

Standing around the computer, my two older daughters, nine and eleven years old, scan the picture of the city we're creating and debate whether it needs more commercial or residential development. My six-year-old son suggests we look at the city budget. In just a few weeks he has learned enough to ask the critical question: "What's the cash flow?"

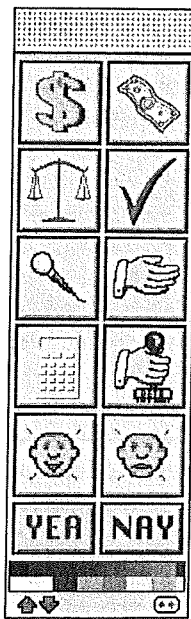
This is SimCity, one of a series of computer simulations that turn public policy and ideas into popular entertainment. With the advent of dramatically improved graphics and powerful, low-cost multimedia computers, a new generation of "edutainment" software has finally begun to fulfill the long-touted promise of computers in education. Most of the new programs use interactive multimedia to make games out of traditional subjects such as arithmetic or geography. In MathBlasters, for example, children solve math problems in order to fuel up a rocket and find a villain in outer space.

However, the Sim series, produced by California-based Maxis, goes a step further: it makes games out of simulations of complex natural and social systems, based on advanced and sometimes controversial areas of science and decision making, such as climatology and environmental science, genetics, and sociobiology. Those who think designing cities is prosaic can move on to simulating the development of planetary ecosystems (SimEarth) or the evolution of new life forms (SimLife). Other programs make games out of the management of railroads (A-Train),

Seductions of Sim

Policy as a
Simulation Game

Paul Starr



and farms (SimFarm), and even national health policy (SimHealth). These are unlikely ever to challenge Nintendo's Super-Mario World in sales. Still, it isn't only policy wonks who are buying the games for themselves and their kids. SimCity has sold two million copies since its release in 1989 and has probably introduced more people to urban planning than any book ever has.

When my family first began playing SimCity and others like it not long ago, my initial reaction was a mixture of excitement and skepticism. The new simulations are certainly a lot more fun than most textbooks. Rather than present information, they provide tools for inventing worlds, exploring hypotheses, and stretching imaginations. Several have a public viewpoint. In SimCity—unlike Monopoly—the player builds a community. One of the “scenarios” in the latest version of SimCity puts the player in Flint, Michigan in 1974 with the task of rebuilding the local job base and community. In SimEarth and SimLife, the object is to create sustainable environments and avoid extinctions.

But I worried whether the games might not be too seductive. What assumptions were buried in the underlying models? What was their “hidden curriculum”? Did a conservative or a liberal determine the response to changes in tax rates in SimCity? While playing SimCity with my eleven-year-old daughter, I railed against what I thought was a built-in bias of the program against mixed-use development. “It’s just the way the game works,” she said a bit impatiently.

My daughter’s words seemed oddly familiar. A few months earlier someone had said virtually the same thing to me, but where? It suddenly flashed back: the earlier conversation had taken place while I was working at the White House on the development of the Clinton health plan. We were discussing the simulation model likely to be used by the Congressional Budget Office (CBO) to “score” proposals for health care reform. When I criticized one assumption, a colleague said to me, “Don’t waste

your breath,” warning that it was hopeless to get CBO to change. Policy would have to adjust.

There are, of course, important differences between computer simulation games and the simulations used to assess policy options. The games are designed to be entertaining; fidelity to empirical reality is not foremost. But simplification is inherent in any simulation. Even “real” simulations (if that is not an oxymoron) inevitably rely on imperfect models and simplifying assumptions that the media, the public, and even policy makers themselves generally don’t understand. Both types of simulation are examples of what might be called a *crossover intellectual technology*, one that has only recently moved from academic and technical fields into popular and public use. The crossover of simulation holds out the promise of an enriched understanding of the world, particularly of complex systems. But there is a danger too: forgetting that simulations depend on the models on which they are built.

The danger is particularly worrisome when simulations are used to make predictions and evaluate policies. And when policymakers depend on simulations to guide present choices—especially when legislators put government on “automatic pilot,” binding policy to numerical indicators of projected trends—they cede power to those who define the models that generate the forecasts. This is happening in America today, most notably with the rise of the CBO as a power center in national policy. In a sense, Washington is already Sim city.

Original Sim

Although it has taken three decades for them to come of age, simulation games—and SimCity in particular—are really children of the ‘60s. Indeed, their development follows a classic pattern of our time. In their infancy, simulations and related advances in computer technology were nurtured by government grants for both military and domestic policy purposes. In

their maturity, they are being turned by private initiative and investment into a phenomenon of popular culture.

To be sure, the genealogy of simulation can be traced back to a varied history preceding the 1960s. At least since their use by the Prussian army in the eighteenth century, simulations of combat have been a staple of military training. War games were, so to speak, the cradle of simulation. By the post-World War II era, engineers and corporate managers were using simulations to design and run power grids, telecommunications networks, factories, and businesses. Business simulations, which began primarily as training exercises, evolved into a routine management tool. And as researchers gained access to computers in the 1950s and '60s, simulations came into wide use for scientific purposes to understand complex systems such as climates, economies, ecosystems, and international relations.

As these examples suggest, simulations referred to at least two types of activity. One kind of simulation created a role-playing game and engaged participants in working out a scenario under prescribed conditions and rules. The other kind projected the behavior of a complex system on the basis of a quantitative model. The new computer simulations create games based on models of complex systems and, in that sense, they combine the two.

The forerunners of these games were developed in the 1960s. "Social simulation" took off during the '60s in several independent forms. At Johns Hopkins, the sociologist James S. Coleman and his colleagues worked on simulations as a means of both advancing social theory and improving education, particularly for minority youth. Role-playing simulations and games, they argued, would enliven the teaching of subjects as diverse as mathematics and social studies. One of the games, called Ghetto, sought to expose the logic of inner-city life. The hope was that as a tool

of research, simulations and games would enable the theorist to define and grasp the underlying rules of social systems. (Economics, of all the social sciences, has most used games this way.) As a tool of school reform, simulations would provide a more accessible, participatory method of education for children who did not respond well to traditional instruction. John

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Dewey's educational ideals would finally be realized—or at least simulated.

Advanced training programs and consensus-building for professionals and decision makers also made increasing use of role-playing simulation games, sometimes involving large groups working under a trained facilitator. Some of the earliest games simulated urban conflicts over resource allocation. In 1964, one of the founders of the field, Richard Duke, designed a game called Metropolis for the city council in Lansing, Michigan. The game used role-playing to work through policy decisions and employed computers to track the effects, as the group went through one cycle of decision making after another. By the mid-1970s, a later version of the game, Metro-Apex, gave computer simulation a central role.

During the 1950s and 1960s, a variety of planners and social scientists concerned with urban problems had been developing large-scale computer models of cities to simulate and predict their development under varying policies. These models were first designed primarily for transportation and land-use planning. The federal highway program provided a major impetus. Modeling burgeoned in both academic and professional city-planning

departments and displaced older traditions that conceived of planning as "architecture writ large."

Large-scale urban simulation models first caught the public eye through the work of an outsider to the field. In 1969, Jay W. Forrester, an electrical engineering professor at MIT with no background in urban research, published *Urban Dynamics*, a book purporting to disprove common intuitions about urban policy. Forrester's next work, *World Dynamics*, proposed a model for the entire planet. A group based at MIT and led by his protégés prepared the 1972 report *The Limits to Growth* sponsored by the Club of Rome, which claimed to show that the world was reaching the end of its ecological tether.

Because of their dramatic conclusions, Forrester and the Club of Rome report captured the public imagination, but the reception accorded their work by researchers and professionals was much cooler. Forrester's urban model was not based on empirical evidence and had no spatial dimension. According to Britton Harris, a leading exponent of modeling and emeritus professor of planning, transportation, and public policy at the University of Pennsylvania, Forrester's model had little influence on urban planning. The Club of Rome report did incorporate data and had real influence, though it too had no spatial dimension. From the vantage of the Club of Rome, the world consisted only of aggregates and averages. While undoubtedly contributing to public awareness of global environmental problems (and better subsequent research), the report itself has not withstood the passage of time. For example, nearly all the resources that it predicted would be in short supply at escalating prices in the 1990s now have larger known reserves and are available at lower prices than they were in 1972.

Professional disillusionment with large-scale models was already setting in at the time of the Club of Rome report. In 1973, a leading journal in urban planning published a "requiem" for large-scale models. The

emerging consensus was that the models had overreached; both the theory underlying the models and the available data were inadequate to make the kind of predictions the modelers were attempting. The modelers' "loss of faith," as one of the leading urban modelers, William Alonso, calls it, became part of a broader collapse of confidence in planning in the 1970s and 1980s. In the same era, efforts to apply simulation and games to the education of minority youth were also proving a disappointment. Critics questioned whether the educational payoff was worth the effort.

But while social simulation flagged, work on simulation models and games did not actually disappear. Rather, it retreated into more specialized circles. Role-playing simulations have become a standard technique for professional training and conflict resolution. During the next two decades, the development of computers, software, and data resources transformed both the scientific and popular potential of computer simulation. By the late 1980s, there was talk of a "renaissance" of large-scale models in urban planning, even though many in the field are still as wary as ever about the models' predictive powers.

The spread of desktop computers and advance of visualization techniques have been particularly important for the revival and popular crossover of simulation. Early computer simulations and games required access to mainframe computers and skills that were, to most people, esoteric. Improved graphics made simulations and games not only more accessible and absorbing, but also more "playable."

Much of the research behind advances in computer graphics was originally sponsored by the Department of Defense and space programs and grew out of work on flight simulation, which in the 1960s and '70s was centered at the University of Utah. The defense and space programs had a similar catalytic role in the development of the Internet. Virtual reality has followed the

same route.

Improved graphics hit the home market with the growth of video games and the advent of the Macintosh. Even flight simulation has crossed over to become home entertainment.

It was while working on a video game for bombing islands that Will Wright, a Macintosh programmer, came up with the idea for SimCity. Wright told me recently that while designing a "terrain editor" to create the landscape, he discovered that he had "more fun building the islands than bombing them."

Wright had never studied urban planning—his background was in robotics and computer games—but on his own he found his way to the planning literature, including Forrester and Jane Jacobs. The subject became interesting to him only after he began simulating urban development. (Many people who have since played SimCity have probably had the same experience.) Drawing on research begun decades earlier, Wright fashioned the models of land use, traffic, power systems, and other aspects of urban development that underlie SimCity. He says he conceived of SimCity not as a game but rather as a "toy" because at least in its standard use there is no preset goal or contest. The player decides what kind of city to build—whether to emphasize its size, wealth, beauty, or harmony with the environment. In 1987, unable to find a software publisher who thought there was a market for such a toy, Wright joined with a businessman, Jeff Braun, to start Maxis and develop SimCity. The company now has more than 20 titles on the market and has spun off a separate firm to create business and public policy applications.

Inside SimCity

The seductive power of computer simulation games lies partly in their extraordinary variety and intricacy. Generating complex variation is one thing that computers do especially well. But interest in such games was limited as long as the "user interface" was text. Adding stereo sound

and three-dimensional graphics enables people to handle greater complexity at a faster pace. This is what makes multimedia simulation such a powerful communication medium. SimCity shows why.

Like several other programs in the Sim series, SimCity offers a choice between two types of play: building a system from scratch or solving the problems in a specific scenario. (All references here are to SimCity 2000, the more elaborate, three-dimensional version of the game released in 1993.) The player who builds a city *de novo* receives a starting fund and a randomly generated, five-square-mile terrain whose features can be chosen and modified at no cost prior to the start of play. For example, the player can decide whether to locate the city on a coast or river and how much area will be covered by water, hills, and forests. The terrain will be different every time. Once play begins, the development of the city is open-ended, with no fixed objectives or time limits, except as the player defines them. In contrast, in the second type of play, the player loads a scenario with a given map and limited time to accomplish a specific task, such as revitalizing Flint, rebuilding Charleston, South Carolina after a hurricane, or turning "Dullsville, U.S.A.," into an exciting community.

As mayor of SimCity, the player has extraordinary powers; there is no city council, state government, or public employee union to worry about. (Weep, Rudolph Giuliani, weep.) The mayor can set local tax rates and locate and build various community facilities and services, such as power plants, water systems, roads, highways, rails, airports, police and fire stations, schools, and hospitals. The mayor can also control annual spending on city services, adopt ordinances on matters ranging from pollution control to the promotion of tourism, and zone areas for industrial, commercial, or residential use.

SimCity operates on a "field of dreams" principle. If as mayor the player creates the right environment, the Sims—the imaginary inhabitants of the city—will come and

build factories, shops, and homes. When they do, buildings and factories pop up on the land and change as the city develops. But if things turn sour—if unemployment rises or high crime rates in a neighborhood drive people away—the icons on the screen change or go dark to indicate population losses or building abandonment. All this takes place in vaguely historical time (the player can set the starting data at 1900, 1950, 2000, or 2050), which primarily affects the available technology and rate of energy consumption.

To help make decisions about zoning, taxes, expenditures, bond issues, and other policies, the program provides a wealth of constantly changing data in maps and graphs showing the city's population growth and density, demand for residential, commercial, and industrial land, unemployment, power and water supply, crime, traffic congestion, pollution, and various other aspects of the city's development. The same sources report changes in interest rates and the growth of the national economy and neighboring cities. Newspapers periodically deliver reports of local sentiment, including the latest public opinion polls and inane, jumbled stories about local and made-up international events. A hallmark of the Sim games is a light touch. (My favorite example: In *SimAnt*, which translates the sociobiology of ant behavior into game form, one ant curses a group from another colony, "Your queen mates with termites.")

The key to *SimCity* is the interaction of private land values with the public budget. As the player constructs a city, the value of property zoned for development is continually changing. These changing values are critical, for they affect property tax receipts and determine—as my six-year-old quickly discovered—whether the cash flow in the city budget is positive or negative and therefore whether the player has to raise taxes, cut spending on city services, and skimp on public investments.

Will Wright aptly refers to the basic conceptual framework of *SimCity* as a "capitalistic land value ecology" and argues that it fits the development of American cities in the twentieth century but would not account for the development, for example, of St. Petersburg. In fact, *SimCity* is somewhat more constraining; the game seems to require a particular type of American city built on an industrial base.

The model in *SimCity*, as Wright describes it, consists of a series of "concentric rings." At the core is a so-called "basic/nonbasic" or "export/import" model, borrowed from the traditional urban development literature, that describes the evolving relationship of the industrial, commercial, and residential sectors. *SimCity* assumes that while 70 percent of industrial production is exported outside of a city, 70 percent of commercial production is consumed internally. Thus in the early stages of a city's development, while its internal market is small, the industrial sector must predominate. As the city and its internal market grow, commerce begins to expand, ultimately overtaking industry as the main source of employment. The demand for residential space depends on the growth of other sectors. If jobs outnumber potential participants in the labor force, people will move to the city and demand for residential development will increase. If the local economy is doing badly and there are fewer jobs than workers, unemployment will rise and people will leave the city.

According to Wright, *SimCity* uses a "bid rent" model to determine land valuations. Property carries different values depending on its use; for example, proximity to the urban center is valued most for commercial and residential purposes and least for industry. The actual numbers used in *SimCity* for land values, city investments, and other items bear no relation to the real world. However, the overall valuation of *SimCity* and thus its tax base will depend on how the player distributes and locates different zones and allocates resources among roads, schools,

and other public services.

Wright says *SimCity* is built "from the inside out." In the outer rings are models for traffic, energy, water, and other systems, which react back upon and modify the land-use model at the core. The hardest problem, according to Wright, is not what to put in but what to leave out. He is disarming about the game's limits. Inevitably, *SimCity* is a "caricature" of reality. The models deliberately exaggerate effects to provide feedback to the player; in real life, the effects of many decisions would be imperceptible. The purpose of *SimCity* is not accuracy or prediction but communication. "Unless it's entertaining, the educational value is irrelevant." Asked how he handles controversial choices, like the effects of tax rates on development, Wright dodges the question and says, "We go for game play"—whatever is most fun.

Still, when players make decisions in *SimCity*, the game generates effects on employment, crime, population growth, tax revenues. I would be more worried about too easy an acceptance of the validity of those effects if *SimCity* worked with real data. Games of that kind may well be on the market not long from now, enabling players to download real maps and data into a game with a visual interface like *SimCity*. But, as now designed, *SimCity* is clearly a fictional world and the effects seem only as real as points scored in a video game. This is even true of the Flint scenario because of the patently fictional quality of all the numbers used in the game.

SimCity's players learn not from any particular aspect of the model but from the process of being forced to make choices and face the consequences. Most immediately, they confront choices of spatial design in distributing land among potential uses and locating community resources like schools and NIMBY's like power plants. These choices have a temporal as well as spatial dimension. Players who overinvest too early in costly capital projects like an airport or stadium will quickly find themselves in fiscal trouble.

The important payoff comes from struggling to master complexity. Wright observes, "Playing the game is the process of discovering how the model works." Of course, few players will be able to give any formal expression to the model. But much of it is implicit in the manual that comes with the game, and many players will be able to figure out critical relationships from the signals that the game provides. To keep up with a city's changing size and demands, the game requires constant monitoring of the city's power, water, transportation, budget, and other systems.

If there is a "hidden curriculum" in *SimCity* and other Sim games, it lies here. Shoshana Zuboff's 1988 book *In the Age of the Smart Machine* describes the confusion and alienation of workers in factories and offices as computers were first introduced over the previous decade. Physical contact with the production process had been an important source of practical knowledge; for example, workers at pulp mills that Zuboff studied had been able to tell whether anything was wrong merely from the color and odor of the pulp. Now the workers were asked to make decisions based on information flashing on a computer screen. This shift deemphasized sensory knowledge and put a premium on more abstract, "intellective" capacities. This is exactly what *SimCity* teaches: the management of complex systems based on "intelligent scanning" of streams of constantly changing information.

As *SimCity* has evolved, it has incorporated increasing levels of complexity. For example, in the original *SimCity*, the fiscal options were limited. There was one tax rate that players could raise or lower, no possibility of floating bonds, and just three types of operating expenditure—transportation, police, and fire protection. In *SimCity 2000*, the player can vary property tax rates by class (residential, commercial, industrial); offer tax incentives to specific industries; impose a sales or income tax; borrow funds; refinance bonds; budget a wider

variety of programs now including education, health, and welfare; and vary expenditures within each budget category (for example, primary and secondary schools versus higher education) and even by neighborhood.

This degree of complexity may seem astonishing in a game for children. But when children play SuperMario World and other popular adventure games, they must learn the most intricate facts about the many imaginary places they navigate. These worlds are typically filled with strange creatures, hidden passageways, and special treasures. Going from one level of the game to the next demands an extraordinary mastery of detail. Compared with these demands, managing SimCity is surprisingly straightforward.

SimCity makes complexity manageable partly by enabling players to ignore much of it when they are first learning the game. For example, players can turn on "auto-budget" and let the program follow its default options until they are ready to take

SimCity teaches the management of complex systems based on streams of constantly changing information.

up fiscal alternatives. When they do, they will find that SimCity allows the mayor to get advice from various city council members—or are they consultants?—who appear at the click of a mouse. Their recommendations may not, however, always be consistent. As I was playing, one adviser urged me to raise taxes to cut the city's deficit, while another said I should cut taxes to stimulate growth. This difference seemed to me a truly real-world touch.

Wright says that the next stage in SimCity's development may enable the player to dive into a city to run a business inside it. He also wants to give players the

ability to modify the model's assumptions. "We want the user to be able to define more and more of the model." Ultimately, he says, the game could allow players to build the models themselves. Whether many people would use this opportunity is unclear. But the option would permit mastery of a simulation in the more fundamental sense of being able to manipulate the assumptions and relationships behind it. In its current version, the model is an unreachable black box. A new Sim game, SimHealth, does allow players to modify assumptions and define the governing values. But in practice, SimHealth shows some of the limitations of the genre.

A Simulation Muddle

The premise of SimHealth is that you have been elected to Congress in 1992 and seek to get reelected by choosing policies for health care. The game and the voters then rate your performance not against an independent standard but rather against your own—the values you have selected at the

outset. This is an attractive concept. However, the framework for "clarifying" values adopted by SimHealth is based on hackneyed and misleading premises. SimHealth asks players to define their values in terms of two dualities—liberty and equality, and community and efficiency—on the premise that more of one

value in a pair necessarily means less of the other.

But is this the case? Historically, many societies that have denied basic liberties have also had extreme inequalities. When we talk about rights, we generally mean equal rights; thus the two concepts overlap, often reinforcing one another. For example, does the right to assemble peaceably for redress of grievances express the value of liberty or equality? What about equal educational opportunity? Compared to the U.S. system today, is Canadian-style national health insurance an expression of equality (since everyone is covered) or of

liberty (since all are guaranteed individual choice of physician and no one suffers from job lock)?

To assume a zero-sum relation between liberty and equality, and community and efficiency, obscures a central challenge of policy—how to achieve progress on more than one value at a time. For example, few would disagree that by eliminating administrative sources of inefficiency, we are better able to carry out aims benefiting the community as a whole. But in SimHealth, efficiency and community are counterposed. Perhaps even more fundamental, SimHealth's framework fails to appreciate that the main political differences in health policy, as in other areas of American politics, concern conflicting interpretations of widely shared values. Those who take different positions do not necessarily differ in the value they place, for example, on liberty; they often disagree about what liberty means in relation to health care (freedom to change jobs without fear of losing coverage, freedom to pick a health plan, freedom to pick a doctor, freedom to consult alternative healers, and so on).

SimHealth's philosophical muddle is inadvertently apparent from the arbitrary connections it asserts between values and particular statements that are supposed to embody them. The value of community supposedly calls for "restructur[ing] health insurance to provide the highest quality care." But it is obscure to me why "community" should mean an emphasis on quality of care rather than, say, careful stewardship of resources, priority for public health measures, or universal coverage.

SimHealth does no better a job of explaining health care policies and proposals. Indeed, the game is littered with crude simplifications and outright errors of fact. It mixes up the concepts of managed care and managed competition, confuses an individual's share of premiums with the coinsurance rate (the individuals' share of payments for covered services), and misstates the basic arrangements proposed

in the Clinton and other proposed health plans in Congress. The effects of particular policies on public opinion seemed entirely arbitrary and capricious. I did not detect any particular political bias. But SimHealth contains so much misinformation that no one could possibly understand competing proposals and policies, much less evaluate them, on the basis of the program. And although SimHealth enables users to modify some assumptions, the model is never clearly explained and the basic architecture is beyond reach.

The oversimplified values framework and misinformation in SimHealth could be fixed, but the bigger problem is false pretensions. Unlike the plainly fictional SimCity, SimHealth claims to simulate the effects of different real-world proposals, which it cannot do. I suspect that if SimCity purported to help evaluate policies toward the homeless, it would seem equally inadequate.

SimHealth is a case of overshoot. The Sim games generally achieve their impact by engaging players in concrete tasks. SimHealth, however, seeks to engage players in formulating policy, which is entirely different. A child can start playing SimCity without any conceptual understanding of urban development. But to choose among various policy options in SimHealth, the player needs to understand their relation to one another. The conceptual threshold is too high, and it is not clear that a game can overcome it. On the other hand, for those who are familiar with the elements of health policy, playing SimHealth quickly becomes repetitive; it lacks the complex variation and intricacy of SimCity and other Sim games. Once the novelty of making health policy into a game has worn off, I doubt SimHealth will hold much interest. It certainly has no value in assessing health care reform.

Simulation in Reality

The critical problem raised by simulation is the black-box nature of the models. In the "real world" of policy simulation, the models are subject to criticism and debate,

at least among professionals. Opposing sides in policy disputes often come armed with their own simulations, ready to fight numbers with numbers. However outrageously biased some of these may be, there is nothing remarkable or offensive about the practice—it is simply one aspect of today's pursuit of politics by other means.

The troubling questions, in my view, concern the use of simulation as an element of statecraft. In principle, models used for official purposes are more open to scrutiny

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than are those in the private sector, and that is enormously important. Within and across the branches of the federal government, the validity of the models and assumptions is subject to intense scrutiny, and a strong sense of professionalism limits political manipulation. However, to most participants in policy debates as well as the public at large, the models are opaque. Only a few can penetrate the black box and understand what is inside. This has two opposite effects. At a conscious level, many people are distrustful of official projections, like much else about government. In practice, however, the numbers take on immense importance. As a result, those who have technical authority over the black boxes acquire an extraordinary degree of influence in the political process. And technical authority matters because the outcome of simulations often depends on what is assumed in the first place.

There is no obvious remedy to the black-box problem, and it affects conservatives as much as liberals. Conservatives who are wary of planning still depend on large-scale models for budgetary projections. Indeed, the most recent version of the balanced-

budget amendment would require Congress to balance not actual outlays and receipts but projections of future streams. Since those projections would be produced through computer simulations, the amendment would give unprecedented authority to whoever served as official simulator—a role that sounds like the modern equivalent of court magician, and perhaps is.

The official simulator today, CBO director Robert Reischauer, may now be as powerful a figure as any member of Congress. The CBO has no veto over legislation, but it has a power that is nearly as great—the power to “score” legislation to determine compliance with budget rules and future effects on the deficit. When someone in Washington today claims savings for a proposed change in national policy, people ask not whether the savings are real but rather, “Are they scoreable?” This

aspect of national policy has all the features of a game with arcane rules and assumptions. (One of the staff economists at the Council of Economic Advisers joked last year that after leaving he would write a kiss-and-tell book called *How to Score in Washington*.)

From the formative stages of policy-making, the effects are substantial. For the past several years, the CBO has cast a broad shadow over the debate about health care reform. Among the cognoscenti, cost-containment proposals have been classified in two ways—“scoreable” and “unscoreable”—depending on whether the CBO was likely to smile or frown. The prospect that the CBO would frown on a policy and deem it “unscoreable” has been a grave, sometimes fatal strike against it.

When the CBO finally made its report on the Clinton health plan, it was front-page news, and again the black-box problem was apparent. Now it was time to hear the score, though few understood what went into it. The president's critics heralded Reischauer for saying that premiums paid to health alliances should be counted in federal receipts (albeit as an “off-budget” item) and

that the plan would raise the federal deficit by \$70 billion in the years prior to 2004 before reducing it. It almost did not matter that the CBO estimated a near-term increase in the federal deficit in part because it projected larger savings to state and local government (indeed, recapturing those savings for the Treasury would make the plan virtually budget-neutral). Nor did conservatives who were praising Reischauer seem to appreciate the implications of CBO's general view of cost containment. While casting a skeptical eye on the market-oriented measures generally favored by conservatives, CBO has endorsed the effectiveness of regulatory measures that conservatives dislike. CBO accepted the Clinton premium caps as 100 percent effective. It has favorably assessed the impact of single-payer plans, particularly on administrative costs. This is by no means to say that CBO's judgments will be decisive, only that they have come to hold unprecedented influence.

CBO has emerged as a power center as the influence of Congress has grown relative to the executive branch over the past two decades. But CBO has also become a force in its own right, apart from the Congress, because of the predominance and persistence of budgetary issues in national politics and the search by the Congress to find ways to bind itself, like Ulysses to the mast, to resist strong impulses within. The official simulator is now called upon to provide not just clairvoyance but collective self-discipline. The discipline will hold only if the simulations do—only if there is one authoritative mechanism for defining the future in the present. The power of CBO has become an institutional necessity.

In the wider world, there is no comparable imperative to find a single mechanism for simulating alternative policies and theories. If there must be black boxes, at least we should have many of them to discourage faith in any one. Even better, we need to open up the boxes by making the models more transparent.

Transparency ought to become both the objective of simulation designers and a critical basis for judging their success. Richard Duke—the pioneer who first introduced computers into urban simulation games in the 1960s—is now deeply skeptical about models embedded in computers that oblige the user simply to accept an outcome as valid. Currently a professor at the University of Michigan and president of the International Simulation and Gaming Association, Duke says, "If a simulation hides the model, it's of little interest to me. If a simulation exposes the model, I'm much more interested." His own work now emphasizes role-playing policy simulation exercises that allow different players to engage each other, not just a black-box model. Besides allowing participants to practice skills in negotiation and group problem solving, the role-playing approach is much less deterministic: it introduces an unpredictable element of human choice into simulation games.

Computer simulation games with many simultaneous players linked through the Internet may also introduce more unpredictability. Moreover, as computer games become more elaborate and widely used, their sheer multiplication and increasing plasticity may promote a healthy skepticism about their predictive power. Playing with simulation is one way to see its limits as well as its possibilities.

For better or worse, simulation is no mere fad. Indeed, to think of simulation games as mere entertainment or even as teaching tools is to underestimate them. They represent a major addition to the intellectual repertoire that will increasingly shape how we communicate ideas and think through problems. The advent of this new medium has escaped the attention of cultural critics because it has come in the form of children's games. But the computer simulation game is an art form; when combined with three-dimensional graphics and sound, it is an extraordinarily powerful one. We shall be working and thinking in SimCity for a long time.♦