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Visualizing a Non-Pandemic: Considerations for Communicating Public Health Risks in Intercultural Contexts

By Candice A. Welhausen

Abstract

Purpose: Report the results of a rhetorical analysis that examines the ways that data visualizations of epidemic disease influence risk perception in global contexts, propose strategies that technical communicators can draw from when constructing data visualizations for intercultural audiences in crisis and emergency risk scenarios, and discuss implications for technical communication practice.

Method: Rhetorical analysis of four select infographics created by the New York Times to communicate Ebola risk during the outbreak that began in West Africa in 2014 using the following facets associated with design in global contexts: use of warm and cool colors, high versus low-context, and collectivism versus individualism.

Results: Data visualizations dramatically shape how risks are perceived. Language-based content may communicate one message about risk, while the visual strategies used in data visualizations may communicate a very different message. Rather than emphasizing control over the outbreak, I argue that the visual message in the infographics in this analysis communicates the opposite. Maps show Ebola breaching national (Figures 1 and 4) and international borders (Figure 2), and line graphs (Figure 3) show sharp increases in cases and deaths in Liberia and Sierra Leone.

Conclusion: Warm colors increase risk perception. Further, data visualizations are high-context, collectivistic forms of visual communication, which lessen risk perception among experts but intensify risk perception among nonexperts. Technical communicators can draw from the following guidelines when constructing data visualizations that communicate risk for intercultural audiences: show quantitative information using a variety of visualization strategies, include explanatory text and/or visuals to more fully contextualize data visualizations, and add comparative data visualizations.

Keywords: data visualization, risk communication, intercultural, public health, epidemic

Practitioner's Take-Away

- An awareness of how different approaches to data visualization and design can affect the ways in which audiences perceive risk, particularly in health and medical contexts
- An understanding of how cultural communication factors can affect how different audiences perceive and respond to aspects of risk
- Strategies for creating data visualizations that effectively convey information about risk—particularly risk associated with health and medical situations—in global contexts

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Introduction

In the twenty-first century, public health efforts to control crisis and emergency risk situations like the spread of infectious diseases are increasingly enacted at the international level. Technical communicators are often uniquely positioned to construct risk communication (Grabill & Simmons, 1998); however, such communication scenarios often pose significant intercultural communication challenges.

A common strategy for disseminating risk information is creating data visualizations like maps, bar charts, and line graphs. Yet while research has explored the effectiveness of these graphics in conveying risk to nonexperts (Ancker et al., 2006; Lipkus & Hollands, 1999), less attention has focused on how these visuals shape risk perception, particularly in crisis and emergency risk communication scenarios, which frequently involve culturally divergent audiences.

This article reports the results of a rhetorical analysis that examines the ways that data visualizations of epidemic disease influence risk perception in global contexts. Following these results, I propose strategies that technical communicators can draw from when constructing data visualizations for intercultural audiences in crisis and emergency risk scenarios, and discuss implications for technical communication practice.

Risk Communication In Global Contexts: An Overview

Technical communicators are often tasked with creating risk communication, which "informs individuals about the existence, nature, form, severity or acceptability of risks" (Plough & Krimsky, 1987, p. 6). Risk is "the probability of harm in any given situation," (Powell & Leiss, 2004, p. 33), and producing risk communication was historically envisioned as subject matter experts "transfer[ring]" information about risks to nonexperts (Plough & Krimsky, 1987, p. 8). However, experts tend to assess risk quantitatively (Short, 1984), that is, in terms of numeric values and mathematical probabilities, while nonexperts gauge how a particular hazard might affect them and their loved ones personally. Thus nonexperts perceive situations that are potentially deadly or likely to affect people in the future (Slovic, 1986) as well as public health threats that they have limited control over (Foege, 1991) as far riskier than experts.

Risk communication practice began to recognize these key perceptual differences in the 1990s with the emergence of social constructivist theory (Fischoff, 1995; Leiss, 1996; Powell & Leiss, 2004) by emphasizing the influence of "social context and culture" (Lundgren & McMakin, 2013, p. 17), which pushed back against the notion that effective risk communication should seek to align nonexperts' perception with expert opinion. In the field of technical communication, for instance, Grabill and Simmons' (1998) "critical rhetoric of risk" prompts practitioners to take culture, values, and interests into account when constructing risk communication.

At the same time, the notion of *culture* is an exceedingly broad and multifaceted concept as Aldoory's (2009) extensive review of risk perception research within the U.S. illustrates, while Kostelnick (1995) calls attention to the difficulty of constructing visual information for culturally heterogeneous readers. Although Kostelnick (1995) does not focus on risk communication, he argues that approaches toward intercultural visual communication often range from "universal" to "culture-focused" with shortcomings inherent to both theoretical positions. Thus, as this research demonstrates, constructing visual risk information for intercultural audiences can pose significant challenges for technical communicators.

Communication challenges can become even more pronounced in crisis and emergency risk scenarios like outbreaks of epidemic disease (see Covello et al., 2001) as demonstrated by the public reaction in the U.S. and Europe to the Ebola outbreak that began in West Africa in 2014 (see Higgins, 2014). Although the probability that the epidemic would spread to these countries was very low for a number of reasons, nonexpert, Western audiences still perceived a high level of risk because they had no control over how the disease was spreading. As news reports publicized the worsening situation, international public response quickly grew into an "epidemic of fear" (see Strong, 1990) that the outbreak would escalate into a global pandemic.

Methods: Rhetorical Analysis Approach

In this article, I examine the following research question:

> *How do mass-media data visualizations for communicating crisis and emergency risk information influence perception of risk in global contexts?*

In addressing this question, I selected four static infographics (labeled Figures 1-4 in Table 1), which include two maps (Figures 1 and 2), one line graph (Figure 3), and a time line (Figure 4) that I analyze in detail.

All of the figures I analyzed were published in the *New York Times* (*NYT*) and used by that publication to communicate Ebola risk during the outbreak that began in West Africa in 2014. [The *NYT* created these figures based upon data from the World Health Organization (WHO), the Centers for Disease Control and Prevention (CDC), Médecins Sans Frontières/Doctors Without Borders (MSF), and other organizations.] The *NYT* published these figures online in the article "How Many Patients Have Been Treated Outside of Africa?" (Ashkenas et al., 2015), and this entry appeared in the World, Africa section of the *NYT*. Due to reproduction limitations, I was unable to include copies of these figures in this article; however, each figure is described in detail in Table 1 and at the beginning of the article's "Results" section in the sub-section entitled 'Use of Warm and Cool Colors.'

Table 1. Description of figures

List of Figures	Genre	Description	Data Source(s) and Date
Figure 1	Map	Shows Ebola cases in the three affected West African countries: Guinea, Sierra Leone, Liberia. Uses shades of brown/beige and red to show increasing number of cases. Includes a scale in the top right-hand corner that displays number of cases in the following increments: 1-5 (light brown/beige), 5-20 (slightly darker brown/beige), 20-100 (darkest representation of brown/beige), 100-500 (bright red), and 500+ (dark red).	WHO Data as of November 5, 2014
Figure 2	Map	Shows the 24 individual cases of Ebola diagnosed outside of West Africa in the U.S. and Europe. Includes Europe, the Middle East, almost the entire continent of North America, the very top portion of South America, a portion of Asia and the top two-thirds of Africa. Labels cities in these countries where individual cases have been diagnosed using small colored boxes. Color of boxes indicates the vital status of each patient: recovered (green), in treatment (yellow) and dead (red).	CDC MSF WHO Other organizations Data as of January 5, 2015
Figure 3	Line graph	Shows the number of cases and deaths in the three affected West African countries for the time period 3/ 21/2014-2/17/15. Uses a series of three side-by-side line graphs. Line showing cases is light gray; line showing deaths is bright red. y axis is labeled 2,200; 4,400; 6,600; 8,800, and 11,000; x axis is labeled with the time period (3/21/2014-2/17/15) in each graphic. Exact numbers for cases and deaths are given at the end of each ascending line and labeled with a colored dot (gray and red, respectively).	WHO 3/21/2014—2/17/2015
Figure 4	Timeline	Shows a timeline of the five Ebola outbreaks that have occurred in Africa: 1976, 1995, 2000, 2007, 2014. Cases and deaths are shown using orange circles. Cases are shown in light orange; deaths are shown using a darker orange. Each outbreak is labeled by "worse year": 1976 is labeled 2nd worst, 1995 outbreak is labeled 5th worse, and 2014 outbreak is labeled 1st. Countries where outbreak occurred are listed under the label. A small map of Africa in light gray shadowing under each outbreak on the timeline shows affected countries in dark orange. Exact numbers of cases and death appear under each small map.	WHO Data as of November 5, 2014

Media coverage often plays a key role in communicating risk about emergent public health threats (Reynolds & Seeger, 2005), shaping the ways in which risks are perceived (Slovic, 1986). In the twenty-first century, online news outlets like the *NYT* have an inherently global reach, and visual risk information about epidemic disease outbreaks reaches an international audience through such venues. Indeed, with a subscription base of over 400,000 readers around the globe (*NYT* International Media Kit, 2014), the *NYT* is one of the most widely read newspapers in the world and is thus an effective selection to review in order to begin understanding aspects of communicating risk in international contexts.

In conducting the rhetorical analysis presented in this article, I applied three facets associated with design in global contexts:

- The use of warm colors (that is, red, orange, and yellow) and cool colors (that is, blue, green, and purple)
- High versus low-context (that is, how much information is presented explicitly versus how much information is implied based on context)
- Collectivism versus individualism (that is, if information focuses on the group as a whole or on the individual within the group)

In analyzing the figures from the *NYT*, I used these categories to assess the perspective of both nonexpert viewers (that is, readers with very little to no knowledge about Ebola) and expert viewers (that is, public health researchers). In so doing, I also emphasized Western (that is, predominantly European and North American) and non-Western (that is, areas other than Europe and North America) cultural considerations. The next section of this entry presents the results of this analysis followed by a discussion of the implications my findings have for technical communicators who are tasked with conveying information about risk to global audiences. In this discussion, I also propose guidelines or strategies technical communicators can use when constructing data visualizations that convey risk to audiences from other cultures.

Results

This section is organized into the three factors of visual intercultural communication identified in the "Methods" section of this article. In this section, I first provide a more in-depth overview of the four different infographics I analyzed for this project (as listed in Table 1) in order to provide readers with a better idea of the various design aspects of each. Such an overview can help readers better conceptualize both an overall infographic and the different design aspects of that infographic as I discuss the results of my review of each of them.

A Description of the Infographics Analyzed for This Study

Here, I provide a more comprehensive description of the kinds of infographics (4 total) I analyzed for this study. To begin, the infographic I refer to as "Figure 1" in Table 1 is a map that uses shades of brown/beige and red to show increasing number of cases. This map includes Guinea, Sierra Leone, and Liberia—the three West African countries affected by the Ebola outbreak. This map includes a scale in the top right-hand corner that displays the number of cases that occurred in each nation in the following increments/colors: 1-5 cases (light brown/beige), 5-20 cases (slightly darker brown/beige), 20-100 cases (darkest representation of brown/beige), 100-500 cases (bright red), and 500+ cases (dark red). On this map, the darkest areas of red shading are clustered in Sierra Leone, southern Guinea, and northern Liberia—thus indicating the highest numbers of cases occurring in those areas—while the lightest areas are north and northwest Guinea and southern Liberia, indicating the fewer number of cases there.

The infographic I refer to as "Figure 2" in Table 1 is a map that that shows Ebola cases diagnosed outside of West Africa. This map includes Europe, the Middle East, almost the entire continent of North America, the very top portion of South America, the western portion of Russia, and the top two-thirds of Africa. The map also contains the names of cities in which individual cases of Ebola were diagnosed, and a series of small, colored boxes—ranging in color from green to yellow to red—appears after the name of each city. In this example, the color of the boxes indicates the vital status of each patient. The system is as follows:

- Recovered (green)
- In treatment (yellow)
- Deceased (red)

Additionally, on the same map, the three West African countries in which the Ebola outbreak occurred (that is, Guinea, Sierra Leone, and Liberia) are shaded in light yellow to indicate “countries with Ebola outbreaks.” The map is also annotated with descriptive information about Ebola patients who were diagnosed in New York (for example, a doctor who had been treating patients in Africa), Madrid (for example, a nurse who had been treating a missionary there), and Dallas (for example, two nurses who had been treating an Ebola patient there).

The infographic identified as “Figure 3” (a series of different line graphs showing the increase of cases in each country affected—Guinea, Sierra Leone, and Liberia—over time) in Table 1 also relies heavily on color to convey information about risk. This graphic uses different colored lines to depict the number of cases and deaths in the three affected West African countries for the time period March 21, 2014 to Feb. 17, 2015. This graphic does so through a series of three line graphs that appear side-by-side in the same overall image, and each of the three individual graphs depicts increases in rates of infection in one of the affected nations. (There is one graph for Guinea, one for Sierra Leone, and one for Liberia.) Each of the individual graphs uses two different colored lines to convey specific information. All three line graphs use a gray line to represent the rates of infection in each nation over time and a red line to note the deaths that occurred in each nation over time. In each of the three line graphs, the y axis notes the number of persons affected by the disease (with specific numbers indicating the rates of 2,200; 4,400; 6,600; and 11,000) and the x axis notes different points in time between March 21, 2014 to Feb. 17, 2015. The right-most/ending point of both the gray lines (infected individuals) and red lines (deceased individuals) on all three line graphs ends with a dot (gray or red depending on the color of the related line) and the specific number of cases of infection diagnosed and of deaths from the disease in each nation as of Feb. 17, 2015.

Finally, the last infographic (labeled as “Figure 4” in Table 1) shows a timeline superimposed above a set of maps of Africa. In this visual, dots are used to indicate when/the year in which a major outbreak of Ebola occurred in Africa (as well as note the number of affected individuals per outbreak based on the size of the related dot). Below each of these dots is a map of Africa in which only the related affected nation is highlighted (in dark orange) while the rest of the continent is depicted in gray. Key points on the timeline part of the infographic are the first Ebola outbreak that occurred in Africa in 1976, followed by dots noting outbreaks in 1995, 2000, 2007, and concluding with the most recent outbreak that began in 2014. On the timeline part of the visual, cases and deaths are depicted by the use of orange circles with light orange circles indicating cases of infection and dark orange circles indicating deaths from the disease. (In each case, the smaller, darker orange circle indicating deaths appears in the middle of a larger, lighter orange circle that notes number of infections.)

Additionally, the dots noting each outbreak are labeled by “worse year.” For instance, the outbreak in 1976 was the 2nd worst, the 1995 outbreak was the 5th worse, and the outbreak that began in 2014 was the 1st. The country(ies) where the outbreak occurred are listed under this label, and as noted earlier, a small map of Africa appears under each listing of countries—the map being completely gray except for those countries listed as having outbreaks appearing in orange on the related map. Finally, under each map of Africa that notes where an outbreak occurred in a given year, the related number of cases of infection and Ebola-related deaths for that year are listed.

Now that I’ve explained these items in more detail, I wish to discuss my analysis of these four infographics in terms of three areas associated with culture and visual design—those areas being the following:

- Use of warm and cool colors
- Aspects of high versus low-context cultures
- Factors of individualistic versus collectivistic cultures

Through such an approach, I highlight how factors of culture and design can affect perceptions of risk in global contexts.

Use of warm and cool colors

The notion that color is often interpreted in culturally-specific ways has long been recognized in intercultural communication theory. Madden et al.’s (2000) investigation into consumers’ color preferences in eight different countries (Austria, Brazil, Canada, Columbia, Hong Kong, China, United States, and Taiwan) reveals cross-cultural consistencies in the ways that warm and cool colors are perceived. They found that cool colors—“blue, green, and white are strongly associated with ‘peaceful,’ ‘gentle,’ and ‘calming’” (p. 97), while warm colors such as red were routinely interpreted as “active,” “hot,” “vibrant,” “emotional,” and “sharp” (p. 98). Somewhat more variation was found for the tones identified as warm (for example, gold, orange, and yellow), but the authors report that meanings for these colors also tended to cluster near the “active,” “hot,” “vibrant,” “emotional” end of their analysis scale.

The item to consider here is that color is often thought to elicit an emotional response (Amare & Manning, 2013). Thus the implications of Madden et al.’s (2000) research suggests that warm and cool color choices can dramatically shape risk perception in visual representations like data visualizations. This is because viewers will often attribute these associations to the risk being depicted in an image. Data visualizations, in turn, frequently use color to differentiate among variables within the context of the same visual. Consequently, analyzing the warm and cool color choices of the *NYT* infographics I examined in this analysis provides an initial framework for informing how technical communicators might think of and use aspects of color when creating visuals depicting aspects of risk to international audiences. Indeed, all four of the figures I analyzed in this article use color as a dominant visualization strategy to differentiate between cases of a given disease/infection and deaths resulting from that disease/infection when depicting the spread of the Ebola outbreak that began in West Africa in 2014.

All four of the *NYT* infographics I analyzed used warm colors to communicate deaths conveying a sense of “active,” “hot,” “vibrant,” “emotional,” and “sharp.” More specifically, red is used in Figure 1 (map of outbreaks in Guinea, Sierra Leone, and Liberia), Figure 2 (map showing infections diagnosed outside of Africa), and Figure 3 (line graph comparing number of infections to deaths in Guinea, Sierra Leone, and Liberia over time). Also, yellow and orange are used in Figures 2 and 4, respectively (but not Figure 3). Such design factors could have implications for how readers from different cultures respond to the information presented in these infographics.

In Western cultures, warm colors (particularly red) are often powerful signifiers of danger or warning, which, along with the use of shading in Figure 1 and Figure 4 (the timeline noting when an outbreak occurred and the related map noting where the outbreak occurred), in all likelihood increased the perceived level of risk among these viewers. Using shading to visually communicate increasing density of a particular variable has long been an established visual convention (Friendly, 2008). Using a warm color can also intensify this effect. For instance, unaffected areas are shown in Figure 1 (map of outbreaks in Guinea, Sierra Leone, and Liberia) in a “peaceful” and “calming” shade of white. The hues in this infographic then grow darker (moving to beige, then to brown, then to dark brown) as the number of cases increases, and they shift to a dangerously dark and arguably more urgent shade of red (at 500+ cases) to indicate the highest number of cases. Figure 2 (map showing infections diagnosed outside of Africa) represents individual deaths as small red squares that stand in strong contrast to the “recovered” patients as depicted by equal-sized small green squares that appear on the same map in greater number. In this case, the use of the cool color green, visually communicates these patients are no longer in danger. Conversely, in Figure 2 small, yellow squares are used to depict where individuals are “in treatment,” and the use of this warm yellow color could—inadvertently—visually suggest there is still a cause for concern.

In Figure 3 (comparative line graphs for number of infections versus deaths in Guinea, Sierra Leone, and Liberia), the data (that is, line) used to indicate number of individuals infected is light gray, while the line used to indicate deaths on each of the three graphs is bright red. In each of the three nations noted in this visual, the number of cases is substantially higher than the number of deaths in two out of the three countries (Liberia and Sierra Leone, respectively), and each of the line graphs in the overall infographic notes the exact number of cases versus deaths for each nation. In all three line graphs, the bright red, line indicating “number of deaths,” however, visually emphasizes the increasing number of deaths in contrast to the lighter gray line showing number of cases/individuals infected. In the line graphs for Liberia and Sierra Leone, the number of cases is three times the number of deaths, but the number of deaths assumes a higher level of visual importance because the creator of this infographic used a bright red line juxtaposed against a dull gray one.

Figure 4 (the timeline of outbreaks over the maps of where the outbreaks occurred), too, uses a warm color (orange) to show deaths, highlighting death as the more severe outcome in contrast to the lighter shade of orange used to show cases of infection. In the context of this infographic, the difference between cases and deaths is more visually pronounced in the 2014 epidemic because the numbers are significantly greater, thus, the corresponding circles used to plot them on the timeline are much larger than all of the others that appear there.

In all likelihood, the warm colors used in all four of the figures (particularly the use of the color red) would seem to increase risk perception. This is because these colors are interpreted cross-culturally as "active," "hot," "vibrant," "emotional," and "sharp." As such, these colors—and the infographic features that use them—more readily draw viewers' attention and have the potential to elevate perceived risk. In contrast, a cool color scheme dominated by greens and blues would have conveyed the opposite visual message. As such, infographics that used such colors to convey the same data (even in the same forms—for example, maps, line graphs, and timelines) might lower perceived risk among individuals because, as research notes, audiences from different cultures tend to interpret these colors as "peaceful," "gentle," and "calming." Thus, considering the rhetorical effect of warm and cool colors is an important design choice for technical communicators who construct visuals used to convey aspects of risk to audiences from different cultures.

Aspects of High versus Low-Context Cultures

Aspects of high and low-context cultures are a second factor that technical communicators should consider when creating visuals used to convey risk in global contexts. From this theoretical perspective, high-context cultures are classified as using less explicit and more indirect methods for conveying ideas and information because meaning is usually inferred from the situation in which the communication occurs. As such, the context in which an interaction takes place provides meaning to the interaction versus the words uttered during the exchange (Hall, 1976). Communication styles in China and Japan, for example, have been characterized as high-context because meaning is gleaned from the situation in which the communication occurs and not from the message itself (Hall, 1976). In these cases, one individual might not directly state key aspects essential to the exchange, for the other party is expected to "fill in" the details/missing information based on the context in which the parties are interacting.

The inverse situation tends to be true among low-context cultures where information can not necessarily be intuited from the context in which information is presented; thus, all details need to be conveyed as explicitly as possible to ensure the correct message has been conveyed (Hall, 1976). As Hall (1976) explains, in low-context messages: "the mass of the information is vested in the explicit code" (p. 91). Certain European countries (for example, Germany and the Netherlands) and the U.S. have, for example, been characterized as low-context cultures because in an exchange, meaning is explicitly conveyed through the message (that is, one "says what one means").

While the categories of high and low-context have generally been used to describe language-based communication strategies, they can also be applied to visual forms of communication. Visual communication is often high-context. As Kress and van Leeuwen (1996) point out, the meaning of visuals often seems intuitive because we already know how to "read" them. As a genre of visual communication, data visualizations are high-context because creators frequently assume that readers will know how to interpret them without a great deal of explicit explanatory information. Indeed, Kostelnick (2004) argues that atlases depicting U.S. census data created in the late 19th and early 20th centuries taught public audiences how to read many statistical graphical forms. During this time period, readers were often assumed to be readily familiar with some genres (for example, maps and line graphs) so minimal description was included when using these genres to convey information. Conversely, other visualizations (the pie chart, for instance,) were less common to many users at the time; thus, additional textual explanations were often included to ensure that audiences understood these visuals correctly. In the twenty-first century, such detail is often no longer necessary, Kostelnick explains, because most readers already know how to interpret these graphics.

The *NYT* infographics I examined for my analysis demonstrate the ways that data visualizations function as a type of high-context visual communication. For instance, Figure 1 (showing outbreaks in Guinea, Sierra Leone, and Liberia) is high-context because there is very limited additional explanatory (that is, textual) information both within the infographic itself (only the names of nations and two capitol cities are included) and in the accompanying article. In other words, this visual is not directly explained. Rather, viewers are expected to intuit its meaning from the other visuals and the text of the article. While Figure 2 (map of outbreaks outside of Africa) and Figure 4 (timeline of outbreaks with comparative maps) do include annotations that describe these visuals, the entry (both the article and the visual) contain limited information (language-based or visual) that directly explains what these visuals mean.

High-context forms of visual communication, like Figures 1-4, communicate a higher level of risk to intercultural nonexpert audiences. This is because the information about disease spread as conveyed in these infographics is presented primarily in terms of numeric values with limited explicit explanatory information. For instance, Figure 1 (the map of outbreaks and deaths in Guinea, Sierra Leone, and Liberia) shows the density of cases in three West African countries in stark visual terms by using a warm color scheme of beige, brown, and red. The space is visually portioned into these numerically-defined categories with no additional detail (total population, for example) to qualify the severity of the epidemic. Figure 3 (comparative line graphs for rates of infections and deaths in Guinea, Sierra Leone, and Liberia) and Figure 4 (timeline of outbreaks with parallel map of where outbreaks occurred) also use visualization strategies that construct risk nearly exclusively through numeric values and without explicit explanatory information. For example, in Figure 3 (comparative line graphs), cases and deaths are reported for each country as well as the dates for when they occurred. Figure 4 (timeline with maps) shows cases and deaths along a timeline, beginning with the first outbreak in 1976 and ending with the outbreak that began in 2014.

Thus, rather than visually communicating that the outbreak that began in 2014 was under control, these four figures show the situation growing progressively worse. If one were to review these four infographics, it would look like the numbers of both cases of infection and deaths from Ebola were increasing (Figures 1 and 3) with no indication of decline (Figure 3) as well as spreading across continents (Figures 2 and 4). Figure 2 (map of cases outside of Africa) in particular reinforces this message because this infographic visually inherently extends the reach of Ebola to the global level through the use of a map depicting other continents and regions. The use of this more global map suggests this highly feared, lethal pathogen was spiraling out of control. Providing additional direct and explicit explanatory information for high-context data visualizations is another strategy that technical communicators can use to lessen risk perception when sharing information with audiences from other cultures.

Factors of Individualistic versus Collectivistic Cultures

Individualism versus collectivism, a facet of cultural communication expectations proposed by Hofstede (1983), offers the final analytical perspective that technical communicators should take into account when creating visuals to convey concepts of risk to intercultural audiences. This facet of intercultural communication focuses on whether a particular culture places more value on the role of individuals or the individual's obligations to society/to the group. Much like high and low-context, this category has also often been applied to language-based forms of communication. For instance, Asian countries that tend to value groups and networked relationships have been described as more collectivistic cultures. In contrast, Western countries that tend to value the autonomy and the independence of the individual over what is best for the group have been described as individualistic. (Such cultures would include the U.S.)

Research in intercultural communication has pointed out that culture is often narrowly defined by nationality (see Jameson, 2007). Yet *culture* can also refer to the shared beliefs, interests, and values of a group defined by other characteristics such as ethnicity, gender, or even socio-economic status. Envisioned through this broader perspective, I suggest that researchers in the field of public health constitute a particular disciplinary cultural group that is inherently collectivistic because public health is the study of health promotion and disease prevention in populations. As Stroupe and Berkelman (1998) explain: "While clinical medicine has the individual as its focus, *public health* is fundamentally concerned with preventing disease, disability, and premature death in the population or community" (1). Thus while clinical medicine is exclusively concerned with treating individual patients, public health emphasizes relationships among aggregated quantitative information about groups, placing value on how to best manage disease in the population and not the individual.

As a dominant form of visual communication in public health, data visualizations tend to reflect this collectivistic perspective. This is because public health researchers often create these graphics to consolidate abstract data into meaningful, concrete visual representations. The objective is to create visualizations that they can employ to hypothesize trends, draw inferences, and (ultimately) make public health decisions. According to these perspectives, I argue that the four figures I analyzed for this project are collectivistic. They are so because they all show geographic (Figures 1 and 4) and temporal (Figures 3 and 4) patterns of disease spread. Both of these factors convey ideas and information in terms of what they mean for the groups affected by and the greater audiences concerned about this particular situation. (This is in opposition to an approach that might focus on providing each individual with person-specific information related to each individual's own, personal situation or context.)

This collectivistic perspective is fundamental for managing outbreaks. This is because when working in this area, researchers need to make effective decisions involving the well being of groups of persons versus focusing on the individual needs and expectations of all members in that group. Yet this collectivistic perspective also aligns with how experts perceive risk. This is because the collectivistic perspective emphasizes risk as a quantitative value, which increases risk perception among nonexpert viewers (particularly those in individualistic cultures) who tend to view risk in terms of how it might personally affect them. For instance, Figure 1 (map of Guinea, Sierra Leone, and Liberia), Figure 3 (line graphs comparing rates of infections versus deaths in Guinea, Sierra Leone, and Liberia) and Figure 4 (timeline of outbreaks and related map of outbreak locations) depict risk from an entirely collectivistic perspective. Only Figure 2 (map noting infections diagnosed outside of West Africa) might convey an individualistic perspective by documenting the locations of the 24 individuals diagnosed with Ebola outside of West Africa. At the same time, Figure 2 also does not account for the social and cultural concerns of nonexpert audiences. This is because Figure 2 does not provide detailed explanatory information, such as what officials will do if more people are infected outside of West Africa. More specifically, in order to mitigate risk perception, nonexperts need to know what they can do to protect themselves and their families (if anything), which is something not conveyed in this visual.

Thus, rather than diminishing risk perception by showing an individualistic perspective, Figure 2, in fact, increases nonexperts' sense of risk by not providing information about actions they can take to decrease their risk. Figures 1, 3, and 4 show aggregate data, and thus nonexpert viewers could not identify with the individual people affected. However, because Figure 2 shows details about individuals, nonexpert viewers might perceive higher risk. This is because the possibility of being infected became increasingly real, particularly if the infected individuals were in close proximity.

This last aspect of cultural communication, individualism versus collectivism, illustrates how data visualizations can frame risk from a collectivistic or individualistic perspective. Infographics like Figure 2 (the map showing the locations of individuals diagnosed outside of West Africa) shows this particular risk affecting individuals, while the other figures included in this analysis show risk affecting groups. This aspect influences how risk is perceived because nonexpert viewers will perceive visuals like Figure 2 as a more individualized representation of risk. Being aware of how visual choices create this particular rhetorical effect is also important for technical communicators to consider when designing visual risk information for intercultural audiences.

Strategies For Desiging Risk Information For International Audiences

The results of the rhetorical analysis I conducted suggest the design strategies used in Figures 1-4 may have inadvertently increased risk perception among international audiences. Thus I propose the following strategies for guiding technical communicators in constructing data visualizations for audiences from other cultures:

1) Show Quantitative Information Using a Variety of Visualization Strategies

Warm or cool color choices can dramatically influence the way that quantitative risk information is shaped and subsequently perceived. Thus technical communicators might use warm colors to increase risk perception in certain scenarios such as smoking cessation materials where the objective is to convey a high risk of lung cancer among patients who continue to smoke. Cool colors, on the other hand, might be used to decrease risk perception when the audience is already anxious about the risk. Still other colors such as gray and brown might be interpreted as more “neutral” by viewers, and thus might be more appropriate in crisis and emergency risk scenarios where risk perception is already high, and technical communicators want to downplay the risk.

Similarly, perspective can also substantially shape the perception of risk particularly in maps used to communicate risk on a geographic scale. Disease maps frame “diseased space” in particular kinds of ways (Welhausen, 2015). Thus including maps that show large geographic areas visually conveys to viewers that the risk is potentially present throughout the entire space depicted. When there are very few cases of a condition in a particular geographic area and/or the cases pose very little risk, technical communicators may want to avoid visualizing the entire geographic area. In such instances, they could instead consider representing the information using alternative visualization strategies. For instance, a table used to convey information on infection rates and deaths from a disease on a country-by-country basis might be a more effective method to communicate information about the global status of a disease versus a regional or a world map.

Different data visualization genres such as maps, line graphs, and bar charts emphasize different types of relationships among data. Thus technical communicators should carefully consider:

- The specific relationship they want to visually construct
- How this representation is likely to influence risk perception

For instance, maps like those shown in Figures 1, 2, and 4 emphasize spatial relationships. Thus using maps like those analyzed here visually communicate disease spread and increasing risk (even though the map in Figure 2 was probably created to convey the opposite) throughout the space depicted.

2) Include Explanatory Text and/or Visuals to More Fully Contextualize Data Visualizations

Researchers in risk communication have argued that nonexperts perceive risk more broadly than experts. However, experts’ perception of risk may not be as narrowly conceived as this idea suggests. Experts tend to assess risk in terms of probability, which focuses on numeric values. Yet assessing probability is not limited to mathematical calculations. Rather determining probability takes into account other contextual factors that directly influence these numeric values.

For instance, during the Ebola outbreak that began in 2014, health care infrastructure and access to protective gear were significant factors in determining the likelihood as well as the extent to which the disease might spread beyond West Africa. Risk assessment from an expert-level perspective then involves not only considering increases or decreases in the actual number of cases and/or deaths in a particular region (and over a particular time frame). Rather, it involves evaluating this numeric data within the context of other information. Such information might substantially increase or decrease overall risk in the potentially affected population. Thus expert viewers often interpret the risk shown in data visualizations through a comprehensive risk assessment strategy. Nonexperts, on the other hand, do not necessarily have access to information about other factors or a scientific understanding of how these factors might change the nature of the risk. When trying to address and convey risk effectively in global contexts, such factors matter a great deal for coordinating effective actions across regions and nations requires the understanding and cooperation of relatively sizable numbers of experts and nonexperts alike. Thus, in global contexts, effective data visualizations need to create a sort of “common ground” for how experts and nonexperts perceive the risks associated with a given situation. For technical communicators creating visual risk information in crisis and emergency risk scenarios, the challenge is often to downplay risk perception in international contexts. To do so, they should include additional explanatory information (visual and/or language-based) for nonexperts.

To make the point: Two of the visuals included in this analysis (Figures 2 and 3) do include textual annotations that provide explanatory information, while Figure 4 provides additional visual information. More specifically, Figure 2 includes the names of cities (as well as treatment facilities in the U.S.) where cases were treated as well as brief descriptions of several of the cases shown on the map. Figure 3 includes annotations with total number of cases and deaths as well as the exact time period. Figure 4 provides illustrations of the African continent for the five outbreaks, visually situating each within a specific, visually-defined geographic space. However, none of these figures includes additional information about the factors previously mentioned that drastically influenced the spread of Ebola: existing health care infrastructure and access to protective gear.

Adding visual or language-based annotations that specifically includes this type of information is a second strategy that technical communicators can use to more effectively manage risk perception. For instance, Figure 2 (map of cases diagnosed outside of West Africa) might have used smaller boxes to show cases in order to include a short description of the hospital and its capabilities in each area of the map where affected patients were being treated (as well as used a series of maps instead of a single large map in order to include more detailed contextual information). While a table that accompanied the map in Figure 2 did give a timeline of these cases and their status, it did not give detailed information about relevant treatment facilities that led to the high recovery rate shown. Figure 3 (comparative line graphs of infection rates and deaths in Guinea, Sierra Leone, and Liberia), too, might have included additional information. This could have included improved access to protective gear in each country (as applicable—and assuming that access to protective gear improved as the outbreak worsened over the timeframe shown). Figure 4 (timeline of outbreaks since 1976) might have shown hospital coverage in the affected areas in the maps of Africa under each outbreak depicted. This figure might also have included textual annotations about improvements in care since the last epidemic (as applicable).

3) Add Comparative Data Visualizations

Technical communicators might consider adding comparative information when using data visualizations to share information about risk factors with global audiences. Lipkus and Hollands (1999), for example, found risk ladders [a chart that shows the numeric values of a particular hazard(s) in descending numeric order; that is, the highest level of risk is shown at the top and the lowest at the bottom] were particularly effective in communicating "risk magnitudes" (p. 155), and that viewers tend to perceive information at the top as riskier. Lipkus and Hollands therefore suggest including comparative information (that is, details that relate the risk shown in the ladder to other risks that viewers are already aware of) may help to minimize this effect.

In a similar vein, technical communicators could include comparative information (either visual or language-based) when showing data visualizations that depict risk in crisis and emergency risk scenarios. For instance, technical communicators might compare the risk of getting Ebola with the risk of getting another communicable disease that is generally not perceived as dangerous or life-threatening. During flu season, for example, the risk of infection can be very high. Nonexpert audiences, however, generally do not perceive this disease as "high risk" because people often get the flu, and its symptomology is generally not severe. This is because the flu is non-lethal for most of the population, and overall the consequences of being infected, though unpleasant, are usually tolerable. Thus including comparative data visualizations of the most recent seasonal flu data for particular geographic regions of the United States and/or Europe to contrast with the information in Figures 1, 3, and 4, for instance, could have lessened how international audiences perceived the risk posed by Ebola in 2014 by situating it within a broader context. Doing so could have allowed nonexperts to compare the two risks in similar visual formats and come to more effective understandings about the actual risks involved with the situation.

Conclusion and Implications

Sociologist Ulrich Beck's (1999) concept of a "world risk society," which is simultaneously "…global, local, and personal" (p. 5), arguably anticipates the cross-cultural crisis and emergency risk communication scenarios of the twenty-first century. While the Ebola outbreak that began in 2014 did not grow into the large-scale pandemic many feared, such a scenario is certainly possible in the future. As public health efforts to control epidemic disease are increasingly enacted globally, understanding the ways that risk messages influence risk perception among culturally divergent audiences will continue to be important for technical communicators.

Risk perception is often deeply grounded in the level of control that viewers believe they have over the risk, particularly for nonexperts. Such perceptions are also shaped by cultural beliefs about disease and health. In Western countries, "containment" is the dominant metaphor for attending to epidemic disease (Welhausen, 2015, p. 274). As a result, the members of these cultures tend to adhere to a biomedical model for addressing disease (see also Segal, 2005)—that is, a framework that sees health as the absence of disease and disease as external to the body. Thus either visually reinforcing containment or a lack thereof is an important communication strategy for technical communicators to consider when constructing risk information about epidemic disease for viewers in these cultures.

For instance, a technical communicator creating online educational materials for parents about the MMR (Measles, Mumps, and Rubella) vaccine may want to reinforce containment (and thus communicate reassurance) by including interactive line graphs and maps that show declining incidence of these diseases over the past several decades. She might also choose to use a warm color like dark red to show higher rates at the beginning of the timeframe and then shift to cooler colors as rates decline. Conversely, if her rhetorical goal is to increase risk perception, she might visually show lack of containment by including national maps showing recent outbreaks of measles, for instance, or increasing incidence over the past decade in specific geographic area(s) where vaccination rates have been more lax. Technical communicators might also use a combination of these strategies depending upon the specific rhetorical situation.

Non-containment can also be an effective risk message for technical communication targeted to more knowledgeable viewers like public health decision-makers and government officials. For instance, while the figures included in this article may have increased risk perception among nonexpert audiences, technical communicators may want to use a similar visual risk message combined with a verbal message emphasizing lack of containment to persuade these viewers to allocate more resources to controlling a particular epidemic.

While containment is an effective visual risk communication strategy in Western cultures, this strategy may be less effective in non-Western cultures that see health and disease holistically—that is, as an imbalance *within* the body. These viewers may interpret control over risk of epidemic disease as internal, assigning more responsibility to individual behavior. For instance, China's first "imported case" of H1N1 during 2009, a graduate student studying abroad who had recently returned home, experienced a significant online public backlash for potentially putting others at risk (Ding, 2013). Ding explains that this case prompted unofficial risk communication that encouraged other students to wait before returning or to self-quarantine upon arrival, reinforcing containment as personal responsibility. In this type of situation, technical communicators might avoid creating visuals that highlight specific cases (like Figure 2, the map showing cases of Ebola diagnosed outside of West Africa)—for such visuals might increase risk perception as well as contribute to blame directed toward specific individuals.

In this article, I have examined how data visualizations can profoundly influence risk perception in global contexts. In so doing I have presented certain strategies technical communicators use when creating such visuals for international audiences. The guidelines I propose offer a model technical communicators can use to align the design choices they make with the expectations of individuals from other cultures. These guidelines can serve as an initial mechanism for addressing aspects of risk communication with global audiences.

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