Institute of Design
ILLINOIS INSTITUTE OF TECHNOLOGY

Responsible Design. Achieving Living Excellence: Implications, Warnings and a Call to Action

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Abstract

The coming century will be one of great peril and promise. Global population growth and the problems it has induced—from resource depletion to global warming—threaten dire consequences on a large scale. Alternatively, new technologies promise awesome additions to our tools for solving these problems. We may yet be able to bring living excellence to our people. The problem is, will our political decision makers have the wisdom to avail themselves of the right tools at the right time? Will we be able to avoid the worst of projected disasters and make best use of the new technologies? Decision makers will need the best of creative thinking from the science community—and from a design community also prepared to contribute. The evidence is clear that decision makers are not yet acting with the full range of advice they need. Advice that offers proactive, constructive options for action is not being heard or heeded. The design professions must prepare themselves to fill this void. Our times have set us new responsibilities, and we must meet the challenge.

Introduction

"It was the best of times, the worst of times". Charles Dickens opened his literary classic **A Tale of Two Cities** with that line. Although he was talking about the French revolution, now more than 200 years past. the statement is even more appropriate today.

In any age many forces are at work; some highly promising, others that seem filled with peril. Today, thoughtful people are watching highly significant trends that threaten more than ever to determine our future—for good or bad. Of great concern, they may already be beyond the capacity of individuals, organizations or even governments to influence.

On the dark side, human population growth has reached a point where its effects are Earth changing and life threatening (Figure 1). There are 6.4 billion people on Earth today. Just fifty years ago, when I was a young man, there were less than half that number. And—even though population growth has all but stopped in most developed countries—the slowing but continuing growth in the developing world will drive the total population to over ten billion in the next 50 years. The problem isn't the people, but the enormous impact they have on each other and the environment as we try to provide them living excellence.

The consequences of this growth are already apparent.

- Pressure on food production continues to rise in spite of great successes in the last 50 years. By 2050, the amount of arable land per capita will have decreased by over 62% since the 1960's (Figure 2).
- Stocks of wild finfish and shellfish are declining alarmingly. New deep-water species are being sought to replace them, but they too may be overfished (Figure 3).

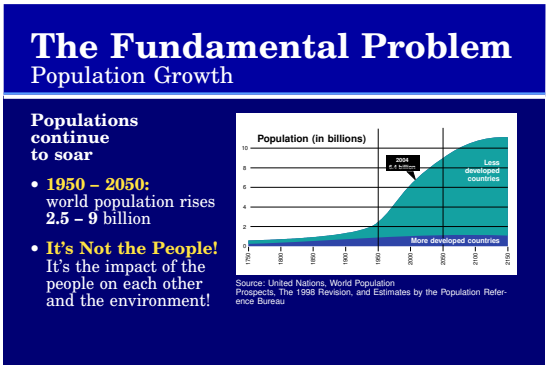

Figure 1 **The Fundamental Problem: Population Growth**

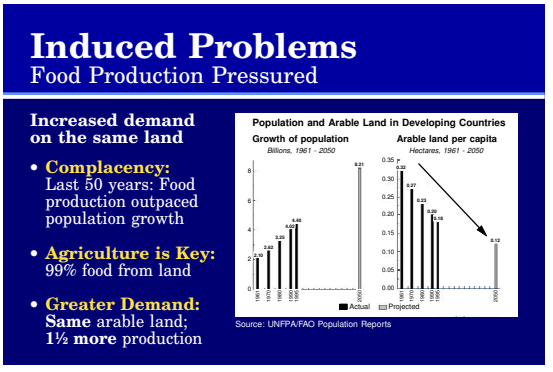

Figure 2 **Induced Problems: Food Production Pressured**

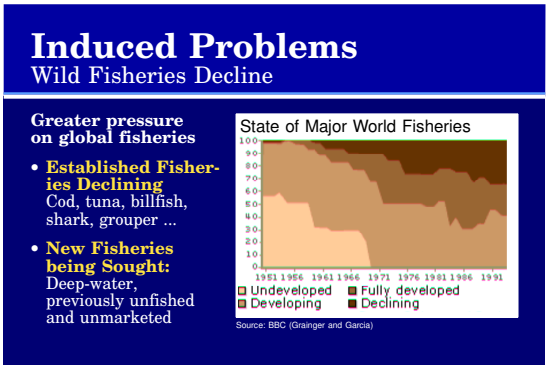

Figure 3 **Induced Problems: Wild Fisheries Decline**

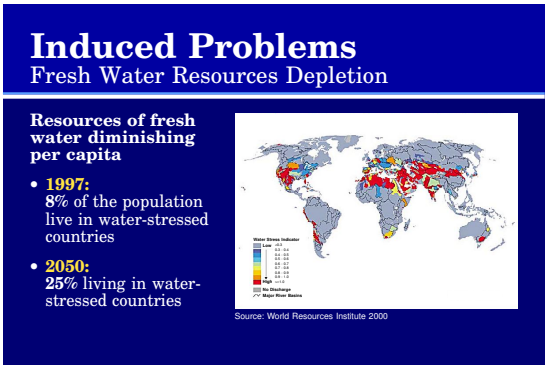

Figure 4 **Induced Problems: Fresh Water Resources Depletion**

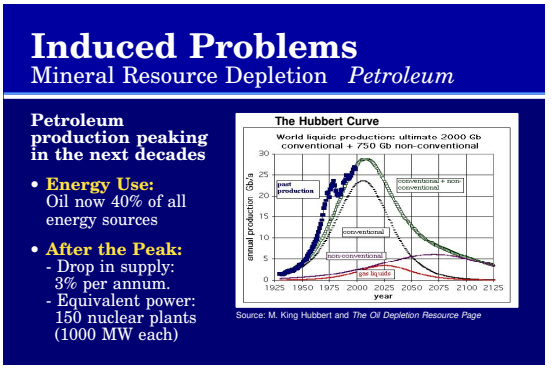

Figure 5 **Induced Problems: Petroleum Resource Depletion**

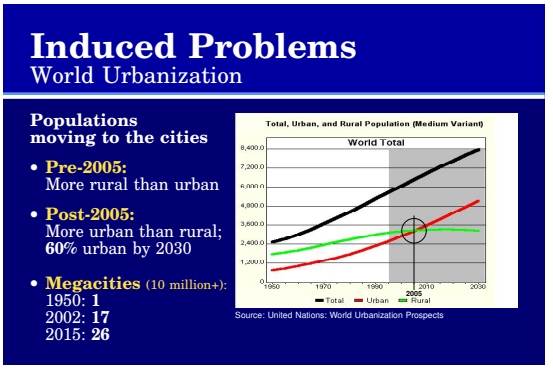

Figure 6 **Induced Problems: World Urbanization**

• Water resources are reaching levels of insufficiency. By 2050, 25 per cent of the world's population will live in water-stressed countries (Figure 4).

• Mineral resources, particularly oil, are approaching finite limits. Petroleum production will peak in the next few decades, requiring major new energy source replacements (Figure 5).

• Cities are growing to sizes barely manageable. From next year on, the world will be more than 50% urban—and increasingly so. The number of megacities of 10 million people or more will reach at least 26 by 2015 (Figure 6).

Global warming is progressing ominously with its own special portents:

• Climate and weather patterns are altering. Sustained droughts and intense flooding will dislocate agriculture and communities (Figure 7).

• Ocean levels are rising faster than expected as polar melting accelerates. Rising ocean water levels will jeopardize coastal cities (Figure 8).

• Increased heat energy is feeding more violent storms. Storms will increase in number, and violence will increase to category 4 and 5 levels in tornados, hurricanes, cyclones and typhoons (Figure 9).

• Climate changes are moving the ranges in which species can live. Biodiversity will decrease with mass extinctions caused by habitat loss (Figure 10).

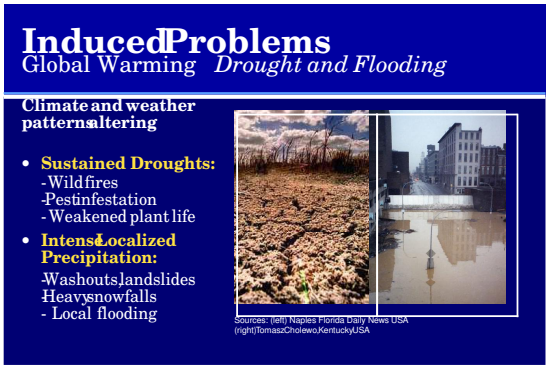

Figure 7 **Global Warming: Drought and Flooding**

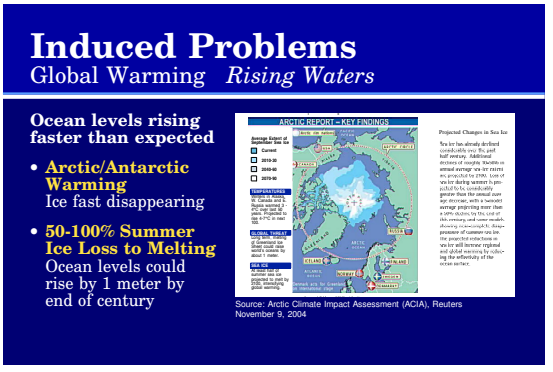

Figure 8 **Global Warming: Rising Waters**

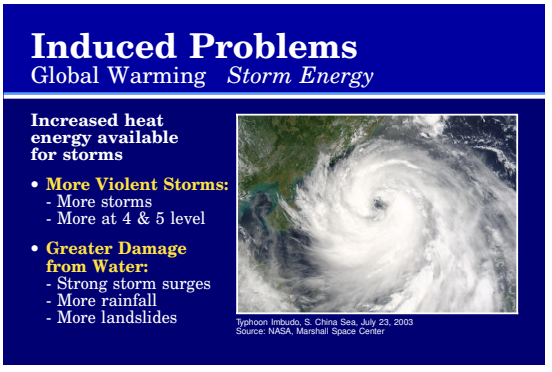

Figure 9 **Global Warming: Storm Energy**

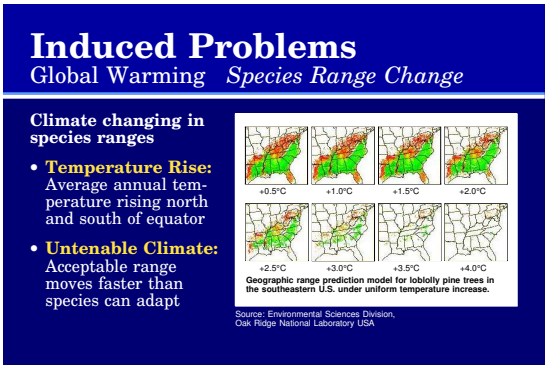

Figure 10 **Global Warming: Species Range Change**

On the bright side, technological revolutions are underway that have the potential to alleviate, even solve many of the problems brought about by population growth.

• Molecular nanotechnology promises technological and post-industrial achievements well surpassing those of the industrial revolution (Figure 11).

• Biogenetics offer biological tools capable of supporting work with life processes at levels comparable to what we can do with electromechanical processes (Figure 12).

• Robotic advances will enable us to consign work humanely—work requiring creativity, adaptivity, thoughtfulness and sensitivity to humans, work requiring strength, scale, precision, repetitive perfection, continuous performance, or ability to withstand hostile environments to robots (Figure 13).

The scale of both problems and opportunities is sobering (Figure 14). Besides the external, direct threats and rewards looming, a host of other events may befall us through our interactions with each other. Wars with weapons of mass destruction are daily topics of conversation. The end of the cold war has ushered in new kinds of

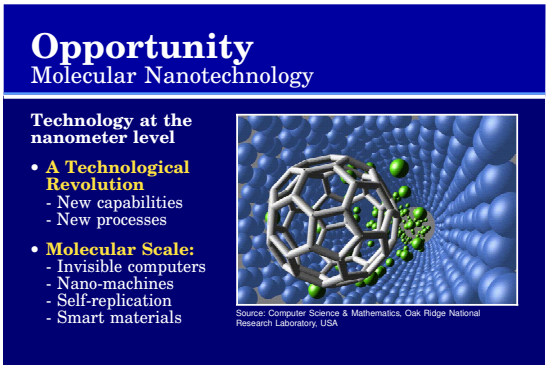

Figure 11 **Molecular Nanotechnology**

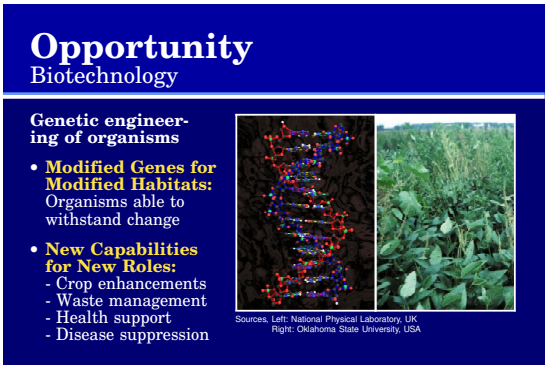

Figure 12 **Biotechnology**

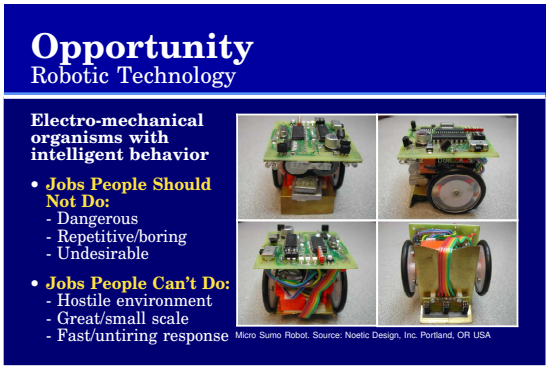

Figure 13 **Robotic Technology**

Figure 14 **The Societal Context**

shadowy wars far less easy to contain. Threats of pandemics occur virtually in parallel with talk of total disease eradication. Catastrophic national political collapses compete with region-wide economic successes. Everywhere, societal-level enhancements to quality-of-life seem almost at hand—if they aren't crushed beneath equally omnipresent disasters.

A scale so dramatic begs reflection about the decisions that must be made, the decision processes that must be used, and the preparation of the advisors to the decision makers who must make the decisions.

Finders, Makers and Creative Advice

Wise decision makers faced with decisions involving forces not wholly understandable or predictable need vision. At the scale of the problems and opportunities facing us today, no single individual will be able to comprehend all that is necessary to make wise decisions for society. Teams of advisors, consultants, experts and assistants will be necessaryi (Figure 15), and decisions will be rendered through discussion and interaction among many.

As important as a wealth of diverse background knowledge is for this staff of experts, the attitude—*way of thinking*—that they bring is equally important. Wisdom will have to be enhanced with creativity, and creativity itself will need to be multidimensional. It will be important to have the right mix of creative advisors.

Creative people tend to fit one of two models (Figure 16).

The first group, "finders", exhibits its creativity through discovery (Figure 17). Finders are driven to understand and to find new models to explain phenomena not well understood. In real-life professions, they usually become scientists and scholars and are responsible in the last several centuries for our great progress in understanding the natural world.

The second group, "makers", is equally creative, but its members demonstrate their creativity through invention (Figure 18). They are driven to synthesize what they know in new constructions, new arrangements, compositions and concepts that are tangible fresh expressions of what is known. They become architects, engineers, artists—designers—and are responsible for the

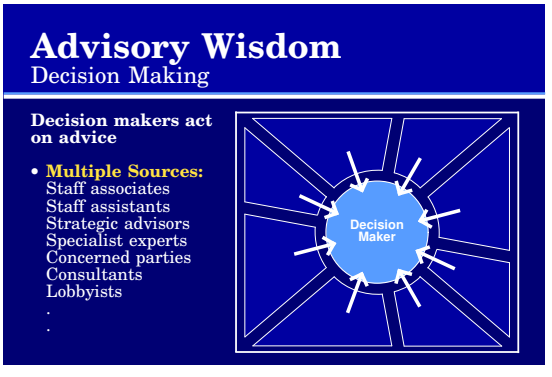

Figure 15 **Decision Making**

Figure 16 **Finders/Makers**

Figure 17 **Finders**

Figure 18 **Makers**

built environment we live in.

The problem is that neither of these two reservoirs of creative wisdom is being used effectively at the highest decision-making levels. In the past, politicians were able to make major errors of judgment without earth-shaking ramifications. With little more than local repercussions, decision-making politicians could set policies that benefited a chosen few at the expense of the many.

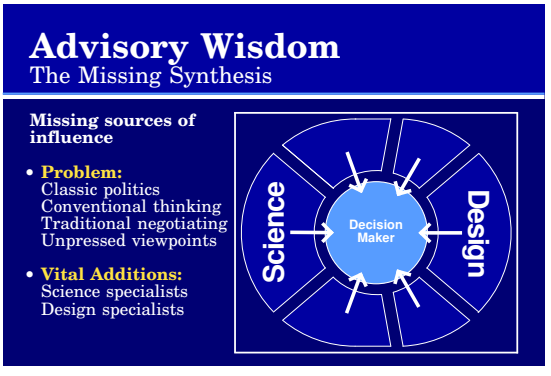

Figure 19 **The Missing Synthesis**

The difference today is that regional, national—even local—decisions may now have repercussions around the world. Uninformed decision-making simply is no longer tolerable. Science and design must contribute credibly to the range of advice (Figure 19).

Not Using Good Advice

Global warming is a good example of ill-advised decision making (Figure 20). First catapulted to public attention in the 1980's, global warming has been treated as a political football by governments around the world, particularly in the developed world. A rational decision-making process would be expected to seek expert opinion on an issue as potentially dangerous as global warming. The principal experts would be scientists and, indeed, scientists did begin to speak out in the mid 1980's. And, as is the scientific way, opinions were given on both sides of the question. Some thought the evidence confirmed mankind's impact on changing climate; some thought that observed phenomena were natural and part of very complex but normal climatic cycles. The result was that governmental leaders listened to those who supported their personal views.

Those scientists who argued for the reality of man-induced global warming advised the cessation of practices producing greenhouse gases, most notably carbon dioxide. Even though scientists on this side of the argument continued to increase in proportion to what is now an overwhelming majority, their advice has continued to be ignored. For the politician in a country like the United States, the economic implications of capping or reducing carbon dioxide emissions have been unrelentingly negative and, therefore, the decision has been to "study the problem further".

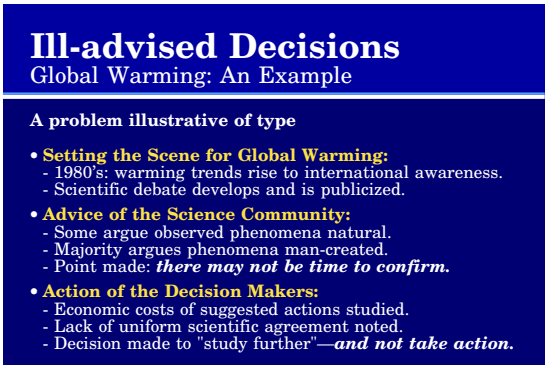

Figure 20 **Global Warming: An Example**

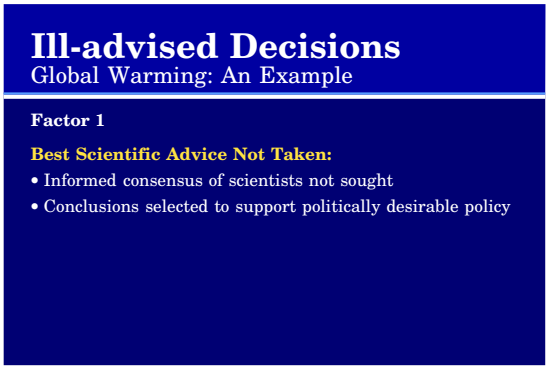

Figure 21 **Global Warming: Factor 1**

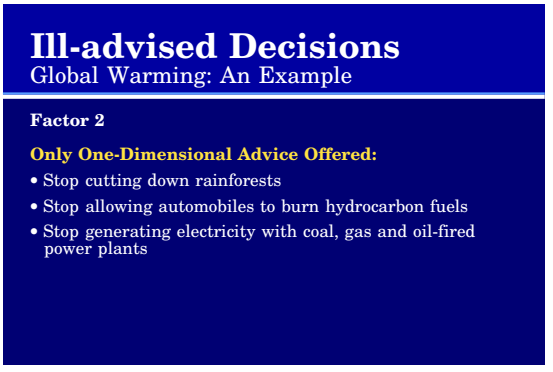

Figure 22 **Global Warming: Factor 2**

The problem, of course, is that there may not be time for further study. Global warming is an environmental problem on a scale beyond rapid human intervention. The display of potentially disastrous small-problem thinking that it has induced is demonstration enough of the need for new processes of policy making.

Two factors stand out. First, the best scientific advice was not taken (Figure 21). True, scientists disagreed, but that is an important part of the scientific method. Skepticism is necessary to support deep inquiry and confirmation of hypotheses. But because the science community was not of a single mind, its advice was manipulated to support politically desirable policy. Had governmental leadership sought informed consensus, it could have obtained it.

Second, scientists offered only one-dimensional recommendations (Figure 22). Where offending practices were recognized as contributing to the production of greenhouse gases, scientists advised stopping those practices—stop cutting down the rain forests, stop allowing automobiles to burn hydrocarbons, stop generating electricity with coal, gas and oil-fired power plants, etc. A natural product of the "finders" way of thinking, the negation model of problem solving—discover the cause of a problem and remove it—played directly into the hands of those politicians who felt that they had to oppose reductive solutions that would lead to economic downturn.

The advice that was missing was advice offering proactive "to do" options (Figure 23). Design thinking as naturally looks for what "to do" to solve a problem as science thinking looks for what not to do—or stop doing—to solve the problem. But there are no design advisors at policy-making levels of government, and design—as we have practiced it around the world—is not perceived as having value for political and institutional policy making.

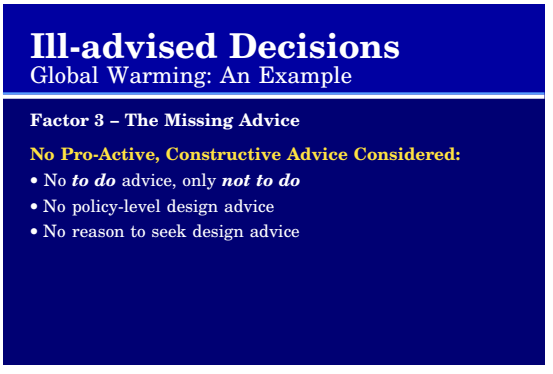

Figure 23 **Global Warming: Factor 3 - The Missing Advice**

Project Phoenix, An Example

In 1988, the Institute of Design decided that looking at the global warming problem from a design perspective would be highly appropriate as a subject for the Japan Design Foundation's 4th International Design Competition (Figure 24). In two proposals that we invested 10,000

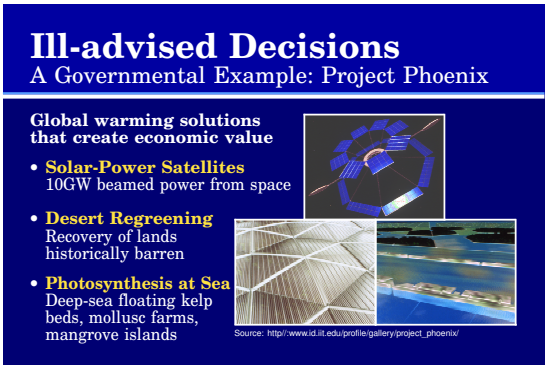

Figure 24 **Project Phoenix**

man-hours developing[1], we showed how ultra-large scale solar power-generation satellites, environmental-scale coverings for regreening deserts, and deep-ocean floating mangrove-island

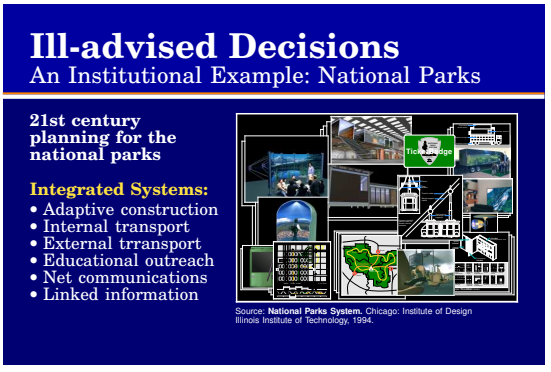

Figure 25 **National Parks Project**

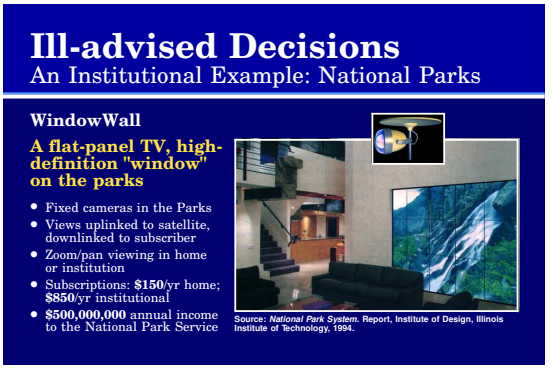

Figure 26 **National Parks Project: WindowWall**

and kelp-bed complexes could both reduce atmospheric carbon dioxide *and* support significant economic and environmental development. They could make money and increase quality of life while fighting global warming! We made the project reports available to governmental leaders in the U.S., Japan, U.K., Germany, France and Russia, with mixed response. Germany and the U.K. responded enthusiastically and received our permission to copy the reports for stimulation of similar research in their universities. No other governments replied.

On reflection, it was not surprising. Given the reserved position all of these governments held on the economic implications of any carbon emissions reduction policy, and the total lack of political credentials of any of the design fields, it was not advice they wanted or thought they needed to hear.

The National Park System, Another Example

In another example, at the institutional level, the Institute of Design was asked in 1994 to look at housing problems for rangers in the U.S. national parks (Figure 25). Funding had long been inadequate, and ranger housing was becoming woefully inadequate. We convinced the National Park Foundation to allow us to look at the larger picture of the future of the parks and what could be done to incorporate new technologies into an integrated vision for park planning.

The result was a comprehensive system plan for the parks that suggested new models for housing and building construction, transportation systems for inside and outside the parks, educational outreach programs and implementation of networked communication systems for administration as well as interpretative guidance, emergency medical services, law enforcement, and research[2]. Among many individual recommendations was one we titled "WindowWall" (Figure 26). It was an idea for how to share views of the parks with people around the country (and the world) and, at the same time, raise money to offset the grave shortages of funding experienced every year by the National Park Service.

The idea postulated fixed, wide-angle video cameras looking at the spectacular views found almost exclusively in national parks. Views were to be uplinked to satellites where they could be downloaded on a subscription basis to institutions in the public and private sectors such as hospitals, libraries, schools, corporate conference rooms, etc.—and individual homes. Software at each screen location would allow subscribers to zoom and pan within the wide angle view to obtain just the continuous "window on the park" they desired. If just 500,000 households (one half of 1 percent of U.S. households in 2000) subscribed at $150 per year and 500,000 institutions worldwide subscribed at just $850 per year, that would generate 500 million dollars—one third of the entire proposed annual national parks budget!

Once again, the idea was thoroughly convincing and the technology exists. Did the National Park Foundation accept the concept and lobby the U.S. National Park Service and Congress to go forward? No. Conservative leaders of the Foundation did not want the Park Service to charge the American people for this use of the parks—even though parks do charge admission fees.

I believe the problem in both these examples is a lack of credibility for the worth of design thinking at these levels of policy planning (Figure 27).

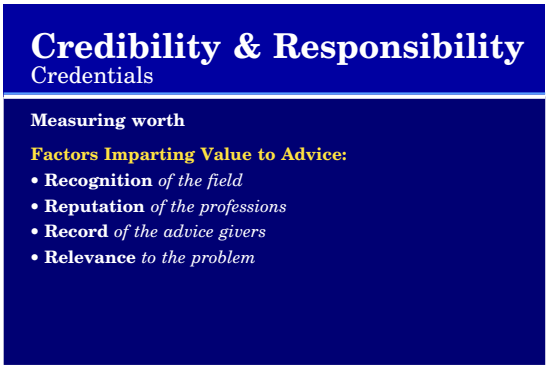

Figure 26 **Credential: Measuring Worth**

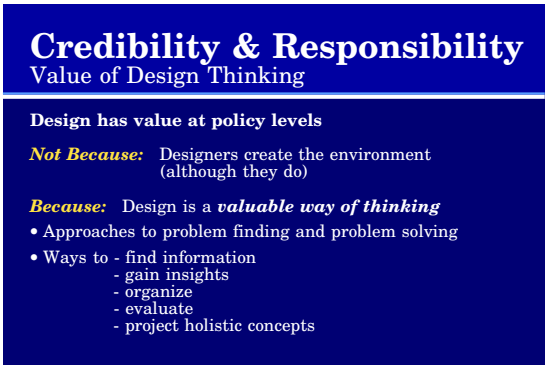

Figure 28 **Value of Design Thinking**

Preparing for the Responsibilities

Unfortunately, that is partly our own fault. Designers, whatever their specialty, have been less than eager to assume roles in high level management and governance outside their training. Perhaps, the inherent fascination that draws designers to the visual and functional world has led us to prefer dealing with ideas than with people. In any case, the consequences have been that few design professionals have aspired to general positions of authority where their achievements would be measured in the world of policies, actions and events. They have chosen instead to exert direct influence on the built environment and find their rewards in the successes of the projects for which they have received commissions.

The motivation is understandable, but no longer wholly acceptable. We have new responsibilities. Although they may have been thrust upon us, we must respond.

Of great importance, we must understand that it is not because of our special abilities to create products, messages, buildings and the rest of the built environment that we need to be heard (Figure 28). It is because of the way that we think and the approach that we bring to problem finding and problem solving. We need to be heard in the policy making process because we offer another way to find information, gain insight from it, organize it, evaluate it and project holistic concepts. Whether the problem is resolvable through physical constructions or concepts as intangible as organization models, event plans or policy formulations, design thinking offers alternative ways of conceptualizing, inventing and planning of critical value to the decision maker.

The Professional Organizations

Our professional design societies will be in the front ranks as we rise to the challenge (Figure 29). To the extent that designers have national and international credibility as professionals, it is through the public awareness created by the activities, communications and actions of our professional societies.

Figure 29 **Professional Organization Responsibilities**

Professional societies must reconsider their charters with a view toward how we can provide high level service to institutions and government. In addition to the many services societies offer their memberships, they must find ways to make the value of design thinking paramount where it was not previously thought to be even relevant. They must take a proactive role in connecting decision makers with design experts and design organizations able to make substantive contributions.

Professional societies must also work to enlarge the supply pipeline. In this role, they must encourage researchers and schools to evolve applications of design processes to non-physical subjects. Perhaps better than any other of our resources, they can make the new values visible and incentives desirable to new generations of students and their teachers.

Design Research

Those concerned with design research must now extend its base (Figure 30). The sustained development we are beginning to see is a recent product and an exciting one, but already it is not enough.

Preparing for Responsibility
Design Research

Design research will need to grow

- **Staying the Course:**
  User-centered design
  Interaction design
  Universal design
  Computer-supported design
- **Widening the Vision:**
  Public policy
  Design and policy planning
  Conceptual synthesis and modeling
  System design evaluation
  Sustainable design
- and much more!

Figure 30 **Research Responsibilities**

In recent years, inspiration for design research has see-sawed between the engineering sciences and the social sciences, sometimes more inspired by the one, sometimes the other—most recently, the social sciences. In the mean time, the development of computer technology has continued at an exponential pace, and graphic and computational tools for creating highly sophisticated processes and methods for a wide range of design and planning research simply await incorporation and refinement by design methodologists. It time to widen our research vision, to see the full range of problems that can benefit from design thinking, and to create the tools and specialized knowledge that will enable designers and planners to participate in these kinds of decision making.

Education

The extension of vision and responsibility ultimately will succeed or fail at the hands of our academic institutions (Figure 31). Design education around the world must also extend its vision and grow to prepare the designers and planners of tomorrow for their responsibilities.

Without abandoning our traditional commitment to individual users, business and industry, design education must add a new commitment to institutions and government. Students must be prepared to work with topics, concepts and processes that have not previously been considered within their realm of expertise. They must also be prepared to work with people in roles designers and planners have not normally experienced.

Fundamental changes will be needed to university-level design education. Design and planning should be treated as a body of knowledge distinct from, but highly associated with other fields. Design should be positioned in its own college, not in a College of Art—or Engineering—or Architecture—or Liberal Arts. Design should be positioned to work in multidisciplinary relationships with all of these colleges—as well as the College of Law, the Business College, and others.

Curricula at the undergraduate level should contain significant courses in the sciences, humanities, technology and the arts. Graduating students with baccalaureate degrees should not be expected to be trained professionals, but rather appropriately prepared applicants for graduate education. Professional programs should be at the graduate level, and PhD programs should be established to further design and planning knowledge for those who would teach in the universities and those who would conduct research in laboratories and institutions.

Preparing for Responsibility
Design Education

Design education holds the long-term key

- **New Clients and Commitments:**
  Government and institutions as new clients
  Expansion of topics, projects and processes
  New roles, rules and work-styles for interaction
- **Repositioning within the University:**
  Design in its own college
- **Reorganization of Curricula:**
  Significant sciences, humanities, technology and arts in undergraduate curricula
  Professional training at the graduate level
  PhD programs for researchers and those who will teach

Figure 31 **Education Responsibilities**

Summary and Conclusions

In this century, we enter a period of peril and promise in which design thinking can play a major role—if we make it possible (Figure 32). Quality of life may suffer grimly or may reach new levels of richness, depending on how wisely we confront the problems we have made. For perhaps the first time in history, man-made problems may exceed the limits of our ability to check them. Our actions in the next decades will be critical.

Our political leaders will have to make decisions, often difficult, that will take all of our combined wisdom. Traditional political processes will not be sufficient. We must have the best scientific thinking in creative advisory roles. We must also have a new voice, design, in advisory roles where the options may benefit from constructive vision.

For those of us in leadership positions among the design professions, professional societies, research institutions and universities, the evidence visible today should be enough to stir us to action. Within our own fields we must initiate the changes that will put us in position to contribute.

Professionals and Professional Societies must work to build bridges to government and institutions, establish the credibility of design thinking, and demonstrate its value to the analysis of problems, development of concepts, and making of decisions.

Researchers must widen the scope of design research and pursue the kinds of knowledge, processes, methods and tools that will better enable design thinking to be used in policy making.

University faculty and administrators must reinvent curricula to fit the times, recognizing the growing maturity of the design fields and the new commitments necessary to match daunting new responsibilities.

The goal for all is service at the highest level. It may seem arrogant to believe that design thinking can have serious impact at policy-making levels. But what if it could? I think we all would rather we tried than wish we had.

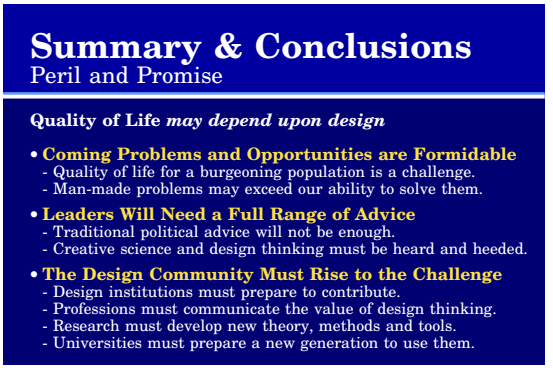

Figure 32 **Summary and Conclusions**

References

1. **Project Phoenix: Fire Replaced** and **Project Phoenix: Fire Reversed**. See versions of these papers reissued in 2004 with full-color illustrations at http//: www.id.iit.edu/ profiles/ gallery/ project_phoenix/

2. **National Park System.** Chicago: Institute of Design, Illinois Institute of Technology, 1994.