12	8.3
		arrows pointing the starting & ending point of the line	0	5	0	0	0	13	0	1	12	8.3
		upward trend of bars (gradual increase of bar height)	1	5	4	80	0	10	0	2	15	13.3
	downward trend of bars	1	5	2	40	0	13	0	1	12	8.3	

Bar Graph		relative height of bars in a bar graph	2	10	1	10	5	25	20	2	25	8
		proportions in a bar graph	0	5	0	0	1	10	10	0	15	0
		disparity between high and low bars	0	5	0	0	1	15	6.7	0	10	0
Color		red color	22	110	11	10	5	283	1.8	10	140	7.1
		red color as signifying the sun (not negative meaning)	1	5	0	0	0	11	0	0	14	0
		red color for making the trend more obvious	0	5	0	0	0	13	0	1	12	8.3
		blue color	1	5	0	0	0	11	0	1	14	7.1
		dark blue color on top of blue for emphasis	0	5	0	0	0	10	0	1	15	6.7
		green color	4	20	2	10	1	65	1.5	2	60	3.3
		grey color	2	10	2	20	0	28	0	0	22	0
		red vs. green	2	10	0	0	1	28	3.6	0	22	0
		green vs. grey	2	10	1	10	0	28	0	0	22	0
		color coding	9	45	14	31.1	11	103	10.7	9	122	7.4
	black and white color only (objective look)	0	5	0	0	0	13	0	1	12	8.3	
Map		use of map	10	50	3	6	4	126	3.2	6	124	4.8
		decrease in area size on a map	4	20	10	50	7	54	13	13	46	28.3
		filling up most areas on a map with red or similar colors	3	15	2	13.3	0	35	0	4	40	10
		coloring a particular area with red color on a map for attention	1	5	0	0	0	15	0	4	10	40
		visual salience of an area cluster on a map	1	5	0	0	0	24	0	0	26	0
		use of world map in the background	0	5	0	0	2	15	13.3	0	10	0
		use of black background	0	5	0	0	1	11	9.1	0	14	0
	maps of countries in proportion to the size	0	5	0	0	1	10	10	0	15	0	
Pie Chart		relative sector size in a pie chart	3	15	3	20	1	35	2.8	4	40	10
Visual Style		use of realistic image	2	10	2	20	6	28	21.4	7	22	31.8
Flow Chart		two way arrows	1	5	1	20	0	13	0	1	12	8.3
		use of circles signifying cyclical nature	0	5	0	0	0	13	0	1	12	8.3
		cyclical arrangement of circles	1	5	0	0	1	13	7.7	1	12	8.3
		pictogram size	1	5	4	80	1	10	10	2	15	13.3

etc.		thickness of line	1	5	0	0	1	10	10	1	15	6.7
		horizontal arrangement of things being compared	0	10	1	10	2	25	8	0	25	0

Appendix 9. The Total Percentages Integrating the Percentages
from the First and the Second Interviews

		Elements or Configurations Identified	Total Percentage
Type	LT	line graph as a type	13.1
	BT	bar graph as a type	14.5
Line Graph		upward trend of line	55.4
		downward trend of line	53.2
		fluctuation in line trend	62.8
		stagnancy in line trend	0
		spike in line trend	76.5
		correlation between lines by similar line trends or line overlap in a line graph	50.5
		contrast between different line trends in a line graph	46.5
		no correlation between two lines	27.1
		showing the most dramatic increase of line trend selectively	20
		long range of time span (X-axis)	7.1
		manipulation of y-axis scale	40
		narrow range of uncertainty, reducing fluctuation of line trend	46.7
		sharper angle of upward line created by making starting & ending point of X-axis closer	40
		just straight line with no fluctuation	8.3
		arrows pointing the starting & ending point of the line	8.3
Bar Graph		upward trend of bars (gradual increase of bar height)	93.3
		downward trend of bars	48.3
		relative height of bars in a bar graph	38
		proportions in a bar graph	10
		disparity between high and low bars	6.7

Color		red color	18.9
		red color as signifying the sun (not negative meaning)	0
		red color for making the trend more obvious	8.3
		blue color	7.1
		dark blue color on top of blue for emphasis	6.7
		green color	14.8
		grey color	20
		red vs. green	3.6
		green vs. grey	10
		color coding	49.2
		black and white color only (objective look)	8.3
Map		use of map	14
		decrease in area size on a map	91.3
		filling up most areas on a map with red or similar colors	23.3
		coloring a particular area with red color on a map for attention	40
		visual salience of an area cluster on a map	0
		use of world map in the background	13.3
		use of black background	9.1
		maps of countries in proportion to the size	10
Pie Chart		relative sector size in a pie chart	32.8
Visual Style		use of realistic image	73.2
Flow Chart		two way arrows	28.3
		use of circles signifying cyclical nature	8.3
		cyclical arrangement of circles	16
etc.		pictogram size	103.3
		thickness of line	16.7
		horizontal arrangement of things being compared	18

Appendix 10. Comparison of the Identified Diagrammatic Elements and Configurations between the Rhetorical Analysis and the Interviews

		Elements and Configurations Identified through the Phase 1A: The Rhetorical Analysis	Elements and Configurations Identified through the Phase 1B & Phase 2: The Two Qualitative Interviews	Total Percentage
Type	LT	line graph as a type	line graph as a type	13.1
	BT	bar graph as a type	bar graph as a type	14.5
Line Graph		upward trend of line	upward trend of line	55.4
		downward trend of line	downward trend of line	53.2
			fluctuation in line trend	62.8
		stagnancy in line trend		0
		spike in line trend	spike in line trend	76.5
		correlation between lines by similar line trends or line overlap in a line graph	correlation between lines by similar line trends or line overlap in a line graph	50.5
		contrast between different line trends in a line graph	contrast between different line trends in a line graph	46.5
		no correlation between two lines	no correlation between two lines	27.1
			showing the most dramatic increase of line trend selectively	20
			long range of time span (X-axis)	7.1
		manipulation of y-axis scale	manipulation of y-axis scale	40
			narrow range of uncertainty, reducing fluctuation of line trend	46.7
			sharper angle of upward line created by making starting & ending point of X-axis closer	40
			just straight line with no fluctuation	8.3
			arrows pointing the starting & ending point of the line	8.3

Bar Graph		upward trend of bars	upward trend of bars	93.3
		downward trend of bars	downward trend of bars	48.3
		relative height of bars in a bar graph	relative height of bars in a bar graph	38
			proportions in a bar graph	10
			disparity between high and low bars	6.7
Color		red color	red color	18.9
		red color as signifying the sun (not negative meaning)		0
			red color for making the trend more obvious	8.3
		blue color	blue color	7.1
			dark blue color on top of blue for emphasis	6.7
		green color	green color	14.8
		grey color	grey color	20
		red vs. green	red vs. green	3.6
		green vs. grey	green vs. grey	10
		color coding	color coding	49.2
		black and white color only (objective look)	8.3	

Map	M	use of map	use of map	14
		decrease in area size on a map	decrease in area size on a map	91.3
		filling up most areas on a map with red or similar colors	filling up most areas on a map with red or similar colors	23.3
		coloring a particular area on a map with red color for attention	coloring a particular area on a map with red color for attention	40
		visual salience of an area cluster on a map		0
			use of world map in the background	13.3
			use of black background	9.1
		maps of countries in proportion to the size	10	
Pie Chart		relative sector size in a pie chart	relative sector size in a pie chart	32.8
Visual Style		use of realistic image	use of realistic image	73.2
Flow Chart		two way arrows	two way arrows	28.3
		cyclical arrangement of circles	use of circles signifying cyclical nature	8.3
		cyclical arrangement of circles	cyclical arrangement of circles	16
etc.		pictogram size	pictogram size	103.3
		thickness of line	thickness of line	16.7
			horizontal arrangement of things being compared	18