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# Tracking the AIDS Epidemic in the United States: Diffusion Through Space and Time

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## ► INTRODUCTION

Places can affect other places through a process called **spatial diffusion**. It is the spread of some phenomenon over space and through time from a limited number of origins. Phenomena take the form of ideas, innovations, products, new technology, culture traits, and contagious diseases. At first glance, comparing the spread of agriculture at the dawn of civilization to the spread of dress styles and popular music or to the diffusion of a new strain of flu virus is like comparing apples and oranges. Upon more careful analysis, however, geographers have discovered that all phenomena that diffuse, no matter how dissimilar, share some general spatial patterns and processes.

There are two types of diffusion: relocation diffusion and expansion diffusion. **Relocation diffusion** occurs when the items being diffused leave the original areas behind as they move to new areas. People move to a new area and take their language, religion, and other cultural items with them, as in the case of African-Americans who moved from the rural South to the urban North during the mid-twentieth century and brought blues music to Chicago and contemporary Mexicans who migrated to America and brought Mexican cuisine with them. Although cultural traits are carried with the people who move, the number of adopters stays the same—at least initially.

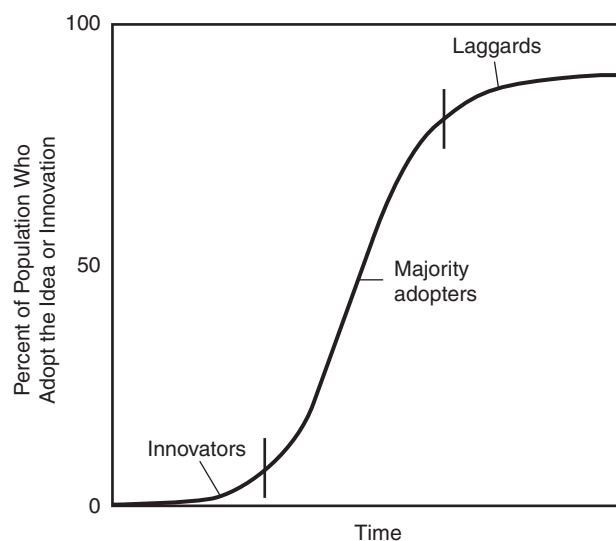
**Expansion diffusion** is the process whereby the item spreads geographically by passing *from* one person *to* another while remaining with the first person. In this case, the number of people adopting the item expands. The phenomenon being diffused often intensifies in the origin region as new areas are affected by the phenomenon. An example of this type is the diffusion of a new strain of hybrid rice in India or the diffusion of AIDS in the United States, the topic of this chapter.

Relocation diffusion is often followed by expansion diffusion, depending partly on how much the new residents interact with the preexisting population. Tacos and pizza are two classic examples of culinary innovations that came to the United States via relocation diffusion and then spread beyond Mexican and Italian immigrant populations by expansion (Figure 3.1).



**Figure 3.1** A self-serve Taco Bell on the UCLA campus illustrates the diffusion of Mexican cuisine in the United States. It also shows how, through syncretism (see Chapter 2), both the substance and the delivery method of traditional Mexican cuisine have been modified to American tastes and lifestyles.

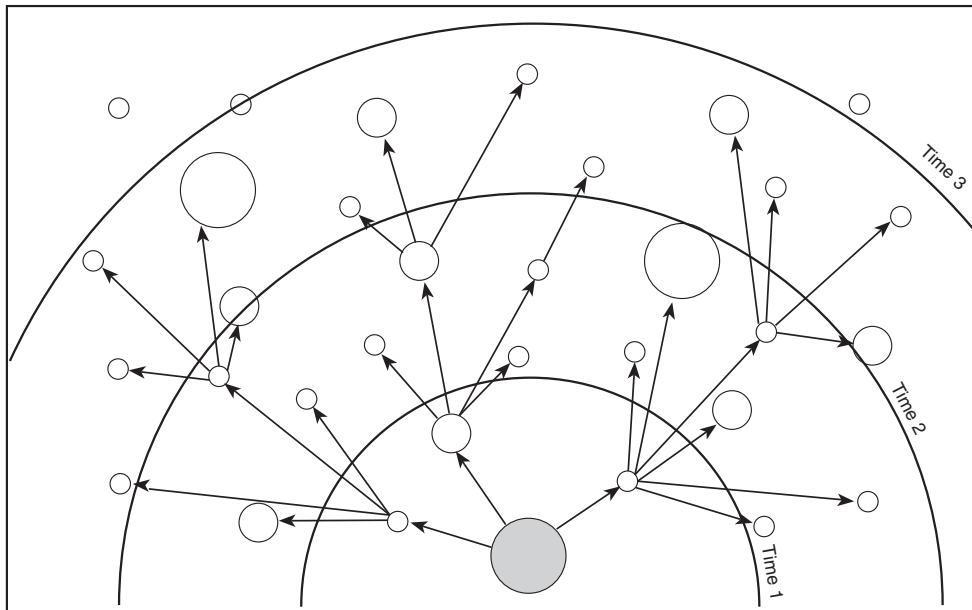
The adoption of phenomena generally follows an S-shaped curve (Figure 3.2). Take the case of cellular phone purchases as an example. Initially, only a small number of purchases were made because very few people knew about the product and few distributors offered it for sale. Later, the number of adopters grew exponentially as the early buyers spread the word through a large susceptible population (people who could afford but had not yet purchased a cellular phone). During this middle phase the majority of people who will eventually adopt do so. Ultimately, the rate of adoption tapered off as the number of susceptible people shrank and the novelty and excitement of cellular phones wore off. The level of adoption never quite reaches 100 percent. Even in the most modern and wealthiest societies, there will always be people who choose to live without telephones and electricity! In addition, many products and diseases taper off at levels much lower than 100 percent, such as snowboards, colored contact lenses, hip-hugger jeans, and the flu. If the



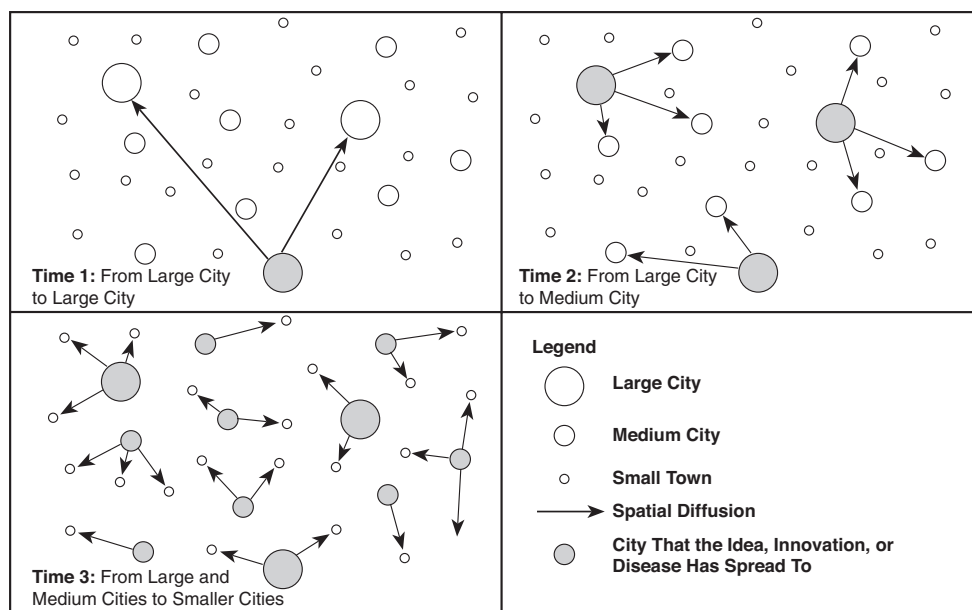
**Figure 3.2** Typical S-shaped curve for the adoption of some idea or innovation.

saturation level is low, say at 10 percent of the population, the innovators might constitute the first 1 percent, the majority adopters from 2 to 9 percent, and the laggards the last 1 percent.

How is it that some people adopt an innovation, purchase a hot new product, or catch a disease earlier than others? *Where* you live has something to do with *when* the diffusing phenomenon reaches you. The diffusion process has two spatial regularities. The first is a **contagious effect**, which says that places near the origin are usually affected first (Figure 3.3a). The farther you are from the point or points



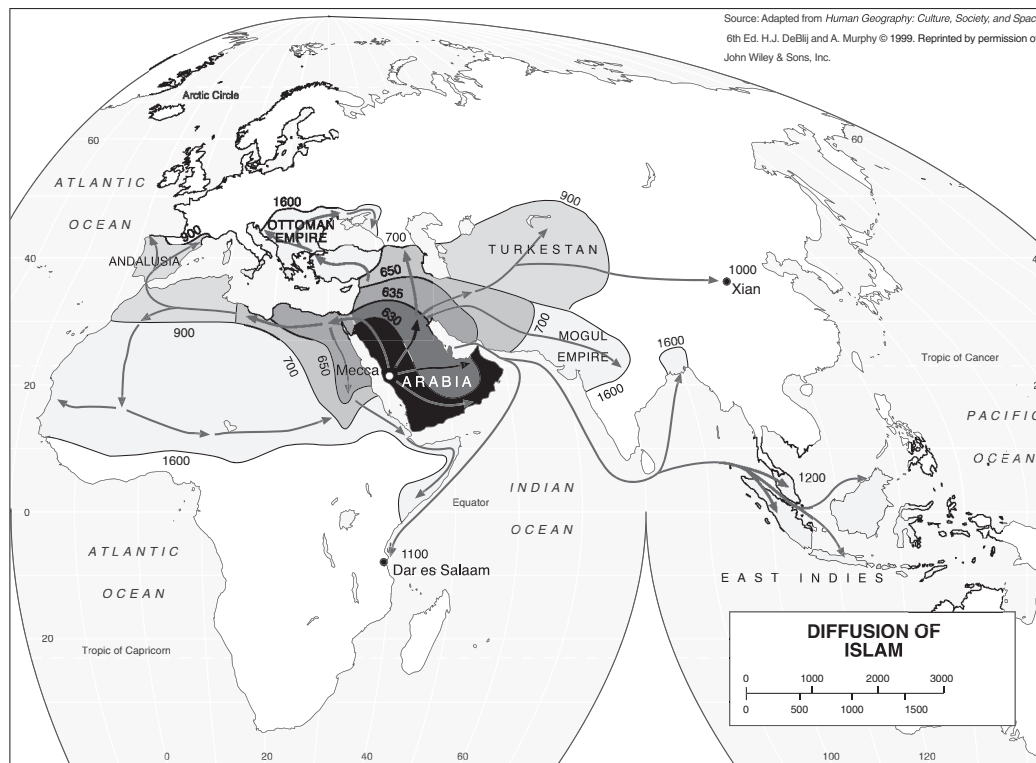
**Figure 3.3a** Typical contagious diffusion spreading like a wave.



**Figure 3.3b** Typical sequence of hierarchical diffusion.

of origin, the later you will be affected. Think of a pebble tossed in a pond. The ripple spreading through the water is akin to the contagious effect in diffusion. This process is strongly influenced by distance because you are more likely to come in contact with nearby persons than with more remote persons. The spread of Islam from its birthplace in Mecca in what is now Saudi Arabia is a good example of contagious diffusion at work (Figure 3.4).

Diffusion processes do not, however, always follow the rule of distance. Sometimes distance is less important to the spread of an idea or disease than contact with major cities or influential people. **Hierarchical effects** occur when phenomena spread first to major cities, then to intermediate-size places, and later to small towns and rural areas (Figure 3.3b). New clothing and music fads, for example, spread quickly among major world cities such as New York, Los Angeles, London, Paris, and Tokyo. Only later do they filter down the **urban hierarchy**, in other words, down from large cities to smaller places (see Chapter 9 for a complete discussion of urban hierarchies). This occurs for several reasons. First, larger places have a greater potential for interaction. Far more travel and contact occur between large cities due, in part, to their complex air, road, and communication links than between smaller cities. With more carriers of ideas coming to a place, large cities have more interactions with other people and places and, therefore, are first to find out about new styles and trends (you will see the effects of size on the number of interactions in Chapter 4). Second, the people in larger cities tend to be more diverse, wealthier, and more accustomed to change; cities attract more risk-taking persons. Third, the same can be said for the industries in larger



**Figure 3.4** The spread of Islam from its origin in Mecca shows the process of contagious diffusion.

cities: They also tend to be more diverse and more able and willing to adopt new technologies and practices.

A classic example of hierarchical diffusion is the spread of radio broadcasting in the “Roaring 20s.” From an initial set of cities (Pittsburgh, Detroit, Los Angeles, Seattle, and Oklahoma City) in 1920, radio diffused to a total of 126 small, medium, and large cities by 1924. In this case, the limiting factor was the need for a large enough audience within a limited broadcasting range to make it worthwhile to invest in transmission equipment and a tower. Half a century later, the musical genre of “punk rock” diffused hierarchically from its breeding grounds in New York and London to the next set of cities such as Cleveland and Los Angeles in the United States, and Belfast and Manchester in the United Kingdom. The hierarchical diffusion of punk rock in the 1970s relied on a different mechanism. Trendsetting musicians including Iggy Pop, Lou Reed, David Bowie, The New York Dolls, The Ramones, The Clash, and The Sex Pistols were attracted to cosmopolitan cities such as New York and London (Figure 3.5). They traveled frequently between New York and London cross-fertilizing new music, and they found a market for their avant-garde music in these cosmopolitan cities.

It can be difficult to disentangle contagious and hierarchical diffusion because both are usually at work in any real situation. One indicator of which diffusion process is dominant is the extent to which the innovation skips over large areas in jumping from city to city (hierarchical) versus the extent to which it spreads from place to place like a wave (contagious). Also, to qualify as hierarchical diffusion, larger cities should have a disproportionately higher number of cases than smaller cities;



**Figure 3.5** The Ramones perform at the Bottom Line in New York City in May of 1976.

that is, they should have a higher adoption rate *per person*. If a city of 1,000,000 people had only 10 times as many cases as a city of 100,000 people, there would be no evidence of hierarchical diffusion.

Above and beyond the contagious and hierarchical effects, the spatial pattern of diffusion is influenced by **barriers to diffusion**. These barriers can be physical in nature such as rivers, oceans, lakes, and mountain ranges, or they can be cultural. Language barriers thwart the easy flow of ideas and fads from the United States and English-speaking Canada to French Canadians in Québec. Similarly, a political boundary can impede or slow down the dissemination of disease. Economic factors play a role if people in a certain place cannot afford to purchase a new commodity.

Cultural and social factors can also *facilitate* diffusion. Geographically varying acceptance of gay lifestyles and differing intravenous drug use rates influence the diffusion of the AIDS epidemic in the United States. On a global scale, Thailand, with an exploitative but legal prostitution industry (so-called sex tourism), has a high AIDS rate, whereas China, with more conservative attitudes toward sex and less contact with the West, has a lower rate.

The purely spatial model of diffusion has been criticized by some geographers. These critics talk about **biased innovations** that diffuse according to social context rather than spatial context. Biased innovations are less accessible to people of a certain gender, class, ethnicity, or age, or less appropriate for them. Many people simply cannot afford expensive innovations and are denied loans to purchase them, even if they would help them to be more productive (e.g., computers, chemical fertilizers for farming, anti-HIV drug “cocktail”). Others lack the necessary education, which in turn can be gender based or class based. In some countries, girls lag 20 to 30 percent behind boys in school enrollment, and poor children in some countries are taken out of school and put to work. In some countries, women are denied access to normal channels of information, and the elderly have low literacy rates. The concept of biased innovations can be extended to diseases that strike different groups of people unequally.

This chapter asks you to look for evidence of contagious and hierarchical effects in the spread of AIDS in the United States. What were the early origins of the epidemic? What paths did it follow? Do there appear to be any barriers to diffusion of the epidemic? Understanding the geographic spread of this disease will help to plan for its effects and to predict (and hopefully dampen) the course of future epidemics.

## ▶ CASE STUDY

## TRACKING THE AIDS EPIDEMIC IN THE UNITED STATES

**GOAL**

To see how ideas, behavior, products, technology, and disease spread through time and across space as illustrated by the spread of AIDS in the United States.

**LEARNING OUTCOMES**

After completing the chapter, you will be able to:

- Define and give examples of hierarchical diffusion.
- Define and give examples of contagious diffusion.
- Interpret a scatter diagram.
- Interpret animated maps that change over time.
- Calculate cumulative totals and make a cumulative graph.
- Describe the diffusion of AIDS in the United States.

**SPECIAL MATERIALS NEEDED**

- Computer with CD drive and Internet Explorer 5.0 and above. See *Read Me*.

**BACKGROUND**

You may never have considered geography and the medical sciences to be related, but in fact they have an old partnership. In particular, the subfield of *epidemiology* is the study of how disease spreads. Geographers have long considered the spread or diffusion of phenomena across space.

AIDS remains a major health concern around the world. As of December 2001, 24.8 million people have died from the disease (3 million in 2001 alone), another 40 million are currently infected with HIV/AIDS, and about 5.3 million new HIV cases occur each year. Each day, 14,000 people become infected with HIV; over 50 percent of those are women and young adults, and about 95 percent occur in less-developed countries. More than 14 million children have been orphaned by AIDS worldwide.

Acquired Immunodeficiency Syndrome (AIDS) is caused by the Human Immunodeficiency Virus (HIV). HIV is a retrovirus that attacks T4 lymphocytes, white blood cells that are an integral part of the body's immune system. People with AIDS usually die of opportunistic diseases such as pneumonia, tuberculosis, and certain forms of cancer. Opportunistic diseases use the opportunity of a depleted immune system to take hold. Until the recent introduction of potent and expensive new drugs called *protease inhibitors*, AIDS was usually fatal within 10 years. In much of the developing world, however, these drugs are too expensive or unavailable.

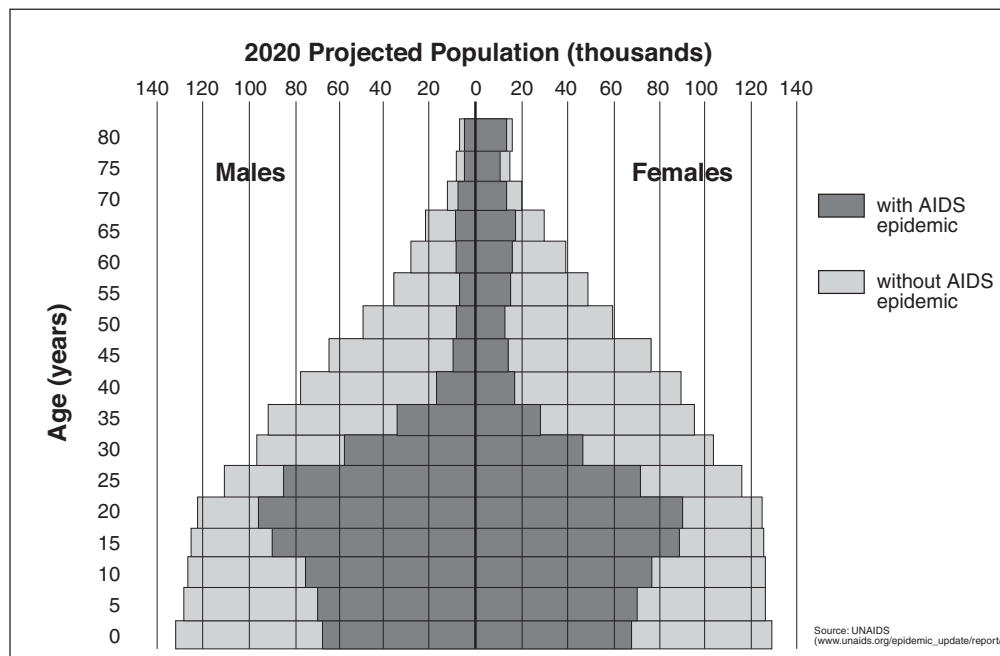
HIV is transmitted via bodily fluids. Because of a very long incubation period (time between infection and appearance of distinctive symptoms), the HIV virus spreads undetected for many years, resulting in seeding for a worldwide AIDS

pandemic. In the United States, homosexual males and intravenous drug users are among those most commonly infected. Infants born to women infected with HIV and people who received blood transfusions before blood was screened for HIV also have disproportionately high infection rates.

The origins of HIV have been traced to Africa, but *how* this disease originated remains unknown. Two strains of HIV have been co-circulating in Africa, HIV-1 originating in East-Central Africa and HIV-2 in West Africa. Virologists did not identify HIV-1 and HIV-2 until 1982 and 1985, respectively. Simian Immunodeficiency Viruses (SIVs) found in wild monkey populations in Africa bear similarities to HIV, particularly HIV-2. The occurrence of HIV-2 is also highly correlated with the habitat of the sooty mangabey, the monkey with the closely related SIV. The source of HIV-1 has been more difficult to identify, but many point to a related SIV in chimpanzees as the most probable source. The earliest documented HIV-1 infection is a man in Kinshasha, Congo, in 1959. Researchers measuring the rate of genetic change of HIV believe that current strains evolved from SIVs in about 1931. We do not know how these SIVs passed from monkeys to humans (a process called *zoonosis*), but cross-transmission of blood from animal populations, perhaps by people butchering monkeys for meat, is most likely. A more controversial interpretation has been that polio vaccines administered in the 1950s were made with kidneys from infected chimpanzees and led to the zoonosis from SIV to HIV. Although several researchers still believe this to be a possibility, subsequent testing of the original vaccine found no trace of the virus. The relatively late date of the vaccinations also makes this interpretation less likely.

No matter how the disease spread to humans, it might have remained an isolated event in rural African villages had not rural-to-urban migration and trade routes spread the virus throughout sub-Saharan Africa from its origins in East Africa (HIV-1) and West Africa (HIV-2). AIDS in Africa largely has spread through contagious and relocation diffusion processes. Heterosexual transmission, the dominant mode in Africa, has led to alarming rates of HIV infection—as high as 39 percent of the adult population of Botswana, and 5 million people in South Africa alone.

Several factors have contributed to the African AIDS epidemic. First, as a result of post-colonial development patterns (see Chapter 7), many African men looking for jobs have little choice but to leave their wives and children behind to live in male-only hostels in mines, plantations, and cities. Prostitution typically thrives in these kinds of situations, and many men inadvertently spread AIDS to their wives or girlfriends on their few trips back home every year. Second, abject poverty, famine, war, and other perils often threaten

► **CASE STUDY** (continued)

**Figure 3.6** Projected population for Botswana in 2020 with and without the AIDS epidemic. Each horizontal bar shows the population (labeled on the vertical bars) for five-year age groups (labeled on the left axis). Notice that by 2020, the 30- to 55-year-old age brackets—composed of today’s 15- to 35-year-old young adults—will be decimated, creating a society devoid of middle-aged expertise and leadership and a generation without parents.

a much more imminent demise than the delayed risk of contracting AIDS. Many African prostitutes complain of no other means of feeding their starving children. Third, ignorance and misinformation about AIDS and AIDS prevention is rampant, and traditional cultural taboos often enforce a code of silence surrounding the entire issue.

AIDS is having a devastating effect upon the development of many sub-Saharan countries, shortening life expectancies by 30 to 50 percent to as low as 30 years (Figure 3.6). Unlike diseases that tend to target infants and the elderly, AIDS kills sexually active adults in the prime of their lives. This increases the ratio of dependent population (children and elderly) to the labor force while requiring more workers and resources for the health care industry. This double whammy adversely diverts a country’s labor force, savings, and resources away from other pressing needs such as agriculture, industry, education, transportation, and services. In Zimbabwe, a country of about 13 million people in Southern Africa, more than 780,000 children have been orphaned by the AIDS epidemic. Many are forced to stop their educations and go into migratory labor or prostitution to feed themselves and their younger siblings. Annual basic care and treatment for a person with AIDS can cost as much as two to three times per capita GDP in the poorest countries. There will likely be 68 million deaths because of AIDS in the 45 most affected countries between 2000 and 2020, more than five

times the death toll of AIDS in the previous two decades in those countries.

Young women are the hardest hit in Africa. They are four times more apt than men to contract AIDS during heterosexual sex, they progress to full-blown AIDS faster, and they die sooner. Because of unequal economic and social power relations between the genders, women often cannot control when and with whom they have sex, let alone insist that their partner wear a condom (Figure 3.7).



**Figure 3.7** A Tanzanian woman stricken with AIDS with her son and a nurse.

► **CASE STUDY** (continued)

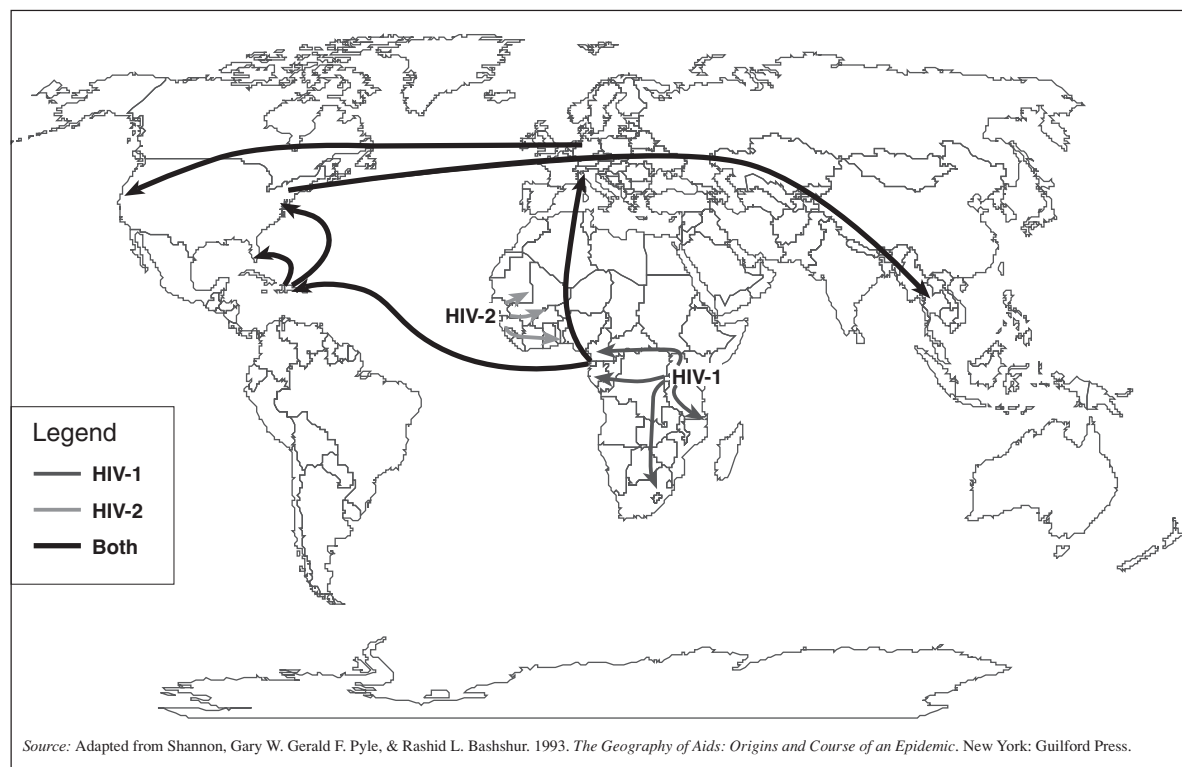
For the first time, the rate of new infections in sub-Saharan Africa stabilized in 2000. Some countries, such as Uganda and Senegal, have been successful at slowing the diffusion of AIDS. Successful anti-AIDS policies include three mutually reinforcing initiatives: (1) limiting the transmission of AIDS by advocating the use of condoms, (2) reducing the transmission of AIDS to newborn children from infected mothers by administering inexpensive (\$4) antiviral drugs to the mother just before birth, and (3) most important, empowering women and girls by better education. Educated and economically independent girls and young women are less likely to be coerced into relationships with older men—major carriers of HIV.

From its origins in Africa, HIV spread throughout most of the world via the global network of travel and migration (Figures 3.8 and 3.9; see also HIV data for every country in the world in the *Country Facts* spreadsheet on the CD). In the Western Hemisphere, Haiti was one of the first countries with high rates of AIDS. The disease has now spread to all Latin American and Caribbean nations, the United States, and Canada. It is believed that the first case in the United States, so-called Patient Zero, was an airline steward who vacationed in Port-au-Prince, Haiti. In 1981, the sexual contacts of 40 homosexual men with AIDS were carefully traced. Eight of the 40 were infected directly by Patient Zero and many others indirectly. HIV infection from the sexual contacts among this sample of 40 homosexual men produced

a geographic trail defining early epicenters of AIDS (Los Angeles, New York City, San Francisco, Miami—all of which have large gay communities).

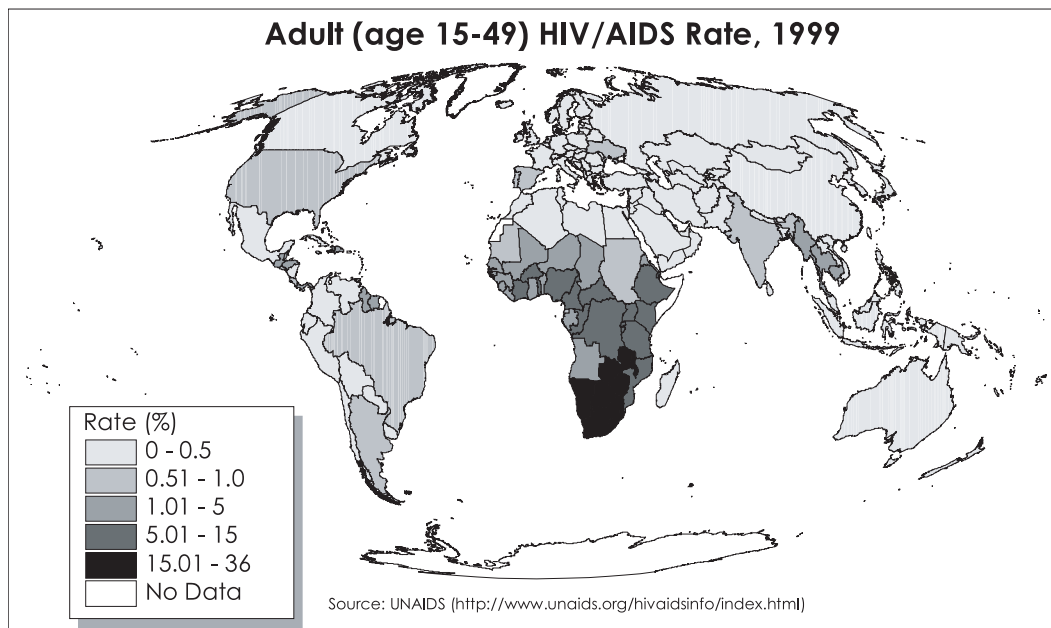
The number of *new* AIDS cases in the United States peaked in 1993 and then began to decline due to increasing prevention programs. Activists have raised public awareness of AIDS and demanded that governments and pharmaceutical companies devote resources to this issue (Figure 3.10). AIDS deaths (about 15,000 in 2001) and new HIV infections (about 40,000) have remained relatively stable for several years. Studies in San Francisco have shown, however, that new HIV infections are again increasing as many in the homosexual community again engage in risky sexual behavior. Infection rates for gay men in New York were found to be more than 12 percent, and some 80 percent were unaware they were infected. The most widely cited cause of increases in risky behavior and new HIV infections is the widespread belief that, because of the availability of new drugs, AIDS has changed from being a death sentence to a treatable disease. This has led to a growing complacency about AIDS, a trend that worries many health officials.

Although the homosexual community and intravenous drug users continue to have the highest HIV/AIDS rates in the United States, AIDS is not restricted to these sub-populations. As seen in Africa and Asia, heterosexual activity can also be a prevalent source for the diffusion of AIDS.



**Figure 3.8** Probable early diffusion of AIDS.

► **CASE STUDY** (continued)



**Figure 3.9** World HIV/AIDS rate for adults at the end of 1999.



**Figure 3.10** Marchers carrying signs at an AIDS march in the United States.

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## Tracking the AIDS Epidemic in the United States

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### ► ACTIVITY 1: MAPPING THE DIFFUSION OF AIDS

- A. Insert the CD into your computer. A window will automatically appear (if this doesn't work, see the *readme.txt* file or the instruction sheet that came with the CD).
- B. If *Human Geography in Action* has already been installed on your computer, click on *Run from HD*. If not, click either *Install* (for faster performance on your home computer) or *Run from CD* (on school lab computers).
- C. Click on the large *Human Geography in Action* logo to start.
- D. Click on *Chapter Menu*.
- E. Click on *Chapter 3—Tracking the AIDS Epidemic*.
- F. Click on *Activity 1: Mapping the Diffusion of AIDS*.
- G. Read the activity description and then click *Continue*.

On the map of the United States, you can visualize the diffusion of the AIDS epidemic across the country by changing the year with the slider bar below the map. You will be mapping the rate of AIDS cases per 100,000 population reported from 1986 to 2000, a 15-year span. Each metropolitan area appears on the map when it exceeds the threshold of 100 cases per 100,000 people. All metro areas are highlighted with a black diamond in the first year they appear and then convert to a blue square for subsequent years. Metro area names can be identified by “mousing over” the black diamonds in the year they appear. Notice that for the first year, 1986, only the metro areas of New York and San Francisco appear. They were the only two metro areas with more than 100 AIDS cases per 100,000 people in that year.

At any time you can click on the *Population* icon to turn on a graduated circle map of metropolitan area populations, in green. You may also click on *AIDS Rate/100,000 People* to see graduated circles in red that change from year to year as the AIDS rate of each metro area changes.

You need to consider many geographical factors as you study the maps and graphs of the spread of AIDS in the United States. First, the most vulnerable populations (homosexuals and intravenous drug users) are not equally distributed throughout the United States but tend to be more prevalent in certain kinds of locations. Second, as you saw in Chapter 2, regional cultural differences occur across the United States. Third, cultural differences can be related to the size of a place. Fourth, you must consider the amount and types of movement of people between the initial source regions and secondary places, keeping in mind that once AIDS has spread to a new place, the new place becomes a potential source region. Unfortunately, the data tell us only where AIDS appears, not which places infected which other places.

- H. With the entire U.S. map visible, slide the bar back and forth to see the diffusion through U.S. metro areas across the 15-year time span.
- I. Click on *Top 15 Metro Regions*. The boundaries of the 15 most populous metropolitan regions in the United States in 1990 (see box) are highlighted in red. See whether there is a relationship between when a metro area passes the 100-cases-per-100,000-people level and whether it is in one of the largest metropolitan regions of the urban hierarchy.

As each metro area appears, determine whether it is within one of the 15 largest metropolitan regions.

Metropolitan areas are functional regions defined and ranked by the U.S. Census Bureau. They are composed of a central “downtown” or “nucleus” county plus all surrounding nonagricultural counties that are connected to the nucleus via intercounty commuting patterns. Cities such as Atlanta that have only one central nucleus are defined as a standard Metropolitan Statistical Area (MSA). Sometimes metropolitan areas overlap with each other and merge together. The Census Bureau recognizes these cases by defining Consolidated Metropolitan Statistical Areas (CMSAs) that are made up of smaller component metro areas called *Primary Metropolitan Statistical Areas* (PMSAs). For instance, the New York CMSA in 1990 was made up of 15 PMSAs stretching from the Monmouth-Ocean, NJ PMSA to the New Haven, CT PMSA (see Chapter 10 for more information about Census-defined metropolitan areas).

The Top 15 layer shows MSA or CMSA boundaries (which we call *metropolitan regions*), and the dots that appear on the map represent the central cities of MSAs or PMSAs (which we call *metro areas*).

1.1. How many metro areas of each population level are added to your map in each year? (The first two rows are already completed to guide you.)

Year	Number of New Metro Areas Appearing on Map <i>within</i> the Top 15	Number of New Metro Areas Appearing on Map <i>not within</i> the Top 15	Total Number of New Metro Areas Appearing on the Map (add the two columns to the left)
1986	2	0	2
1987	1	0	1
1988	_____	_____	_____
1989	_____	_____	_____
1990	_____	_____	_____
1991	_____	_____	_____
1992	_____	_____	_____
1993	_____	_____	_____
1994	_____	_____	_____
1995	_____	_____	_____
1996	_____	_____	_____
1997	_____	_____	_____
1998	_____	_____	_____
1999	_____	_____	_____
2000	_____	_____	_____

1.2. In the table on the previous page, does the sequence of small and large metro areas over time provide evidence for hierarchical effects in the diffusion of AIDS? Explain.

1.3. Miami, Florida, had a 1986 population of 1,769,500. Seattle, Washington, had a 1986 population of 1,751,100. Seattle crossed the 100-per-100,000 threshold in 1991; Miami did so in 1988. Why did Miami have such a high early rate of AIDS? (*Hint*: Refer to Figure 3.8.)

1.4. San Francisco, California, had a 1986 population of 1,588,000. San Jose, California, had a 1986 population of 1,401,600. Both are part of the Bay Area CMSA (ranked #5). San Jose crossed the 100-per-100,000 threshold in 1993, and San Francisco did so in 1986. Why did San Francisco have such a high early rate of AIDS?

1.5. Go back to the national map and move the time slider slowly back and forth. Do you see any particular barriers blocking AIDS diffusion or pathways promoting it?

1.6. In Question 1.1 you should have found several metro areas not within the Top 15 that appeared on the map between 1986 and 1990. Go back to the national map and identify them, and write their names here.

1.7. At first glance it might seem that these smaller metro areas with early high rates of AIDS do not fit the hierarchical diffusion pattern of big cities first and small cities later. What is it about the locations of the metro areas in Question 1.6 that might explain their earlier-than-expected AIDS outbreaks? (Going back to look at Figure 3.3 might help you.)

J. When you are finished, close the *Activity 1* browser window. Click *Back to Chapter Contents*. Proceed to *Activity 2*, or click the *Exit* button at the top right of the chapter content page. Log off your computer if you are on a campus network. Don't forget your CD.

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## Tracking the AIDS Epidemic in the United States

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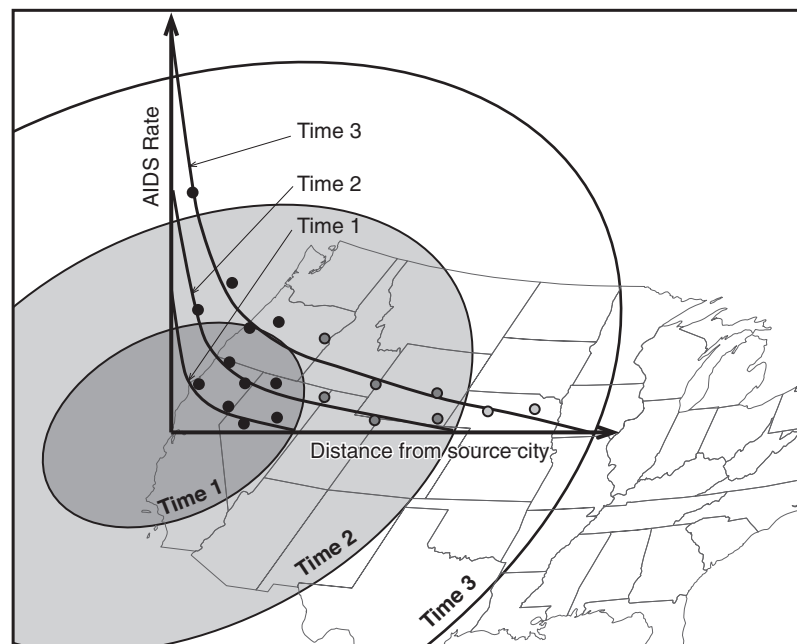
### ▶ ACTIVITY 2: AIDS RATES AND DISTANCE FROM INITIAL CENTERS

AIDS diffusion prior to 1986 is not well documented, but we know that concentrations of reported AIDS cases in the early 1980s were in New York, Los Angeles, and San Francisco. Other early centers of AIDS cases included Miami, Houston, and Denver. Here we examine the relationship between the AIDS rate and distance from three regional source cities: New York, Miami, and San Francisco. Select the metro area that is closest to your college or that is assigned by your instructor and answer questions about the relationships you see.

- A. If you are continuing from Activity 1, go to Step F. Otherwise, insert the CD into your computer. A window will automatically appear (if this doesn't work, see the *readme.txt* file or the instruction sheet that came with the CD).
- B. If *Human Geography in Action* has already been installed on your computer, click on *Run from HD*. If not, click either *Install* (for faster performance on your home computer) or *Run from CD* (on school lab computers).
- C. Click on the large *Human Geography in Action* logo to start.
- D. Click on *Chapter Menu*.
- E. Click on *Chapter 3—Tracking the AIDS Epidemic*.
- F. Click on *Activity 2: AIDS Rate and the Distance from Initial Centers*.
- G. Read the activity description and then click *Continue*.
- H. Click on the metro area you wish to examine: *New York*, *San Francisco*, or *Miami*.

### ▶ DISTANCE FROM THE INITIAL CENTERS

You can now see a scatter diagram that plots the AIDS rate in 1986 against distance from New York City (or Miami or San Francisco, depending on your choice) for 46 nearby metropolitan areas. A *scatter diagram* depicts the relationship between two variables. One variable (distance) is measured on the *x*-axis (horizontal), and another (AIDS rate) is measured on the *y*-axis (vertical). The placement of the dots tells you the *x* and *y* values for the place in question (see Figure 3.11). As you move the cursor around, red crosshairs that move along the *x*- and *y*-axes show you the *x* and *y* values of the tip of the cursor arrow. Try “mousing over” any of the dots to see a temporary window with name of the metro area the dot represents, the population, and the distance from the source city (*x*) and AIDS rate (*y*) for that metro area. The scatter diagram is a “scatter” of these dots, which show groupings or trends in the relationship between the two variables. Note that the source city (New York), at distance = 0, is on the *y*-axis.



**Figure 3.11** The graph shows the typical downward-sloping scatterplot of AIDS rates versus distance from a source node (in this case, San Francisco) and the associated line of best fit. The graph is superimposed over a diagram of contagious diffusion spreading like a wave (which is overlaid on a map of the United States). As time increases, more cities become adopters (or cross the threshold of AIDS rates) at farther distances.

A best-fitting, smoothed blue curve through this scatterplot shows the general trend in the relationship between the AIDS rate and distance. A horizontal red line shows the 100-AIDS-cases-per-100,000-population threshold above which metro areas appeared on the map in Activity 1.

- I. Slowly move the slider to the right to see the graph interactively change over a 15-year time period. Pay attention to how the graph changes, particularly the line of best fit.

2.1. Look at changes in the *height* of the curve. What has happened to the rate of AIDS for most of these metro areas over the 15-year interval?

2.2. Move the slider all the way to the right-hand side so that the graph stops at 2000.

(a) What is the relationship between the rate of AIDS and distance from your initial source metro area in 2000?

(b) Does the graph provide evidence of spatially contagious diffusion?

(c) How much scatter is there around your best-fitting curve?

2.3. Metro areas that fall farthest from the best-fitting curve are termed *outliers* because they deviate from the general trend. Click on the outliers in the graph to see their names and populations. What factors might explain why some metro areas have a much higher AIDS rate than expected given their distance from New York (or Miami or San Francisco) while others are far below the trend? You could go back and look at the population layer on the diffusion map in Activity 1 to help answer this question.

- J. When you are finished, close the *Activity 2* browser window. Click *Back to Chapter Contents*. Proceed to *Activity 3*, or click the *Exit* button at the top right of the chapter contents page. Log off your computer if you are on a campus network. Don't forget your CD.

Name: \_\_\_\_\_

Instructor: \_\_\_\_\_

## Tracking the AIDS Epidemic in the United States

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### ▶ ACTIVITY 3: S-CURVES

In most diffusion processes, the number of cases follows an S-shaped curve (Figure 3.2). Growth is usually slow at first because only a few people and places adopt the new idea or catch the new disease. Growth then accelerates as the idea or disease spreads rapidly. Finally, growth slows down again as the susceptible population approaches the saturation point. In Activity 3 you will make one S-curve and look at others on your computer screen to see how well AIDS diffusion fits the model.

- A. Return to Question 1.1 in Activity 1 and copy the last column into the middle column of the table below.

Year	Number of New Metro Areas Added Each Year	Cumulative Number of Metro Areas
1986	2	2
1987	1	3
1988	_____	_____
1989	_____	_____
1990	_____	_____
1991	_____	_____
1992	_____	_____
1993	_____	_____
1994	_____	_____
1995	_____	_____
1996	_____	_____
1997	_____	_____
1998	_____	_____
1999	_____	_____
2000	_____	_____

- B. In the last column, calculate the cumulative number of metro areas that have passed the 100-cases-per-100,000-persons threshold for each year. The cumulative number is the running total of the added metro areas each year. The first two entries are already filled in to get you on the right track.
- C. On the following graph paper, plot the cumulative number of metro areas surpassing the AIDS threshold for each year. The  $y$ -axis of the graph goes to 100. Note that 98 metro areas with a population over 500,000 people were included in this study.



- F. Click on the large *Human Geography in Action* logo to start.
- G. Click on *Chapter Menu*.
- H. Click on *Chapter 3—Tracking the AIDS Epidemic*.
- I. Click on *Activity 3: S-Curves*.
- J. Read the activity description and then click *Continue*.
- K. A map of the United States will be visible, showing all metropolitan areas with populations over 500,000. “Mouse over” any metro area to see its name, and click on any metro area to see its S-curve. The variable on the *y*-axis is different than in the graph you just made by hand. The graph on the screen shows the actual AIDS rate in the metro area. As such, it is possible for the AIDS rate to go down as AIDS patients die. If the rate is seen to be increasing, it means that new cases are increasing even faster than AIDS patients are dying.
- L. Click on your metro area or the one closest to where you live.

The Centers for Disease Control, which collects the data graphed here, updated the definition of AIDS several times as more was learned about the disease. The greatest change began with the 1993 data, when the 23 clinical conditions in the previous definition were extended to include HIV-infected persons with CD4+ T-lymphocyte counts of less than 200/ $\mu$ l or a CD4+ percentage of less than 14 (a measure of a compromised immune system), and persons diagnosed with pulmonary tuberculosis, recurrent pneumonia, and invasive cervical cancer (three opportunistic diseases seen among AIDS patients). Other changes were implemented in 1987 and 1994. State reporting requirements have also varied across this time period, and the CDC estimates that reporting of AIDS cases in the U.S. is now more than 85 percent complete.

3.3. Based on the shape of your metro area’s graph, in which year did the transition from innovator to majority adopter occur?

3.4. Has the AIDS rate for your metro area leveled off (entered into laggard stage) or even declined? If so, when?

- M. Go to the *File* menu and *Print*.
- N. When you have finished, close the *Activity 3* browser window, and click the *Exit* button at the top right of the Activity 3 page. If you are on a campus network, log off your machine. Don’t forget your CD.

## ► DEFINITIONS OF KEY TERMS

**Barriers to Diffusion** Physical, political, cultural, or economic impediments to diffusion.

**Biased Innovations** Innovations (or diseases) that are less (or more) accessible to people of a certain gender, class, age, or ethnicity. The biased innovation diffusion theory emphasizes social context in addition to spatial context.

**Contagious Effects** Diffusion of a disease, cultural trait, idea, or innovation that spreads outward from a node or epicenter in wavelike fashion. Spatially contagious diffusion emphasizes the frictional force of distance in explaining the spread of things in time and space.

**Expansion Diffusion** A process in which the items being diffused remain and often intensify in the origin area as new areas are being affected (i.e., the items diffuse from person to person).

**Hierarchical Effects** Diffusion of a disease, cultural trait, idea, or innovation from larger to smaller places, leaping

over nearby but small places in the early stages.

Hierarchical diffusion emphasizes the size distribution of urban places (i.e., the urban hierarchy) in explaining the spread of things over time and space.

**Relocation Diffusion** A process in which items being diffused leave the originating areas as they move to new areas (i.e., the items diffuse with people migrating).

**Spatial Diffusion** The spread of some phenomenon over space and through time from a limited number of origins.

**Urban Hierarchy** A system of cities consisting of various levels with few cities at the top level and increasingly more settlements on each lower level. The position of a city within the hierarchy is determined by the types of central place functions it provides.

## ► FURTHER READINGS

- Cliff, A. D., and Smallman-Raynor, M. R. 1992. The AIDS Pandemic: Global Geographical Patterns and Local Spatial Processes. *Geographical Journal* 158(2):182–197.
- Cohen, Jon. 1999. AIDS Virus Traced to Chimp Subspecies. *Science* 283:772–773.
- Crimp, D. (ed.). 1988. *AIDS: Cultural Analysis, Cultural Criticism*. Cambridge, MA: MIT Press.
- Gladwell, Malcolm. 1997. The Coolhunt. *The New Yorker* (March 17):76–88.
- Gould, Peter. 1969. *Spatial Diffusion*. Resource Paper No. 4, Commission on College Geography. Washington, DC: Association of American Geographers.
- Gould, Peter. 1993. *The Slow Plague: A Geography of the AIDS Pandemic*. Cambridge, MA: Blackwell.
- Hagerstrand, Torsten. 1967. *Innovation Diffusion as a Spatial Process*. Chicago: University of Chicago Press.
- Hillis, David M. 2000. How to Resolve the Debate on the Origin of AIDS. *Science* 289:1877–1878.
- Lamprey, Peter, Merywen Wigley, Danra Carr, and Yvette Collymore. 2001. Facing the HIV/AIDS Pandemic. *Population Bulletin* 57(3):3–39.
- McGeary, Johanna. 2001. Death Stalks a Continent. *Time* (Feb. 12):36–54. See also photo essay by James Nachtwey-Magnum, Crimes Against Humanity, pp. 26–35 in the same issue.
- Morrill, Richard, Gary L. Gaile, and Grant Ian Thrall. 1988. *Spatial Diffusion*. Newbury Park, CA: Sage.
- Nina, Siu-Ngam Lam, Ming Fan, and Kam-biu Liu. 1996. Spatial-Temporal Spread of the AIDS Epidemic, 1982–1990: A Correlogram Analysis of Four Regions of the United States. *Geographical Analysis* 28:93–107.
- Opong, Joseph R. 1998. A Vulnerability Interpretation of the Geography of HIV/AIDS in Ghana, 1986–1995. *Professional Geographer* 50:437–448.
- Patton, C. 1990. *Inventing AIDS*. London: Routledge.
- Pyle, Gerald F. and William A. Gross. 1997. The Diffusion of HIV/AIDS and HIV Infection in an Archetypal Textile County. *Applied Geographic Studies* 1:63–81.
- Shannon, Gary W., Gerald F., Pyle, and Rashid L. Bashshur. 1991. *The Geography of AIDS: Origins and Course of an Epidemic*. New York: Guilford.
- The Economist. 2000. A Turning Point for AIDS? *The Economist* (July 15):77–79.
- Yapa, Lakshman. 1996. Innovation Diffusion and Paradigms of Development, pp. 230–272 in *Concepts in Human Geography*, Carville Earle, Kent Mathewson, and Martin S. Kenzer (eds.). London: Rowman and Littlefield.
- Zhu, Tuofu, Bette K. Korber, Andre J. Nahmias, Edward Hooper, Paul M. Sharp, and David D. Ho. 1998. An African HIV-1 Sequence from 1959 and Implications for the Origin of the Epidemic. *Nature* 391:594–597.

## ► WEB RESOURCES

The AIDS Memorial Quilt: [www.aidsquilt.org/](http://www.aidsquilt.org/).

Body Health Resources Corporation *The Body*: [www.thebody.com/index.shtml](http://www.thebody.com/index.shtml). (Very informative for those with AIDS.)

British Broadcasting Corporation. *General AIDS/HIV Information*: [www.bbc.co.uk/worldservice/health/sexualhealth/aids/](http://www.bbc.co.uk/worldservice/health/sexualhealth/aids/).

Center for AIDS Prevention Studies: [www.caps.ucsf.edu/](http://www.caps.ucsf.edu/).

Centers for Disease Control. *National Prevention Information Network*: [www.cdcnpin.org/scripts/index.asp](http://www.cdcnpin.org/scripts/index.asp).

Eberstadt, Nicholas. 2002. The Future of AIDS. *Foreign Affairs* (Nov./Dec.): [www.foreignaffairs.org/20021101faessay9990/nicholas-eberstadt/the-future-of-aids.html](http://www.foreignaffairs.org/20021101faessay9990/nicholas-eberstadt/the-future-of-aids.html).

National Center for Health statistics. *Faststats A to Z: AIDS/HIV*. [www.cdc.gov/nchs/faststats/aids-hiv.htm](http://www.cdc.gov/nchs/faststats/aids-hiv.htm).

Population Reference Bureau. *HIV/AIDS Focus Area*. [www.prb.org/pubs/](http://www.prb.org/pubs/).

United Nations. *The Report on the Global HIV/AIDS Epidemic*. [www.unaids.org/barcelona/presskit/report.html](http://www.unaids.org/barcelona/presskit/report.html).

United Nations. *United Nations AIDS Program, Facts by Country 2002 Updates*: [www.unaids.org/hivaidsinfo/statistics/fact\\_sheets/index\\_en.htm](http://www.unaids.org/hivaidsinfo/statistics/fact_sheets/index_en.htm).

World Bank. *HIV/AIDS*: [http://www1.worldbank.org/hiv\\_aids/](http://www1.worldbank.org/hiv_aids/).

World Health Organization: [www.who.int/health-topics/hiv.htm](http://www.who.int/health-topics/hiv.htm) (especially the fact sheet on Women and HIV/AIDS).

## ► ITEMS TO HAND IN

Activity 1: • Answers to Questions 1.1–1.7

Activity 2: • Answers to Questions 2.1–2.3

Activity 3: • Answers to Questions 3.1–3.4

