

Engineering in a Shrinking World

Donald C. Slack, Professor and Head

Department of Agricultural and Biosystems Engineering

The University of Arizona

Tucson, Arizona 85721

slackd@email.arizona.edu

Abstract. *Technological developments, primarily in communications and transportation have “shrunk” the world considerably in the past 15-30 years. It is now much easier to communicate and travel in the world. The result is greater opportunities to collaborate with our peers throughout the world to address pressing problems of the 21st Century.*

Keywords. Technology, communications, Internet, cooperation, collaboration.

Introduction

Our world is shrinking!! While this phenomena has been ongoing for centuries, since man first developed intercontinental travel, the effects seem to have accelerated up to the present time. What do we mean by a “shrinking world”, what are some of the effects and how do they affect the way in which we practice our profession of Agricultural and Biological Engineering.

The Shrinking World

Of course, the world is not getting smaller. It has just gotten much easier for us to travel and communicate with each other. Today we can travel distances in two days that 150 years ago would take two months. We, as individuals can contact each other directly and talk or exchange information in real time without using an intermediary such as a switchboard operator, an international operator, a Teletype operator, etc. In short, we can interact with someone half a world away almost as conveniently as we can interact with our neighbor or our office mate. Thus, from the perspective of human interaction, the world has “shrunk”.

Shrinkage Catalyst

Three factors have greatly facilitated our *interconnectedness* in the world. Many of these changes have taken place within the past thirty years, although the foundations for such changes were laid much earlier.

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The first factor was the advent of reliable and inexpensive intercontinental travel. The second is the communications revolution and the third, which has really been dependant on the emergence of the first two factors is the increased inter-reliance of the economies of the world as manifested in *globalization of the economy*.

The Effects.

Travel.

How do the above factors affect what we do and how we do it? Lets look at transportation for example. A little over thirty years ago, the *jumbo jet* in the form of the Boeing 747 made intercontinental travel a reality for a majority of the middle classes of most countries (there are still millions of people who cannot travel beyond their own countries and many who cannot travel much beyond the bounds of their villages). New air routes developed and the relative cost of such travel decreased considerably. It is much cheaper today to travel to almost any international destination than it was in 1970. For example, in early 1970, before jumbo jets had become widely used, I traveled to Thailand from the US (Chicago). The flight was made on a *long-range* version of the Boeing 707 called the Boeing 320C. The trip was made in several legs, Chicago – Anchorage; Anchorage – Tokyo; Tokyo – Hong Kong and finally, Hong Kong – Bangkok. The one-way airfare (I went to stay for four years) was about \$1,500 (1970 dollars). Today one can fly from Tucson, Arizona to Bangkok for under \$1,000 (2002 dollars). And from LA to Bangkok there is only one stop in Tokyo! One can describe similar or even more dramatic declines in travel costs to other international location, especially between Europe and the US.

It is also much easier to prepare for travel to most places in 2002 as well. In 1970 one need to apply for and obtain a visa prior to travel to almost any country. While it is still necessary to obtain a visa prior to travel to a number of countries, there are many countries that one can visit and obtain the visa at the airport upon arrival. Of course this may be subject to change given the current security concerns, but it is presently possible for an American citizen with a valid passport to buy a ticket to Bangkok or Cairo or Amman or Tel Aviv and travel the next day, obtaining their visa in the airport upon arrival. In other countries which do require that the visa be obtained prior to arrival, it is often possible to obtain a multiple entry visa good for up to five years.

There was also a requirement that one have a long list of vaccinations and carry an international vaccination certificate to travel to virtually any country. On arrive one cleared passport control, then health inspection prior to customs. The required shots varied from country to country but always included smallpox and often included polio, tetanus, yellow fever and cholera. It is still advisable to have up-to-date tetanus/diphtheria and Hepatitis A shots but they are not required most places. The U.S. does require that you have a yellow fever shot if you travel to certain tropical countries.

Communications.

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The communications revolution of the past 20 years has been even more dramatic than that of travel. This revolution has occurred across all fronts of communications including voice, data and documents.

Voice Communication.

Thirty years ago, a telephone call from Africa or many Asian locations was a time consuming process that required one to access an international operator, wait patiently for the connection to be made and then deliver the message quickly to be as cost effective as possible. A three minute call from Northeast Thailand to the U.S. in 1970 could cost \$25 and the quality was often so poor that messages had to be repeated several times to be understood. As recently as 1988 there were still many locations in the world, even in major cities where it was time consuming and difficult to make a telephone call. However, by 1990 one could call from most major cities to many locations around the globe simply by dialing the country code and the number to be called. In 2002, one can make that three-minute, \$25 telephone call from Khon Kaen, Thailand to the U.S. by simply dialing the correct sequence of numbers, with no operator intervention and the cost is on the order of five dollars or less for a three minute call. This is now true for most major cities in the world.

It is still somewhat difficult to make calls to or from anyplace in the world with a cellular phone, although, in the U.S. it is possible to obtain cel phones and service which can be used from major regions of the world (Europe + U.S. + Middle East, etc.). Such service is a little more pricey than your normal cel service costing as recently as two years ago on the order of \$1,200 for the phone plus the calling cost. If one wants to call from anyplace in the world to anyplace in the world, one can purchase a satellite phone for about the same price (~\$1,200) and with a \$25 monthly fee and one dollar per minute, you really can call anyplace in the world!

The Internet.

The internet truly has revolutionized the way we can and do interact with each other. For international communications it is particularly convenient because we can compose and send an e-mail to our colleague at any time of day (or night) and the colleague can compose and send a response at a time most convenient to them. So.. if I want to communicate with my colleague in Egypt, who is just getting off work as I arrive in my office, I can send an e-mail anytime during the day and expect a response when I arrive in my office the next morning. If I am communicating with my colleagues in Latin America (where the time zone differential is not so great), I can often do so in real time, exchanging several messages per day and all is done from my desk! While this may seem commonplace to many, it was a virtual impossibility in 1990!

Our ability to exchange data and documents via the internet has been greatly enhanced in the past five years as both the capacity and speed of our desk-top computers have increased dramatically. We can now transmit rather large data files via the Internet. This allows us to develop joint research proposals without traveling to our collaborators country. Of equal importance, we can exchange data and information as our research progresses. Multiple partner projects have even

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utilized project web-sites where data and information is posted to the web-site each day and all participants can thus gain access almost immediately.

While we as scientists and engineers have come to rely on the internet, it is still not available nor accessible to large percentages of the population in many parts of the world as can be seen from the data in figure 1.

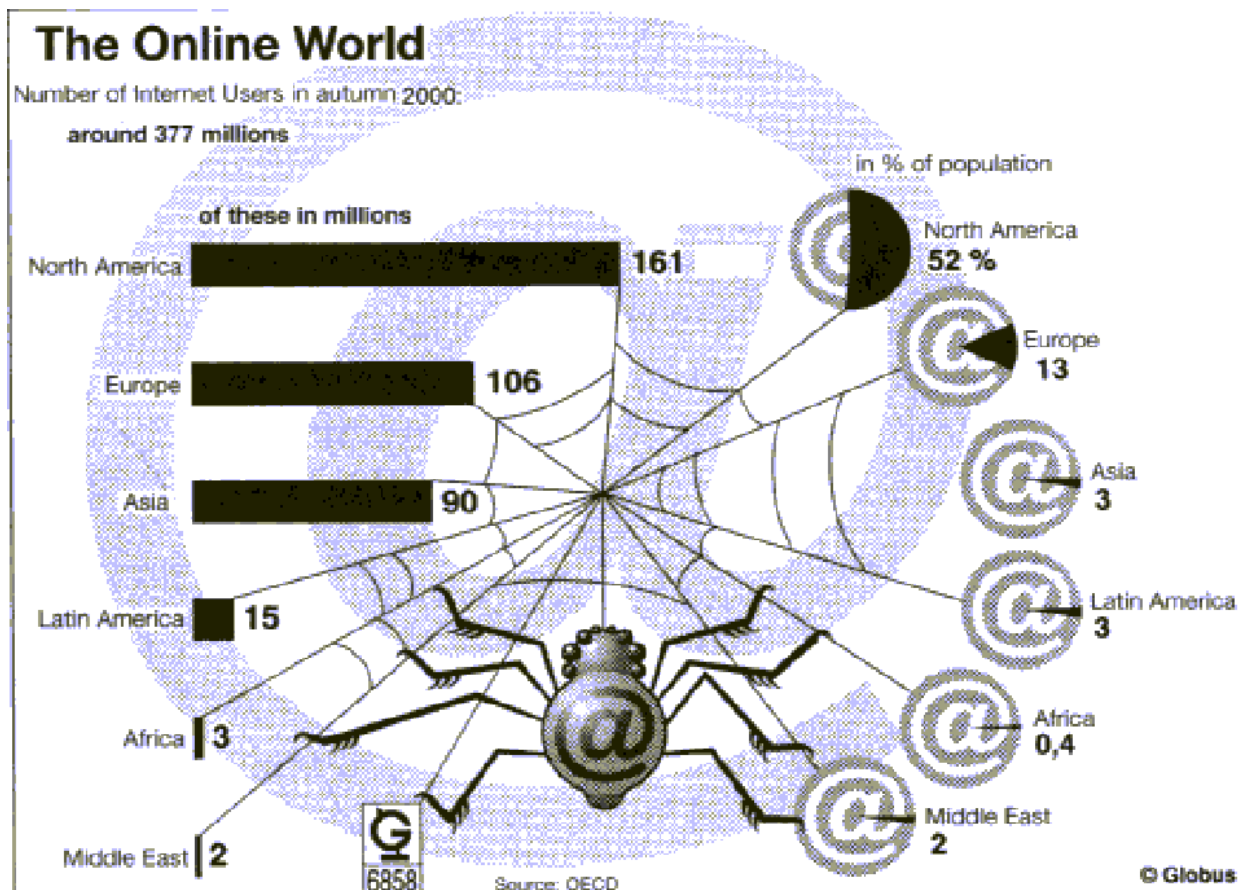


Figure 1. Number of Internet Users in the World – Fall 2000 (D+C, 2001)

International Courier Service.

International courier service has also expanded greatly within the past 20 years so that today, we can send small packages and documents to almost any major city in the globe within a matter of days. This is very useful for joint research projects where we may need a critical part for an instrument that is available only in the U. S. That part can be obtained in the U.S. and sent via courier to a collaborator within a 2 to 3 day period. Similarly important documents relating to projects can be shipped in this manner when it is necessary to have documents with original signatures (unfortunately many funding agencies still do not accept electronic submission for

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project proposals, particularly those involving international partners). Air courier services now are available in virtually every country and are actually not terribly expensive for documents or small instruments or instrument parts.

Taking advantage of the shrinking world.

So, how do we as Agricultural and Biological Engineers utilize these tremendous strides in technology to address the problems of the 21st century? The mechanisms have actually been outlined in the preceding paragraphs. We use them to exchange data, to develop proposals, to conduct research and development projects, to further education of professionals in the field and to develop stronger partnerships. There are plenty of problems for us to address.

The United Nations Environmental Program (UNEP) recently asked 200 experts within the agency to identify the most important environmental problems of the 21st century. Figure 2 illustrates the opinions of those experts.

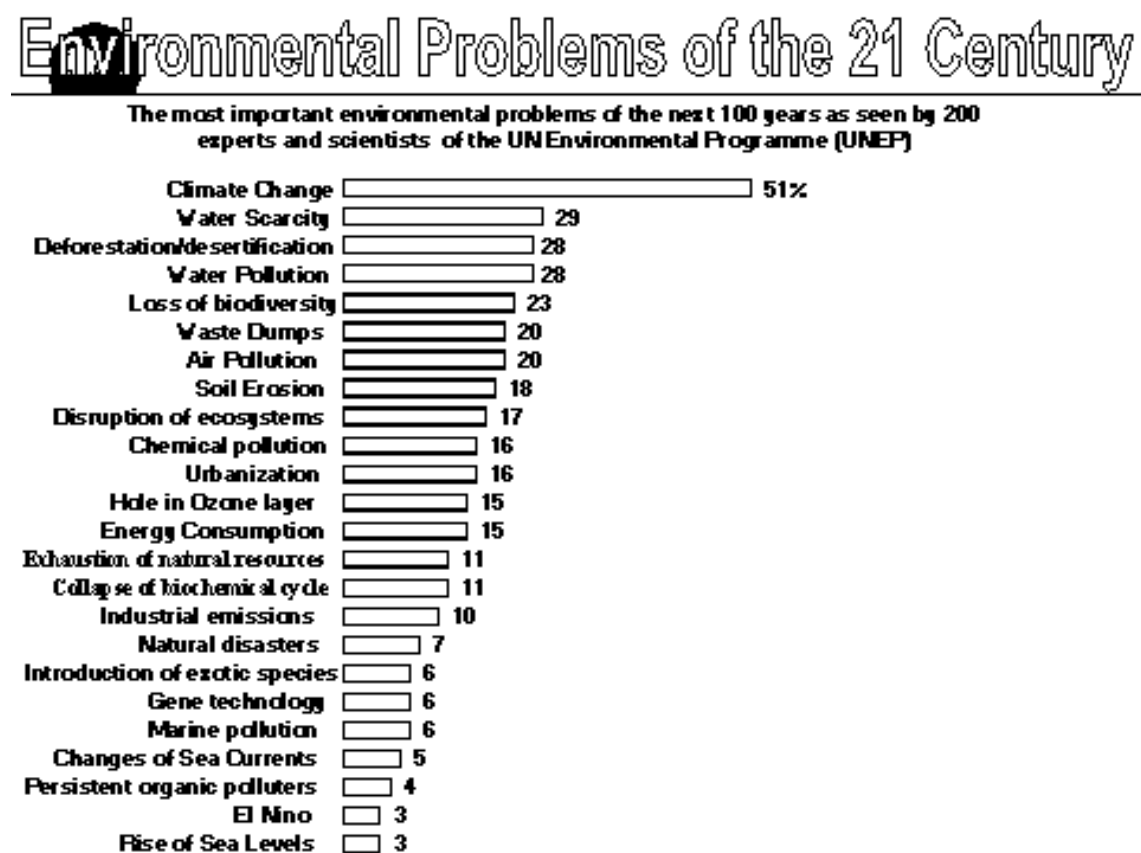


Figure 2. Environmental Problems of the 21st Century (Unmüssig, 2002)

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Many of us are currently working on aspects of many of these problems, water scarcity, water quality, erosion, the effects of climate change, etc. But... if these problems are not enough, there are plenty of others for us to work on. Health problems are becoming a greater concern to our profession and, although great strides have been made in disease treatment and prevention in the past century, there are a never-ending parade of diseases and parasites that still kill up to ten million people per year as shown in Figure 3.

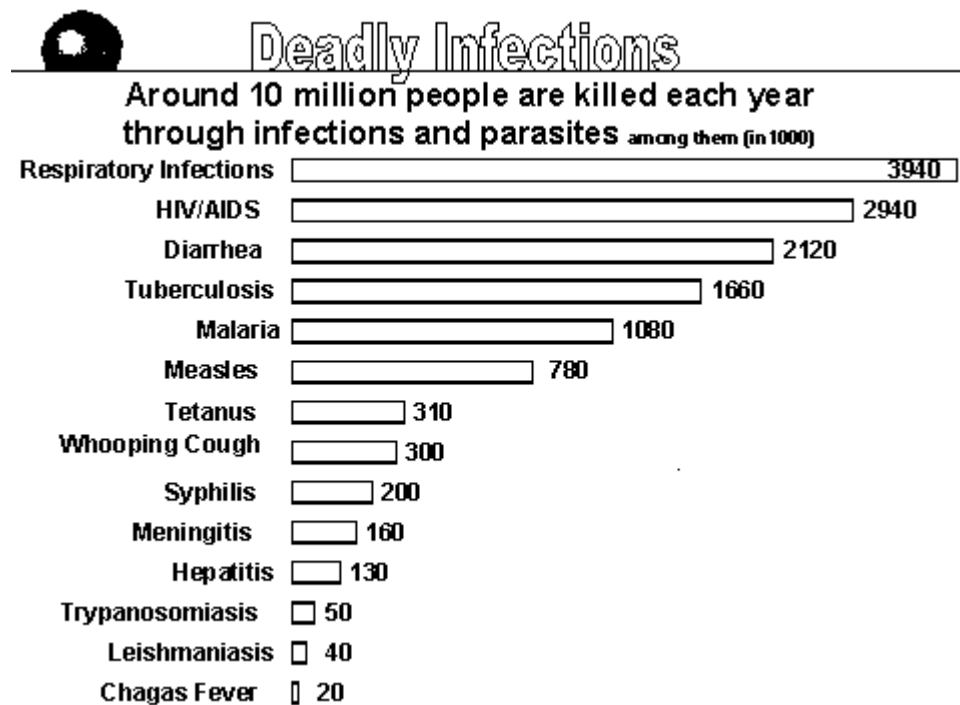


Figure 3. Yearly deaths from disease and parasites (D+C, 2002)

Summary.

Technological developments of the last 30 years have given us many tools which allow us to work more closely together as a world community of Biological and Agricultural Engineers to address pressing problems of the twenty-first century. Let us resolve to use these tools and our collective expertise to continue to help assure that the people of the world have adequate clean water, sufficient food and natural resources and a livable environment for this century and those to come.

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