Visualizing Economics: Designing a Persuasive Argument **By Catherine Mulbrandon** 

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# Abstract

The discussion of economics in the media can be confusing and contradictory. Often numbers are quoted out of context, while political agendas distort the presentation of economic data. At the same time, the visualization of economic data has become more common, although reporters and editors regularly fall back on conventional methods to present this information. However, some attempts by graphic designers to add visual interest to these graphics ends up distracting from, rather than revealing the data's significance. I will be using economic stories in the media to explore the role of visualization in persuasive communication by employing the work of several authors including, Chaim Perelman's *The Realm of Rhetoric* and Jacques Bertin's *Semiology of Graphics*. My purpose is to understand how a designer shapes an argument, while maintaining the integrity of economic data in its visual representation.



### **Designer's Guide to Creating Charts and Diagrams** The figure of a showgirl does not illustrates the data, instead it operates as chartjunk, defined by Edward Tufte as "ink that does not tell the viewer anything new."



Nigel Holmes in Understanding USA

On the other hand, this graphic illustrates the relative size of the Federal surplus to the debt; the interest of the viewer is engaged by a visually meaningful representation of the ratio of debt to deficit, not with meaningless decoration.

# Introduction

#### **The Public Discussion of Economics**

Cable news and the Internet provide more time and space to cover the economy than ever before. Diagrams and charts representing economic data have become more common with computer software, like Excel, providing a quick way to create many of these graphics. However, to present this information, editors often rely on conventional methods, i.e. tables, graphs and bar charts, then simplify the graphic for their audience by showing only a few data points. Attempts by graphic designers to add visual interest to these bland presentations can distract from, rather than support the meaning of the data. But this does not have to be the case. Graphics can be designed to reveal the meaning of the numbers and still display a rich, complex data set to the viewer.

My interest in the visual display of economic information developed after I earned my bachelors in economics, during the seven years I spent working for a financial consulting company. In my job, I saw how the presentation of data was used by consultants to influence and persuade clients to make more appropriate investment decisions. In this paper, I will to use the subject of economics to explore the role of visualization when making an argument. An argument's persuasiveness is judged by its success in acting upon the mind of the audience. My goal is to understand how a designer can contribute to the presentation of an argument by creating a visualization of complex data. I am especially interested in the effect visual representations of economic data has on the debate over public policy, enabling citizens to fully participate in the democratic process. For that reason, I will focus-not on journals where economists persuade each other-but in the public places where politicians and citizens, journalist and members of political organizations engage in debates over economic policy.

#### Why Verbal Communication is not Enough

Do people understand their government's economic policy? How do voters know what is the real effect of a political candidate's plan to create jobs or to balance the budget? While newspapers and magazines are a common source for economic information, for many people, television is often their first and most important source for news. At the same time, many people discuss these questions with their family, friends and neighbors, trying to make sense of the world in which they live. In order to influence a wider audience, they might call-in a



The Visual Display of Quantitative Information

"[T]ranslating factual information into even the most appropriate visual form as diagrams is but the first step in verbal/visual communication. It must be supported by a second step that follows from the first: understanding how the recipient is likely to interpret the diagrams. That, alas is a consideration that is usually ignored in our thinking about how to translate verbal language [or statistical data] into visual form." (White, 144) talk radio program or C-SPAN, write a letter to their Congressman or a letter-to-the-editor in their local newspaper. However, with the growth of the Internet, more sources and outlets are now available to the average citizen to communicate and debate these issues, for example bloggers posting their opinions and links to other web sites, political newsgroups and e-mail mailing lists. Unfortunately, e-mail and web sites while allowing even greater access to information about the government and to elected representatives are not often used effectively as tools for communication. (Hoobler, 1999)

Part of what is missing in this public setting is a common understanding of the problem being discussed. The beginning of a productive discussion comes from a shared understanding about the different values people hold. Creating a clear picture of your ideas, your values in the mind of your audience, communicates your point-of-view and focuses the discussion on an issue. It is an important step to influence their actions; to win them over to a proposed solution. Oral storytelling is one of oldest ways to communicate, but visual forms of communication have been an important method people have used to document and explain the world. They are powerful tools to help people think through a problem, store information for future reference, and illustrate relationships by grouping and classifying different information.

#### **Defining Visualization**

Visualization, or visual representation, is the creation of an artifact in order to communicate a clear picture of idea or concept in the mind of an audience. Designers creating visualizations of complex information must choose an overall strategy for the presentation of their message, and choose the best tactics to deliver it to the appropriate audience. A subset of visual representation called graphic representation is one tactic; graphics are created by drawing a point, line, or area on paper, varying those marks through color, size, shape, orientation, texture and position. Described by Jacques Bertin, graphics are "one of the basic sign-systems conceived by the human mind for the purposes of storing, understanding, and communicating essential information. As a 'language' for the eye, graphics benefits from the ubiquitous properties of visual perception" (Bertin, 2). This makes it a powerful tool in the hands of a designer.

The field of information visualization began with statisticians and scientists attempting to analyze and store large amounts of data for easy retrieval. Their needs were satisfied by visualization of very large data sets, which supports exploration of the relationships and patterns in the world they were observing. The three audiences for these graphics—a scientist, his or her peer group, and non-experts in the general public—gave rise to three types of visualizations:

There is the kind that scientists use to figure out what is going on [in] their experiments, and almost 90% of the pictures they make through visualization are for themselves. The other visualization called 'Peer Group Visualization' is shown to other researchers who know and understand what they are doing and it keeps 10%. The third kind of visualization, which is less than 1%, is for [the] general public... (Professor Joel Welling, Pittsburgh Supercomputing Center, as quoted by Eun, 13)

Economists have adopted several methods to communicate their ideas with their peers, one of which includes visualization of economic data. These methodologies determine the boundary between what was accepted as "truth" verses what is labeled "opinion." While this visualization should not be perceived as manipulated nor distorted, nevertheless, data selection must occur giving some subset of the data, presence, by pulling it out for special treatment; this technique is used in rhetoric to focus the attention of the audience on evidence that supports one's argument. This is where conscientious information design becomes necessary. When making an argument to each successive audience—first to oneself then to one's peer group and finally to the public—the message must become clearer, less ambiguous, and may require a reduction in the amount of information to ensure that the message is received. But the integrity of that presentation must be maintained to ensure that each audience sees the data in context enabling them to judge its validly and thus maintaining their trust.

# Economics, Rhetoric, and Integrity

My approach entails a careful reading of several books, exploring the relationship between rhetoric, economics, and integrity in the presentation of information. In *The Realm of Rhetoric*, Chaim Perelman argues that rhetoric's goal is to increase a particular audience's adherence to the a thesis or set of values which will move that audience to action. While in the *Semiology of Graphics*, Jacques Bertin presents a comprehensive theory of the graphic image, analyzing the many different methods to visualize data on paper. Bertin's work was previously analyzed in Robin Snyder's thesis, *Effective Information Visualization for Discovery and Understanding*. In her paper, she presents a simplified version of Bertin's theory of data visualization and compares it with more recent research in the field. In my paper, I am focusing on Bertin's definition of an "image", while using Perelman's work in rhetoric to analyze the role this image can play in supporting an argument.

#### **Defining Rhetoric**

Rhetoric is the art of persuasive communication, reinterpreted over the centuries by each generation of scholars. The new rhetoric introduced in the 20th century shifts the focus away from the author's intent (analysis of their style and figures of speech) to the impact an author's work on an audience. However, the mob of men that was the audience for ancient rhetoric is not the audience of the new rhetoric. The new rhetoric is interested in many types of audiences: a single individual, a group of specialists or the general public, (or in the case of philosophers a universal audience). Perelman argues that philosophers, in order to engage and persuade an universal audience, must create an argument that "appeals to common sense or common opinion, to intuition or to self-evidence, presuming that each member of the universal audience is part of the community to which he alludes, sharing the same intuitions and self-evident truths". (Perelman, 17) Designers for this audience must take the same approach in order to create a persuasive artifacts for the public, i.e. design that creates a consensus around a set of values, moving people to take action.

#### **Defining Economics**

Economics is the "social science that seeks to analyze and describe the production, distribution, and consumption of wealth". (Britan-

nica Online, retrieved 6 October 2003, "economics") Fundamentally, economics is a way of looking at the world. A joke one of my economics professors once told in class, illustrates the point of view of your stereotypical economist:

Two people are walking down the street; one is an economist the other is not. They both see a \$20 bill lying on the sidewalk. The economist keeps on walking without picking up the \$20. When his friend asks him why he didn't take it. He answers, "If it had any value, someone would have already picked it up."

Economist assume that when there is a more efficient, profitable course of action someone will find it and exploit it for their own benefit. Often referred to as the effect of the Invisible Hand in the marketplace, which was first described by Adam Smith: when many individuals act in their own self-interest, this will achieve the best possible out come for a society by maximizing the benefits from the available resources: people, raw materials, land, capital etc. Moreover, in the mathematical models that economist use to describe the world, it is often assumed that this happens instantaneously, i.e. that there are no inefficiencies to be exploited because "someone as already picked up the \$20".

The theories of macroeconomics—used to justify public policy—attempt to measure and describe the whole economy rather than any actions of any one agent within it, i.e. individual, company, or government institution. For the purpose of this paper, I will be investigating the techniques used to communicate an idea through the visualization of information. Therefore, I will not be judging the validity of these theories currently being debated. Although my background is in economics and finance, I will be taking the point of view of someone interested in designing for people who are not experts in the subject. With this paper, I hope to engage and persuade the community of designers to look at the impact their work has on the public debate of complex issues, such as economics.

#### Why Economics' Methodology is Rhetoric

In *The Rhetoric of Economics*, Denise McCloskey challenges the belief that economists employ the methodology of Logical Positivism in their search for truth, instead she argues that economist rely on the tools of rhetoric to persuade each other. Bruce Caldwell in *Beyond Positivism* makes a comprehensive survey of competing methodologies employed by economist in the twentieth century. He argues that

there must be a pluralism of methodologies, since there is no universally trusted method to determine which theories to accept and which to reject. Does rhetoric have a role to play in economic debate? Mc-Closkey argues yes. Economists relying on mathematical models of the economy and statistical tests of significances are relying on metaphor "the most important example of economic rhetoric...and everyone understands that a metaphorical question is at issue when someone asks whether a mechanical or a biological analogy best suits the economy as a whole." (McCloskey, 40) Perhaps the most famous economic metaphor is Adam Smith's "Invisible Hand". If we accept McCloskey's argument that an economic model functions as a metaphor then the graphical representations of these models (such as supply and demand curves) can function as metaphors of economic activity.

In *Beyond Positivism*, Caldwell chooses methodological pluralism, rather than choosing among differing methodologies to determining the validity of an economic theory. Currently no single methodology, in his opinion, can definitively choose the correct theory among competing theories. Against the charge that this pluralism will lead to anarchy, he states that (in words a student of rhetoric would recognize) "methodological discussion is as much a form of persuasion as it is a means of ensuring that problems are viewed from different perspectives. Unless a particular methodological view is persuasive, its existence is usually inconsequential." (Caldwell, 251) Since the art of persuasive communication (i.e. rhetoric) can find a home in economics, a designer trying to communicate these ideas needs to understand rhetoric in their own work.

#### **Defining Integrity**

Presenting economic data with integrity requires the designer to visualize the information without distortion while at the same time making the message as clear as possible. Presenting the premises of an argument, giving the audience the opportunity to judge the merits of the case without manipulation of facts is one form of integrity. The audience should be able to discern the different parts of the argument and understand how they support the conclusion. The tension between integrity of the data and the presentation of the message can be found in the graph on the left. In this graphic, the message is clear: the price of stamps has increase so dramatically over the course of 30 years that the cost to mail a letter is now out of reach for most people. Yet, when you look more closely at the data in the graphic it tells a different story. The red line is based on the nominal change in price, i.e. not taking



Designer's Guide to Creating Charts and Diagrams



Edited to show the data in the graph.

into account the effect of inflation. Moreover, that effect would be substantial at 248%. That this information is available on the graphic is not good enough. Since it is displayed as text and is not part of the image the effect of inflation on the slope can be easily overlooked. The slope of the line is what will be seen first and easily interpreted by the viewer. In addition, there is no clear baseline to represent zero and although one might assume that it is the bottom of the mailboxes, this is not the case. Finally, the choice of the size of the male figure in the graphic is a deliberate one used to exaggerate the increase of the price. Had a larger figure been chosen this increase in price could have been shown as well within people's financial reach, even appropriate. While we do not know the context in which this graphic was originally displayed, one could easily assume that it was not intended for an audience of "experts". The cartoon-like images, the small data set, the description of C.P.I. as "cost of living increase" makes it very unlikely that this was created for an audience of economists.



Treating the chessboard as the equivalent of a graphic and applying Bertin's methodology, the board has two axis, which represent the position of the pieces on the board. The horizontal and vertical axis are the first two components of the data set. A third component is the type of piece: king, knight, pawn etc. The fourth component is the player each piece belongs to, which is designated by its color: black or white.





Prints and Photographs Division Library of Congress

# Information Visualization in the News

#### **Designing for the Novice**

People are pattern-making machines. Yet, there is a difference in how a grandmaster might view a graphic representation of a chessboard and how a novice would view it. A novice chess player looks at each piece and tries to determine their next move based on all the possible moves that they might make. A grand master in chess is able to recognize the pattern that the pieces make on the board from thousands of hours of practice and study. A well-design graphic can help a novice player make sense of the data, to see the patterns more quickly and to be able to interpret their meaning. An expert may be able to look at the raw data and see the connections between the different elements but a novice is at a disadvantage unless the graphic is somehow simplified. While the graphic representation of a chessboard cannot be simplified (reordering the pieces on the board according to the color of the piece would violate the rules of the game) when the data in a graphic can be reordered, for example ranking countries by their GDP in a bar graph, it creates a well-constructed graphic *image* that a novice can intuitively understand.

#### **Qualitative Visualizations**

Although graphs are useful for visualizing quantitative relationships not all visualizations of economic conditions are quantitative in nature. One strength of photography is its ability to picture the object of the argument, to make it concrete and give it *presence* in the mind of the viewer. Photographs can provide an emotional impact that supports the message contained in a graphic. During the Great Depression, photographers were sent out by the Farm Security Administration to document, among other things, the adverse effects of the Depression on the lives of people in rural communities and smalltowns. Many of these images show people displaced by the Dust Bowl, farm mechanization and the Depression; people who were forced to seek jobs out West or the industrial cities.

Illustrations can also serve to support a message. In Harvard Business Review article the writer argued that most business executives' believed out-of-date myths about salaries. The illustrator, describing his approach to creating the accompanying picture, states:

Craig Frazier in The Illustrated Voice



The article was direct and critical. I presented a drawing that I felt reflected the author's frank and cynical sentiment. I found the style of writing honest and easy to respond to. The figure stands with arms crossed, looking straight ahead, his view shrouded by two dollar bills tied to his head. He seems focused and fixed on his posture—unaware of his periphery. (Frazier, 87)

The author's storytelling is transformed, by the illustrator, into a colorful and simple image, that supports the message of the article.



Commuters left stranded: A striker pickets in front of the Metropolitan Transportation Authority last week in Los Angeles, Public transit mechanics walked off the job to protest changes in a health insurance trust fund.

# As health care costs rise, workers shoulder burden

Labor fights flare as premiums soar

By Stephanie Armour and Julie Appleby USA TODAY

In California, 70,000 supermarlet workers are walking the picket lines to protest proposed health benefit cuts. Thousands of commatters in Los Angeles have been stranded as public transit mechanics walked off their jobs over charges to a health insurance trust fund. And in Chicago, garbage piled up for days this month after trash hauliers went on strike to prevent health insurance crost increases.

bargaining table, health care has emerged as the top concern, replacing wages and job security.

USA Todav

October 21, 2003



sough the battles involve union thers, they illustrate what of workers face: the ending of ra when large employers covimost — in ort all — of the cost eath care and the beginning of iture when workers will insingly he responsible for those

In the past two years, with insurce premiums rising at their fastclip in a decade, employers we shifted more of the cost to inters. That has come as a shock or the managed-care decade, then workers saw their out-of-

Now, it's back to the future as mployers embrace ideas that fell ut of favor with the rise of manged care: annual deductibles and o-payments of 20% or more for See COVER STORY next page •

News photographs are another example of visuals working with (sometimes overshadowing) the text to deliver a message. These photographs are often the most memorable part of the front page, competing with the main headline for the attention of the reader. The message of an article will have the most impact when it is mirrored and reinforced through the images that accompany it. According to Roland Barthes, the press photograph is a message embedded in "a complex of concurrent messages with the photograph as centre and surrounds constituted by the text, the title, the caption, the lay-out and, in a more abstract but no less 'informative' way, by the very name of the paper..." (Barthes p.15). The caption of a photo and the photo are read as one element and therefore, "caught as it were in the iconographic message, the verbal message seems to share in its objectivity". (Barthes p. 26) Therefore, the caption can be used to impose an interpretation of the photograph, while at the same time borrowing the photos perceived objectivity. While this effect is less noticeable with a headline or the text of the article due to their distance from the picture. When analyzing the messages in the newspapers the text must be understood as working with the graphics that accompany it.

#### Analyzing a News Article — USA Today

Pick up the front page of a newspaper or a current affairs magazine today a chances are that you will find an article about some economic issue from pensions to the deficit to health care.

In a recent USA Today article about the rise of health care cost, there is a photo of a woman on a picket line with a sign "To Save Our Health and Welfare Benefits". This photograph is the first part of the article that catches the eye of a reader glancing at the front page. It shows the emotion on the face of the striking worker. Below, a simple bar graph shows the increase in the cost of health insurance premiums, although the title of this graph is "Workers' share steady". This seams at odds with the overall tone of the photo and the headline of the article "As health care costs rise, workers shoulder burden". The large bold typeface and its position right below the photo, suggests that this headline will be the second element of the article to be noticed by the reader. It is only through a closer reading of the small print under the graph is this inconsistency clarified: the percentage of the cost paid by the workers has remained steady, but the dollar amount has increased as the overall cost has increased. If "Workers' share steady" were truly the message then drawing two pie charts showing the change in the percentage would be a stronger image than the bar graph. The headline should be changed to reflect that message as well.

A reader will glance over the headline and images an article to determine its content, especially on the prime real estate of a newspaper—front page above the fold. These elements in the USA Today article present the message that health care cost are rising, that the financial burden on workers is increasing and that (unionized) workers don't like it as illustrated by the photo and the second headline "Labor fights flare as premiums soar". However, within the article, in the third paragraph, the underlining message is presented:

Though the battles involve union members, they illustrate what many workers face: the ending of an era when large employers covered most—if not all—of the cost of health care and the beginning of a future when workers will increasingly be responsible for those cost. (Health care, 1)

This assertion is stated as a fact although the evidence presented up until now does not directly address it. The article supports this claim by pointing out: that despite the "managed-care decade" where worker out-of pocket costs decreased, the insurance premiums are increasing faster than before; that the number of firms that pay 100% of the premiums for their workers has decreased; that unions are foregoing higher increase in salaries to keep health benefits; that a grocery company facing competition from chains like WallMart that cover less of the health costs; that the Windber Medical Center costs have increased and in the words of an administrator it is the "number one expense, next to salary". It is implied through this series of anecdotal statistics that the trend of increasing cost paid by workers is nearly inevitable. Borrowing the authority of different sources can be an important tactic to strengthen an argument's persuasiveness. Some of the data included in the article is from the Kaiser Family Foundation described as a nonprofit research group. Kaiser, not a well-known name, was only mentioned briefly in the inside pages of the article and cited at the bottom of the bar chart. A spokesman for the union, a resident scholar from a "conservative" think tank, a laid off product manager, an administrator for a Medical Center, and spokesperson for a grocery store chain, provide a mix of different points of-view that help create the impression that the article is not biased. Also the article points out the tension between unionizes and nonunion workers and between senior workers and new hires.



USA Today October 21, 2003

On the second page of the article, a chart labeled "Health and the city" does not present information directly related to the message in the article nor does it provide a broader context. Instead it looks like an "infographic" that seems to be helpful information but instead does not move the debate forward. The graph "More people lack coverage" shows the historical count of uninsured. It is related to the text in the article but the dip in the number of uninsured in 1989 is left unexplained and it is unclear why the 1987 was a significant place to begin the graph. Finally another photograph is included, of the same subject matter in the first photograph on the front page. The headline, "Amount workers pay for family coverage rises nearly 50% from '00 to '03" has a statistic, 50%, used to support the original premise that the cost bourn by workers has increased dramatically over the past few years. While 50% seems high it is presented out of context; the reader does not know if this is the only time that the cost has changed this much in a three year period.

The article is a patchwork quilt of statistics, charts, quotes, and photographs, that is threadbare is several places. A mix of different sources supports the premise that this conflict over who should pay for health care is intractable. The way the argument is presented, there are two choices: you pay out-of-pocket or your employer pays. However, the current role that the government has in paying for health care is not presented in either the article or the images that companioned it. The focus of the article is on one aspect of the financing of health care. One solution to this problem is to place the information in a broader context by creating graphics that provide the answers to some basic questions about who is paying for health care, how much it costs, and showing the historical data. These graphics could be developed over time and reused in any article that covers this subject. Even if there is not enough space in the newspaper itself, they could easily be added to the companion web site, updated when necessary. This provides a consistent overview of the subject, placing the article's data in context, even when the article itself is focused on one small part of the story.

#### Bertin's "Rhetoric of the Image"

In the *Semiology of Graphics*, Bertin writes about two issues related to rhetoric: first, the importance of designing a graph for an audience and second, the ability of a graph to deliver a message. He argues that a designer must consider the reader when constructing a graphic, the reader being Bertin's word for audience. In order to judge the usefulness of a graphic you must first understand the questions the reader is asking. These questions are based on the components of the data set (i.e. the concepts that vary in their value, such as the stock price) and by the 'level of reading' which he classifies into three groups: elementary intermediate, and overall. Bertin obligingly uses stock prices to illustrate these three levels in his book.

Given two components, prices and dates, two types of questions can be asked: "On a given day (the eighth, for example), what is the quotation for stock X?" or "On what day(s) was a given quote (430 francs, for example) reached?"







Semiology of Graphics

Elementary: "'On a given date, what is the quotation for stock X?' There is only one input date, and on that date there is only one pertinent correspondence, a single point."

Intermediate: "'Over the first three days, what was the movement of the stock?'...Such questions are numerous, since the groups can be formed by any combination of the categories (dates) of the input component."

Overall: "'During the entire period, what was the trend of the stock?...Such a question tends to reduce all the information to a single, ordered relationship among the components. It enables the reader to retain the whole of the information and compare it to other information. This is the external form of information processing." (Bertin, 141)

Bertin endeavors to provide a comprehensive theory describing the creation an efficient construction, i.e. the "meaningful visual form, perceptible in the minimum instant of vision, will be called the image." (Bertin, 142) It is through this image that a message is delivered to the reader in the most economical way possible. In contrast, figurations are constructions of multiple images that require the reader to select out and retain in their memory a large number of these images in order to answer the majority of questions that the information is capable of generating. It does not support questions of an intermediate or overall level. These figurations can provide value as storage for data, when the reader is interested in an efficient way to answer elementary level questions.

[However] the most efficient constructions are those in which any question, whatever its type and level, can be answered in a single instant of perception, that is, in a single image...We could superimpose several images in a figuration, and it would still remain efficient, provided that the images were not very numerous, that they were very simple, and were differentiated in the most efficient graphic manner. (Bertin, 146)

It is through the designer's construction of the graphic that certain questions and answers are given presence in the mind of the reader. In the construction of an image, the integrity in the presentation of the data is maintained by supporting the reading of the data at the elementary and intermediate levels while still communicating a message at the overall level. Three functions of graphic representation:

Inventory Graphics—Information comprehensive Replaces human memory Figuration: multiple elementary images

Processing Graphics—Information comprehensive Inscribed in human memory Collection of reorderable images

Massage Graphics—Information simplified Inscribed in human memory Superimposition of several simplified images (Bertin, 166)

It is by a thorough understanding of these properties of graphics that one can select and visualize data to support an argument. In Bertin's definition of graphics it is a "rational and efficient tool when the properties of visual perception are competently utilized, graphics is one of the major 'languages' applicable to information processing." (Bertin, 2) the other two are verbal and mathematical. In economics, all three modes are employed to communicate the ideas and theories. Graphic information processing lies between two extremes: a graphic where everything is chaotic or a binary graphic (having two parts, one side black, the other side white). Therefore, graphics are useful "only for transcribing intermediate complexities, that is, problems relating to statistical studies".(Bertin, 166)

However, when communicating statistical or mathematical concepts with an audience of novices (the general public) simple images can be used as an effective tool of rhetoric. Complex images are more effective for the expert audiences, i.e. the economists exploring the data for themselves or economists speaking to an audience of their peers. "Complex images...generally offer numerous levels of reading, among which the reader may hesitate. On the other hand, simple images offer few levels and reduce this hesitation. They are more easily memorized and can be used in superimposition of images."(Bertin, 166) This is not to say that a designer will never need to use the other types of graphic information process (i.e. inventory graphics or processing graphics) for their own exploration but that the final images that they create will often be designed as a "message" graphic supporting an argument.

The map below meets the requirements for an "image" as defined by Bertin.



The Visual Display of Quantitative Information

Kenneth Burke's four master tropes: metaphor, metonymy, synecdoche, and irony can be used to analyze the above "image." Irony is the ability to see from more than one perspective; in Bertin's theory, this corresponds with the three levels of reading: elementary, intermediate and overall. In this image of population of the United States, the white dots on the dark background become a metaphor for the country's poplutaion. However, if we take the graphic as a reduction of a whole country into the abstraction of lines, points and areas this is metonymy. Finally, having the population of the United States stand in for the country of the United States is an example of synecdoche, since the people are part of the country.

Every argument implies a preliminary selection of facts and values, their specific description in a given language, and an emphasis which varies with the importance given them. Choice of elements, of a mode of description and presentation, judgements of values or importance-all these elements are considered all the more justifiably as exhibiting a partiality when one sees more clearly what other presentation, what other value judgement could oppose them. (Perelman, 34)

Moreover, the presentation of these elements must be placed in a context that allows the reader to judge the validity of the data used to support the argument.

For Bertin, one doesn't *read* a graph in the way one reads a paragraph, instead you ask it a question. "The questions left without visual answers measure the uselessness of poor construction." (Bertin, x) Therefore, the design of a graphic may support some questions and not others and that "choosing to single out certain things for presentation in a speech [or a graphic] draws the attention of the audience to them and thereby gives them a presence that prevents them from being neglected." (Perelman, 35) However, visual representation can take other forms than quantitative visualizations, such as a photo of striking workers or the price of gasoline displayed on a gas pump displacing the future price of gas. "The techniques of presentation which creates presence are essential above all when it's a question of evoking realities that are distant in time and space...it combats the domination of our sensibility by our surroundings". (Perelman, 35) The function of news programs is to draw to the viewer's attention events that are distant in time and space.

#### **Television and Graphics**

The use of graphics on paper can be very powerful when they are designed well but what about another medium such as television. A common sight on C-SPAN is a member of Congress speaking in the House of Representatives, standing next to a large cardboard display with a colorful chart printed on it. While he is arguing for a bill before the House; the point of this chart is to show how the bill will affect the deficit. It is a rhetorical tool to show everyone watching—especially on TV—how this "objective" data supports the position that he is taking. Yet, it feels forced, the impact of the visual on the television audience is muted, the static image set on a large poster board is not taking advantage of television strength: moving pictures. Scrreenshots from the NewsHour









Newspapers are a writer's medium; the real work of story telling is in the text of the article. Television shifts the balance of power to the moving pictures. In a classic book describing political journalism Timothy Crouse wrote "A TV story with good visual could sometimes run a print story into the ground...the test of a good TV correspondent...was whether he could deal with all of the technical problems, guide his cameraman toward the right shots, and put the film together to form a coherent story". (Crouse, 154) Skillful use of those visual combined with an understanding of the relationship between text and image takes advantage of television's power, and the best TV correspondents do this. "When a producer wanted to compliment a gifted TV correspondent, he said, 'So-and-so writes well to film.' Which meant that the correspondent had a gift for weaving the copy and the film into one neat, indivisible strand of meaning: each picture illustrated a point that the voice was making." (Crouse, 154) What was true in the coverage of a presidential campaign in 1971 is true in today's coverage of economic issues.

#### Analyzing a TV News Segment — The NewsHour

The PBS daily news program The NewsHour covers in an hour-long format the current issues of the day; interviewing in their studio, experts and politicians often relying on a "talking heads" presentation. However, they also produce longer segments by regular correspondents that focus on a particular issue. A regular contributor to the program is Paul Solman, who covers economic news, using plain English and interesting visuals in his segments.

On March 5, 2003 Paul Solman's segment about the cost of the upcoming war with Iraq was broadcast. Like the newspaper article for USA Today, this TV segment relies on interviews from multiple points-of-view but this time the focus in on experts in academia. Yet, the video provides the audience with a picture of the interviewees talking in their offices and classrooms, setting these conversations (with an economist, two historians, a political scientist, and a student) in the setting of academia. That place is Yale University in its "exclusive grand strategy class". Moreover, Solman is careful to point out that we are at a school that is the "training ground for politicians" and the last three presidents, thereby establishing the authority of the institution and by association the people interviewed in this news segment.

Through editing the interviews and his own narration, Solman juxtaposes the different commentators to represent the different sides



in a debate over the cost to the United States to go to war with Iraq. Solman is also arguing for the value of an economic analysis to try to determine this cost. While Solman will sometime summaries the position of one of the debaters, he will always follow up with a clip of them speaking their own words. A significant advantage of television is its ability to "quote" people in their own voice with their nonverbal facial cues to accompany it, thereby strengthening in the mind of the audience that there are different points-of-views also allowing the viewer to judge for themselves the trustworthiness of the speaker.

The debate represented in the segment began when economist, William Nordhaus, published a study in December 2002 estimating the cost for United States (three months be for the war began). For that reason, he is the central figure in the segment. How is this study visualized for the TV audience? First, the cover of the study superimposed on an image of a military helicopter. During a interview with Nordhaus, the images are edited in the video showing the elements that make-up the calculation: solders running in the desert and climbing into a helicopter represent solders pay and their movement across the globe; the dust of explosions represent weapons; for oil fields destroyed we see images of an oil field on fire. As for the humanitarian assistance, the symbol of the Red Cross on a military transport is shown and for reconstruction, we see the rubble of concrete buildings. The most abstract visual is for occupation/peacekeeping duties. This is represented by a soldier's silhouette at dusk, walking across the screen. The lack of a clear image for peacekeeping seems now to be prescient given the current difficulty the US military is experiencing with this task. As for the impact on the oil market, the interview with Nordhaus shifts to a gas station where we see close-ups of the prices on a gas pump as he and Solman discuss the possible increases of gasoline prices on the economy. All these cases are examples of metonymy, the reduction of an abstract idea to a concrete part, giving it presence in the mind of the audience. What about the use of graphics in this segment? While we see several uses of qualitative image, representing the objects in the Nordhaus' analysis there has been no quantitative data up to this point. It is only when the price of oil is mentioned that a number (\$75) is added to the video images, emphasizing the narration of the correspondent. Later, we see the only visual graphic of quantitative data in the piece: a table representing of the cost of the war based



on two different scenarios. It is a pitiful example of data visualization in contrast with Bertin's graphic "image." Especially compared with the rich, visual storytelling in the piece, that helps the viewer understand the economist's controversial ideas.

In the *Semiology of Graphics*, Bertin restricted his theory to the application of graphics on paper. We must extrapolate from paper to video, to apply his work to television. Where is Bertin's "image" in this new segment? First, each frame in the video is perceived in an "instant of vision" but when does it become a "meaningful visual form"? That meaning is to be found within the context of what came immediately before and what came immediately after and that meaning (not unlike the relationship between a caption and a photo) it is dependant on weaving the words and these moving pictures into an "indivisible strand of meaning". But there is no way to visualize complex data on television so that the viewer can read the graphic efficiently, at all three levels, elementary, intermediate and overall in that instant of vision. The moving image on television is able to accommodate qualitative pictures in its visual storytelling but is force to leave the quantitative image behind.

## Conclusion

#### The Moving Image

In this paper, I analyzed two examples of the visualization of economic information in the news: a newspaper article about the cost of health care and a television news story about the cost of the War in Iraq. The newspaper article was able to use both qualitative visualization such as the photo of a striking worker and quantitative visualizations such as the bar chart. In the other hand, the TV correspondent relied almost exclusively on qualitative visuals, such as interviewing an economist standing in a gas station talking about the price of oil.

While the television piece was more effective in the visual storytelling (television's power has been demonstrated time and again), it was clear that it could not provide an image for the quantitative data. The only time they attempted to create one, they showed a table of numbers with a pretty border around it. This leaves us with the question: is it possible to present economic data or any quantitative data in a way that takes advantage of motion, sound and interactivity found in a digital environment, but have it speak with the power of Bertin's "image." I believe that the answer is yes and this is a rich area for further study. This idea is timely with the development of the Internet, which provides the ability to communicate to a wide audience with a combination of animation and interactivity. (And by interactivity, I mean, not just buttons and scroll bars, but the ability to sort, query, filter and zoom the data in real time.) With the explosion of economic data in the last 60 years, there is no lack of opportunities for visualization. Yet even now, if you go to Internet searching for this data you are likely find Excel spreadsheets and written reports posted to a web site.

#### The Designer's Role

There are two traps for the designer, the first is to treat the economist as the expert who owns the "meaning" of the data while the designer's role is to take this message and make is "accessible" or "interesting." By accessible I mean Tufte's chartjunk, illustrations that may catch the attention of the audience but at the expense of presenting the information with integrity and clarity. The second trap is to assume that the data "speaks for itself." While this view sidesteps the first trap by encouraging presentations that are stripped of ornamentation, it does not take into consideration that the presentation of the information requires a context for meaningful interpretation, "…that in a human conversation a number is high or low relative only to some standard, and the only relevant standard is provided by the humans involved". (McCloskey, 100) The power of Bertin's "image" for an audience is that the number of questions it answers are limited only by the data itself; at the same time, it can leave behind a picture in the mind of the audience by virtue of its rhetorical persuasion. Yet, we do not need to assume that "plain" visuals make the data's message clear to the audience. On the contrary, visual elements such as pictographs, photos, illustrations, animation, and video can support communication and clarify meaning for an audience. By expanding the designer's role to include creating meaning out of the data, the visualization process can truly support the communication of a message and in some ways, placing the role of the designer on the same level of the economist.

In *The Realm of Rhetoric*, Perelman describes the creation of a new rhetoric whose "goal is always to strengthen a consensus around certain values which one wants to see prevail and which should orient action in the future." (Perelman, 20) This persuasion is based on an appeal to the audience's common sense and their commonly held beliefs; it "aims at inciting action, or at least at creating a disposition to act." (Perelman, 12) This is not imposing one's will on the audience through force but instead brings about a "meeting of minds-a meeting which social and political institutions can facilitate or prevent...Freedom of speech and the press are important democratic victories, but even in a liberal society not everyone, in whatever circumstances, can speak and make himself heard." (Perelman, 11) It is important to point out that visualization of economic information is part of the process of helping people communicate with each other about political and social ideas. The "rhetorically savvy scientist [or designer] asks every time he or she is faced with data, 'So what?' 'How large is large?' 'What does it matter for the intellectual or political or moral issue at hand?" (McCloskey, 101) Numbers and statistics are often accused of being too abstract and therefore, not important or relevant to people. However, "what is present for us is foremost in our minds and important to us. Curiously, what loses in importance becomes abstract, almost nonexistent." (Perelman, 11) If the numbers use by economists and policy makers were given presence in the minds of people through the techniques of graphic representation and visualization then the disconnection people sometimes feel when these issues are debated in media can be diminished as citizens understand how their government's economic policy supports or does not support the values they hold.

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