the Creative Learning EXCHANGE

Volume 4, Number 1 - Winter/Spring 1995

BUILDING SYSTEMS INTO THE HISTORY/ SOCIAL STUDIES CURRICULA: SOME PRELIMINARY THOUGHTS

by P. Jeffrey Potash, System Dynamics Group, Trinity College of Vermont[1]

A favorite bumper sticker of mine reads "History happens." But does it? Or did it? According to the Bradley Commission's 1989 Report on Historical Education, young Americans are, on an unparalleled scale, "historically illiterate." To some degree, their ignorance of the past reflects a larger cultural indifference which imagines that "our" world, governed by unprecedented rates of technological invention and change, is altogether detached from an obsolete and irrelevant past. But that ignorance—and I speak here as a student and teacher of history who rejects this premise—is also rooted in the pedagogic shortcomings in the current "system" of historical education. It is to this latter issue that I'd like to proffer some thoughts on using "systems thinking" and dynamic modeling to improve levels of historical literacy.

STEP ONE: HOW DID WE GET TO WHERE WE ARE TODAY? RECONSTRUCTING THE "SYSTEMS"

It is a rather interesting phenomena that teachers of history or social studies rarely if ever see themselves as players within history. Few, I've found, fully understand the historical evolution and purposes of the "systems" which govern how and what they teach. Daily teaching is predicated upon a simple positive feedback loop which argues that the more history one is taught, the more one learns; knowledge compounds as students desire to learn more. Let's examine how pedagogic systems rooted in history have wreaked havoc with this notion of compounding historical knowledge.

SYSTEM #1: THE SYSTEM OF CULTURAL HOMOGENIZATION

Begin with the recognition that the decision in the 1880s to reorganize American education and replace the classical core (Greek, Latin, Ethics, etc.) with a new curriculum emphasizing modern language, science, and American history was inextricably linked to the Industrial Revolution which followed the Civil War. In the heady atmosphere of unprecedented invention and the corporatization of America by self-proclaimed "Captains of Industry," this great industrial leviathan magnetically drew a flood of rural transplants and foreign immigrants into America's burgeoning metropolises to fuel the machine and to search for streets they'd been promised were strewn with riches.

In this context of industrial and social transformation, the teaching of American history was designed to impose homogeneity and order on a heterogeneous population of immigrants and urban transplants while training them to adapt to the discipline imposed by a new industrialized workplace. The system combined four basic ingredients: (a) t**he teacher**, (b) **the text**, (c) t**he artificial definition of discrete time periods within American history** (i.e., the Colonial era, the Revolutionary Era, the Early National Period) and, (d) t**he substitution of a mythical for a "real" past**.

Consider how the system worked: Operating within a rigid social system which assembled students in rows and demanded strict obedience, history was transmitted via the teacher armed with the great tome or common bible referred to as "the text." The text fused all the information together with a singularly authoritarian narrative line. American history was ingeniously compartmentalized, divided into a series of discrete periods or events, each functioning in some linear fashion for purposes of illustrating sequential progress. American history could be understood as an assembly line, through which the discrete contributions of prominent individuals in the past culminated in the glories of the present moment. This was an image suited for the new industrial order. Students were to see themselves as the benefactors of this past while at the same time being prepared to enter a working world where loyalty, passivity, and an adherence to the discipline of industrial time reigned supreme.

***HISTORY** continued on page 3*

UP-DATES...

The GIST Project

During the 1990-91 school year, Georgia Pacific became a county-wide Partner in Education with a commitment to assist with mathematics and science programs. A committee was formed during the 1991-92 year to study possible innovations in math and science. John Mangan was the contact person for Georgia Pacific Company. John became aware of systems thinking through a GP presentation and presented his ideas to the Math and Science committee. As a result, Glynn County administrators took a trip to Tucson, Arizona to observe the systems thinking project at Orange Grove Middle School. This group of administrators with the approval of the Math and Science committee decided that a systems thinking project would be a part of Glynn County's math and science initiative.

In the late spring of 1992, interested teachers were asked to sign up for short summer workshops conducted by High Performance Systems personnel. From the participants in these workshops, nine (9) middle school teachers (the Core Team) were selected for additional training in systems thinking and, specifically, in creating simulations using STELLA II. This training also included nine (9) engineers from Georgia Pacific. This partnership was intended to encourage dialogue and support between the teachers and the GP engineers. Georgia Pacific Company was solely responsible for all 1992-93 funding which included ten (10) weeks release time for each core team member, technical support from High Performance Systems, and an outside facilitator, Lyn Miller. As 1992-93 proceeded, the Glynn County Systems Thinking Project became Glynn's Integration of Systems Thinking (GIST).

During 1993-94, the major funding from Georgia Pacific was reduced. Because of the funding reductions, our contact with High Performance Systems was reduced to technical support by phone. At this point, we also lost Lyn Miller as our facilitator. These changes also resulted in the Core Team members' taking control of decisions in order to keep the project moving forward.

Our funding for 1994-95 is a part of a major grant from the state to Glynn County. GIST is one of five programs in the county to receive a part of this grant.

The 1995-96 school year will be funded by the Waters Foundation. This funding will cover release time for development, Core Team members' attendance at major conferences in the area of Systems Thinking and Dynamic Modeling, and a full time mentor.

Along with the funding changes that occurred during 1993-94, the Core Team began to change the design of the Learning Environment. The "Peach Pit" idea that Barry Richmond used in the March, 1993, Project Summary came from our Core Team concerns about the emphasis on the simulations. The Core Team members realized that the LE's did not have to be simulation driven; instead, they could become curriculum driven with the simulations used as enhancement.

Because of these realizations and changes, our emphasis for 1993-94 has taken a direction different from the original plan. In the original form, the Learning Environments were intended to be multidisciplinary units which incorporate all major academic areas.

***UPDATES** continued on page 11*

FROM THE EDITOR. . .

Sometimes I feel like singing the song from *Oklahoma*: "June is bustin' out all over!" Only substitute systems education. Since the conference in June, there has been a swell of activity. Trips this year to the George School, Ridgewood, Tucson, and Georgia (not to mention my own little neck of the woods here in Massachusetts) have shown me what wonderful things are happening throughout the country. The exciting part is that all of the projects have been going for several years and are showing signs of maturing and growing in their abilities to have a positive effect on children's education, sometimes despite a lack of substantial funding. The phone and e-mail at our office has a 'clamoring for more' quality to it. More people are hungry to learn more. It is energizing and motivating.

For those of you who are encountering a new voice on the phone (which sounds less like me), you have been talking to my dear friend and new helper—Jan Bramhall. Jan has had a head start on getting to know all of you and what you are doing. She has been the wizard behind the layout of the ***CLExchange*** since its inception three years ago.

Lisa Schleelein, whom many of you met at the conference, and who did sound like me on the phone, has joined her husband in Ithaca, New York, where he has a new job. As you all know who talked with her or met her, Lisa was a ray of sunshine. In fact, how could we have had the conference without her??

I would like to reiterate the plea in the Updates column. If you are interested in joining into a discussion about the sequencing and delivery of the concepts in a K-12 systems education, please call, write or e-mail me.

Lees Stuntz, Editor (stuntzln@tiac.net)

SYSTEMS IN HISTORY/SOCIAL STUDIES

continued from page 1

Thus, classroom history emphasized the inviolability of the teacher, the text, and the singular causal force relationship between American values and progress. Memorization of particular facts and dates thus formed the pedagogical basis for indoctrinating all students with a common heritage while concomitantly inculcating them with essential skills which they required to function as modern workers within a newly industrialized setting.

So, too, the ambiguities of American history were exorcised via the substitution of myth for fact. Thus, by way of illustration, the celebration of Thanksgiving (also an 1890s "invention") became the archetypal "creation" story to which all immigrants could subscribe. The common birth of America was followed with a series of unassailable facts, events and great men whose brave actions had maintained the American experiment on solid footing.

Admittedly, we have modified much of this basic system, and I shall address this momentarily. Yet is it not true that the system of teaching history in the public schools retains much from this era? Consider, for instance, the degree to which participants remain captive to a pedagogy which favors passive acquiescence to texts, to singular causality, and to mythology. And why, now as then, do students legitimately bemoan the fact that the most recent past—that which clearly has the most bearing upon the present—too often is sacrificed at the alter of the eternal excuse, "because we spent too much time on the early events, we'll be unable to proceed beyond, say, the second world war?" From the vantage point of "the system," the answer is clear: an American history designed to be unambiguous inevitably is most effective when it speaks to a distant past. The fragility of the imagery runs afoul of the rifts which permeate modern times. Subsequently, the "system" prefers not to tackle the most recent and most relevant past.

SYSTEM #2: TOWARD GREATER EFFICIENCY—THE CASE FOR "SOCIAL STUDIES"

Recognize that today's "system" also rests on a secondary—and intentionally corrective—foundation which originated in the post-World War I era. The causes of change were multiple: a spirit of disgruntlement arising out of Woodrow Wilson's failed crusade to remake the world in America's image combined with a growing academic belief in the inviolability of science led to the promotion of a more utilitarian approach to teaching about the past. "Social studies" meant that history could be joined together with civics, geography, sociology and the "problems of democracy" to speak to the "organization and development of human society" with a new "social efficiency."

The concept of social studies has been further enlarged to address the issue of inclusively. As an outgrowth of the social movements of the 1960s and 1970s, pressures have grown to acknowledge those who have traditionally been slighted in the telling of America's story. Given a society which has increasingly viewed itself as fragmented into divergent and competing interest groups, history has become a vehicle through which to follow the interplay between victims and victimizers back in time. Though disparate individuals and social groups occupy the same time and same general place, their stories are related only in that each vied for power with one another.

Over time, the phenomenon which the historian Hazel Hertzberg called "the balknization of the history curriculum"—a burgeoning fragmentation involving discrete topics—has joined with an intensifying demand for greater inclusion of other cultural perspective. Concomitantly, textbook companies have increasingly sought to develop texts which antagonize the fewest possible purchasers. What this means, as Francis Fitzgerald has wonderfully described in America Re*vised*, is that "even those advertised as 'thematic' histories do not make the obvious connections between events. As there is no link between the reconstruction of the South and the civil-rights movement, so there is none between Watergate and Vietnam. Because the texts cannot identify the actors in history, they cannot make these connections. Events—wars, political disputes, judicial decisions—simply appear, like Athena out of the head of Zeus. And history is just one damn thing after another. It is in fact not history at all."

SYSTEM #3: THE GROWING FRACTURE BETWEEN THOSE WHO DO AND THOSE WHO TEACH HISTORY

During the last twenty-five years, academic historians (resident in their proverbial ivory towers) have contributed to a burgeoning historical literature, a literature punctuated by myriad methods, materials, and, above all, an abundance of interpretations or explanations. Individual behaviors have been explained by everything from cultural prejudices to environmental circumstance, and events by an equally large array of economic, political, social and religious impulses. While impressive in its intellectual scope, the voluminous literature has reached such proportions that it is fully impossible for even the professional historian to stay abreast of it.

And so pre-college educators have, by necessity, traveled an independent route in developing their own teaching. History at the pre-college level embodies the worst of all worlds:

wherein commercial texts prey upon teachers' misgivings about their own knowledge to present "the facts" in a politically correct and innocuous way. The only bridge between past and present resides in the fractured manner in which interest groups seek self-enrichment. The meaning of history has been irrevocably altered in the aftermath of the multicultural explosions beginning in the 1960s and continuing into the present. History has been enlarged to incorporate new players—women, immigrants, and others generally ignored in the traditional telling of the "American story." Inclusion of these peoples and their disparate experiences, though, has fractured the singular line of progress which has always been woven through history. Now, we see interest groups playing throughout history. Small wonder, then, that the past merely serves as a backdrop for explaining the splintered and confused nature of our present. And equally logical, given the disengagement of history from the present controversies whose roots lie within the past, small wonder that students increasingly "turn off" from history altogether.

STEP TWO: FINDING SYSTEMS IN HISTORY—NEW APPROACHES TO TEACHING

It would naturally follow that our emphasis upon a particularized and fragmented past renders it extremely difficult to identify "systems" which operate both within the past and present. Rest assured, there are many. Very briefly, let me suggest some illustrative systems which better allow students to understand some important dynamics which shaped the past.

ILLUSTRATION #1: REVISITING THE ANCIENT PAST

For the first 990,000 years of human existence on this planet (beginning in one million b.c., when Homo erectus first appeared on this planet, and continuing until 10,000 b.c.), archaeologists tell us that the human population increased from 125,000 to 6 million. During the next 10,000 years, that 6 million rose to 133 million, more than one hundred times the earlier rate of growth.

Why? The answer rests with the "discovery" of agriculture. This "system" signaled a "revolution" in human history. At its simplest level, fewer people could produce more food. What did that mean? Recent excavations of ancient Jericho (circa 7000 b.c.) tell us that agriculture allowed people to congregate in significantly larger and more dense units, known as cities (Jericho had about 3500 residents). Because farmers could generate surplus food, they could feed non-farmers. And non-farmers, in turn, could generate non-food items for exchange. Within a relatively brief moment in history, we see planted (sorry, couldn't resist) the basic structures for trade and social improvement. Yet, we also see some "negative feedbacks": with Jericho residents acquiring more material comforts than their neighbors, we see the construction of thick stone walls around the city, the rise of political leadership, religious structures, and ultimately, the formation of armies, all serving to protect Jericho inhabitants.

In the millennia which follow, we see rapid population growth emanating from the spread of agriculture. We also see the rise of city-states competing for finite resources, which, in turn, give rise to empires, all rooted in the basic human desire to acquire, and all benefiting from increasingly large and more technologically fitted armies: Sumeria, Babylonia, Assyria, Egypt, Greece, Rome —all stand in historical testimonial to the human struggle to meet basic needs and, for some, to generate greater comforts. Empire wields a two-edged sword, as the struggle to acquire is bolstered by strength, invention, and ingenuity, while the struggle to maintain is predicated on compounding needs.

ILLUSTRATION #2: COLONIAL AMERICA

There are really several key systems here whose influence proves extremely important. One, of course, is the "system" of population growth. From the initial planting of a white European presence (which in turn, spreads disease throughout the native populations) on the coastal shores, the story of Colonial America is one of exponential population growth. Fueling this growth are a multiplicity of important factors, among them a relative abundance of resources, low population densities, an agrarian economy, and a magnetic attraction for Europe's overflow. And, in turn, population growth then serves as a vehicle for landed expansionism, occupational specialization, and commercial opportunity. Yet there were limits to the system: increasing demands upon finite land resources in New England towns reduce productivity and dictate changes in cultural norms (marriage age, size of families), while also triggering urban migration and the eventual planting of a permanent impoverished class within Boston and other cities.

Recent scholarship reveals that this latter situation formed one of the foundations for Revolutionary demands for change. What else was "wrong" with the British mercantilist "system?" Though "taxation without Representation" serves as a convenient rallying cry for explaining in simple, linear terms what happened (Why don't we revolt, then?), the realities were far more complex: exchange rates involving American raw materials and English finished goods increasingly bolstered American debt. Rural discontent arising from land scarcities and British restrictive frontier policies allowed "dispossessed" individuals there as in the cities to embrace radicalism. So, too, British heavy-handedness in taxation reflected an increasingly bureaucratic government unresponsive to the "common Englishman."

.

Perhaps most fascinating from an explicitly "systems" vantage point were the conscious efforts on the part of the Constitutional Framers to structure a government which addressed the immediate needs of nationhood while concomitantly anticipating the future. Small wonder—given that these men were so well versed in the workings of the ancient world—that their constructs would be first and foremost rooted in the lessons of the past. Fundamental concerns over the propensity of power to corrupt dictated the inclusion of multiple checks and balances between legislative, executive, and judicial branches. Equally interesting was Madison's insistence, in Federalist 10, that the unparalleled size of the American Republic would render it impossible for disparate factions to coalesce and impose tyranny. Finally, the key structure of a national bank paying interest would bolster faith in government and stabilize the value of the money supply.

ILLUSTRATION #3: NINETEENTH CENTURY AMERICA—INVENTION AND INDUSTRIAL REVOLUTION

The spirit of nationalism provided a favorable climate for expansionism: invention joined with a "transportation revolution" (beginning with toll roads, and gaining momentum with canals, steamboats, and railroads) to bolster regional economic production and interregional exchange. But progress had costs: Northerners and Midwesterners, fearful that the South's growing appetite for new western lands would jeopardize their own future needs, sought legislative recourse. Southerners, economically and, more importantly, culturally captive to the demands of "King Cotton," saw no recourse other than insurrection.

Integral to Northern victory in the Civil War was the industrial leviathan. The invention of the Bessemer process for steel, the construction of an intercontinental railroad and the harnessing of electrical power, gave rise to unparalleled productivity. The alteration of agricultural technologies permitted unprecedented levels of urbanization, which used corporate structures and assembly lines to produce economies of scale.

Yet again, the "system" often overshot its mark, as trusts sought to overcome competitive realities, and great Depressions (such as that in 1893) revealed that Americans could now produce in excess of their domestic demands. As the great Admiral Alfred Thayer Mahan advised Teddy Roosevelt, security dictated that America construct a great navy with which to protect foreign markets for its exports and ready supplies of cheap imports. Thus, began "America's rise to globalism."

Summary: These are but a few of the "systematic" elements which abound within American history, elements involving population growth, technological change, and vital resources, to name just a few. These are the bases upon which so much of the economic, social, and political systems are formed. And, in turn, these are the building blocks upon which individual events and behaviors can then be understood.

STEP #3: MODELING IN HISTORY

Recognizing recurring patterns within the past provides a valuable lesson for bridging past and present. Yet, having said that, I believe in the verity of Jay Forrester's observation, which deserves quoting in its entirety:

"Systems thinking appears to be thinking about systems, talking about the characteristics of systems, acknowledging that systems are important, discussing some of the insights from system archetypes, and relating the experiences people have with systems. Systems thinking can be a door opener and a source of incentive to go deeper into the study of systems. But I believe that systems thinking has almost no chance [of changing] the mental models that students will use in their future decision making. . . On the other hand, system dynamics modeling is learning by doing. It is learning by being surprised by the mistakes one makes. System dynamics modeling is a participative activity in which one learns by trial and error and practice. I believe that immersion in such active learning can change mental models."

"History is an exceptional place for changing how students think."

My experiences in teaching students how to model convince me that history is an exceptional place for changing how students think. My first endeavor, during the spring of 1991, to assist a small group of students in developing a model to study subsistence agriculture in Vermont during the late 18th and early 19th century, illuminated two critical strengths which model building has over traditional learning. I'll not dwell on the details, as these have been published in Historical Methods magazine. I would point out that in building the model, students were obliged to develop a common language and logic and to think long and hard about the critical "systems" which govern agricultural production and consumption. Equally exciting for me as an historian was their ability to understand and work with multiple factors of causality. Food production, for instance, was influenced by the amount of land in production, the quality, the size of one's labor force, the demands for consumption, and the uncertainty of nature. Recognizing how some farmers succeeded while others failed was for all the students a new awakening into the multidimensionality of the past. Discovering

the "leverage points" within the system—those elements which the farmer could hope to change in order to improve his situation—allowed us to "reshape" history. And, most impressively, students were able to extrapolate from Vermont's experience to understand other aspects of agricultural history and of the agricultural present and future.

While this experience was gratifying, I have benefited tremendously over the last two years through my collaboration with a colleague, John Heinbokel, a biologist. Our first effort, entitled *Plagues and People*, commenced with a relatively simple model of disease dissemination that drew upon historical epidemics to develop the historical contexts within which these operated, and to better understand the current AIDS epidemic in terms of cultural as well as biological factors.

Our current project, entitled *Population Dynamics and the Human Experience*, is doubtless the most exciting and ambitious project of all. We are identifying myriad structures which influence how, where, and why human populations have grown over the course of history; and then look at the role of human population growth as it has effected economic, political, and social systems, past and present.

At the risk of invalidating my assertions about easy accessibility, let me present a few "generic" mapped models which might serve as starting points for getting social studies teachers "hooked" on modeling. (See figures 1-3, next three pages)

As has been already illustrated in my previous remarks, the most critical system shaping human history has to be population. What factors generate growth? Historically, we can address high birth rates, lower marriage age and immigration, to name just a few. And what of the outflow of populations? Factors influencing death are critical (medical care, disease, wars, to name a few), as is out-migration. This limited number of causal factors (see Figure 1, next page) permits analysis of patterns of everything from Colonial New England town growth to the impact of a cataclysmic event on some population (the Civil War, for instance, on the South) to changing global demographics emanating from improvements in medical care over the last century.

Systems thinking and modeling will accord the study of history its rightful place as a critical component for inculcating critical thinking skills.

Yet another valuable model involves food production. Again, as Figure 2 suggests, students can better understand the historical impact of food production in shaping the size and character of human populations, in understanding how and when technologies have changed, and in understanding what distinguishes long from short-term food crises.

Systems of production and exchange of goods are admittedly more complex but not impossible to follow in a model (see Figure 3). Principles of supply and demand, at the heart of this system, connect with a multiplicity of historical issues, among them fluctuating demands for varying types of labor, circumstances surrounding technological change and the degree of profitability attached to various economic pursuits at varying points in time.

To date, my own exploration of possibilities has only scratched the surface. Still, I have every reason to believe, to paraphrase a remark proffered at last year's Concord conference by Ron Zaraza from Portland's impressive CC-STADUS project, while math and science people "think" more easily about systems, the systems worth studying ultimately are social, cultural, and historically rooted.

Conclusion

My hope for the future is that academic "doers" can join with teachers in changing the face of historical education. As a "pinheaded" academic, I know that I can help teachers by sharing my knowledge of the abundant materials which will allow us to build accurate historical models. There is an incredible amount of literature out there, which deals with everything from historical population growth to food production, labor forces to technological innovation. In effect, we have more than enough raw material with which to keep modelers busy for a very, very, long time.

In turn,, we need those teachers to join us in experimentation. I have every confidence that the use of systems thinking and modeling will accord the study of history its rightful place as a critical component for inculcating critical thinking skills within our students. More than that, understanding how and why history has unfolded in the manner in which it has, replete with recurring patterns, will better enable students to learn from the past when thinking about the present and future.

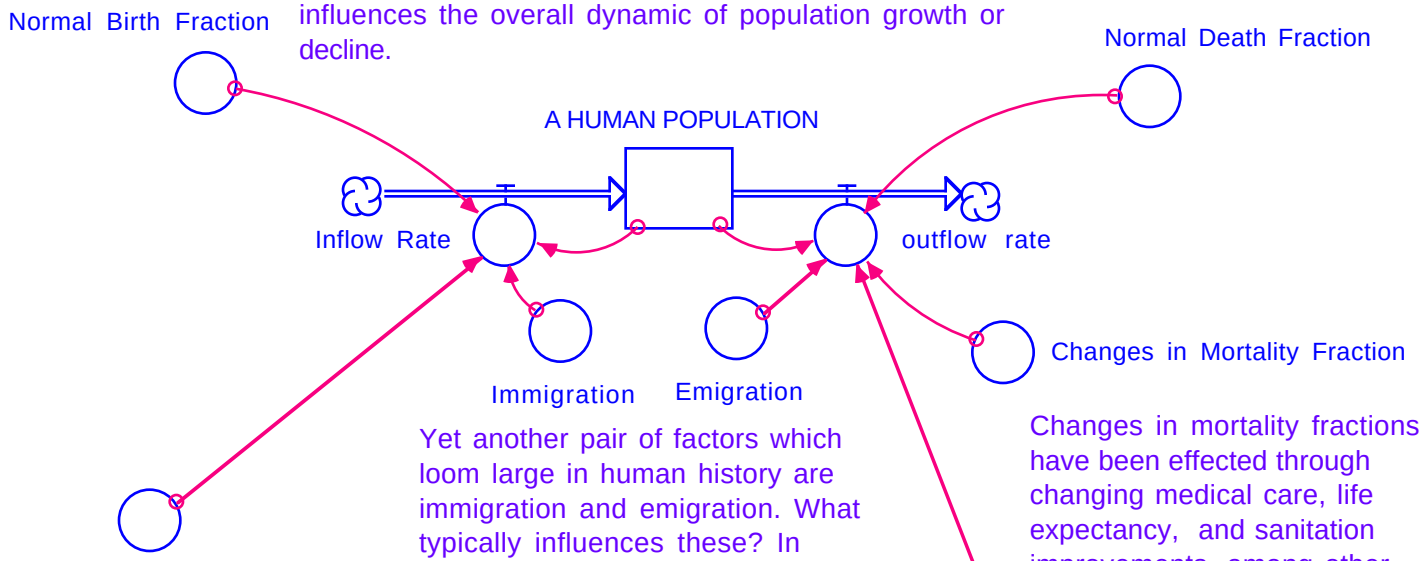
Recognize that our society's present historical complacency draws upon the misnomer, best articulated in Aldous Huxley's *Brave New World* and George Orwell's *1984*, that only totalitarian regimes wage "campaigns against the Past," to ban the teaching of history or to cavalierly rewrite the past to conform to political exigencies. Let us collectively join forces to see that historical literacy is revived and reinvigorated with a new spirit of purpose.

[1] *Jeff Potash is an Associate Professor of History at Trinity College of Vermont. He may be reached at 208 Colchester Ave., Burlington, VT 05401, by e-mail at potash@moose.uvm.edu, or by phone at 802-658-0337.*

Figure 1. Modeling Population Dynamics and the Human Experience

For those unfamiliar with a STELLA model, the center box is a "stock" of people; the arrow to the left of the box indicates a "flow" of "new" people into the population, with the surrounding circles (converters) and arrows (connectors) providing information which collectively defines the "rate" of the flow. Likewise, to the right of the stock, one has an "outflow" of people from the population, again, with various factors identified as influencing the rate of the flow.

The two most basic defining elements for a human population are the "birth fraction" and "death fractions." During some time unit (typically a year), a percentage of the population dies, while another percentage gives birth. The size of the difference between these two significantly influences the overall dynamic of population growth or decline.



Both in terms of the past and present, significant changes in births have been rendered through changing ages of marriage, desired family sizes, birth control, among other factors.

Yet another pair of factors which loom large in human history are immigration and emigration. What typically influences these? In history, we think of overpopulation elsewhere stimulating immigration, or some magnetic factor of comparative advantage: frontier history, colonization, and urbanization are all influenced by rates of immigration. Alternately, emigration could be triggered by resource limitations or comparative advantages seen elsewhere.

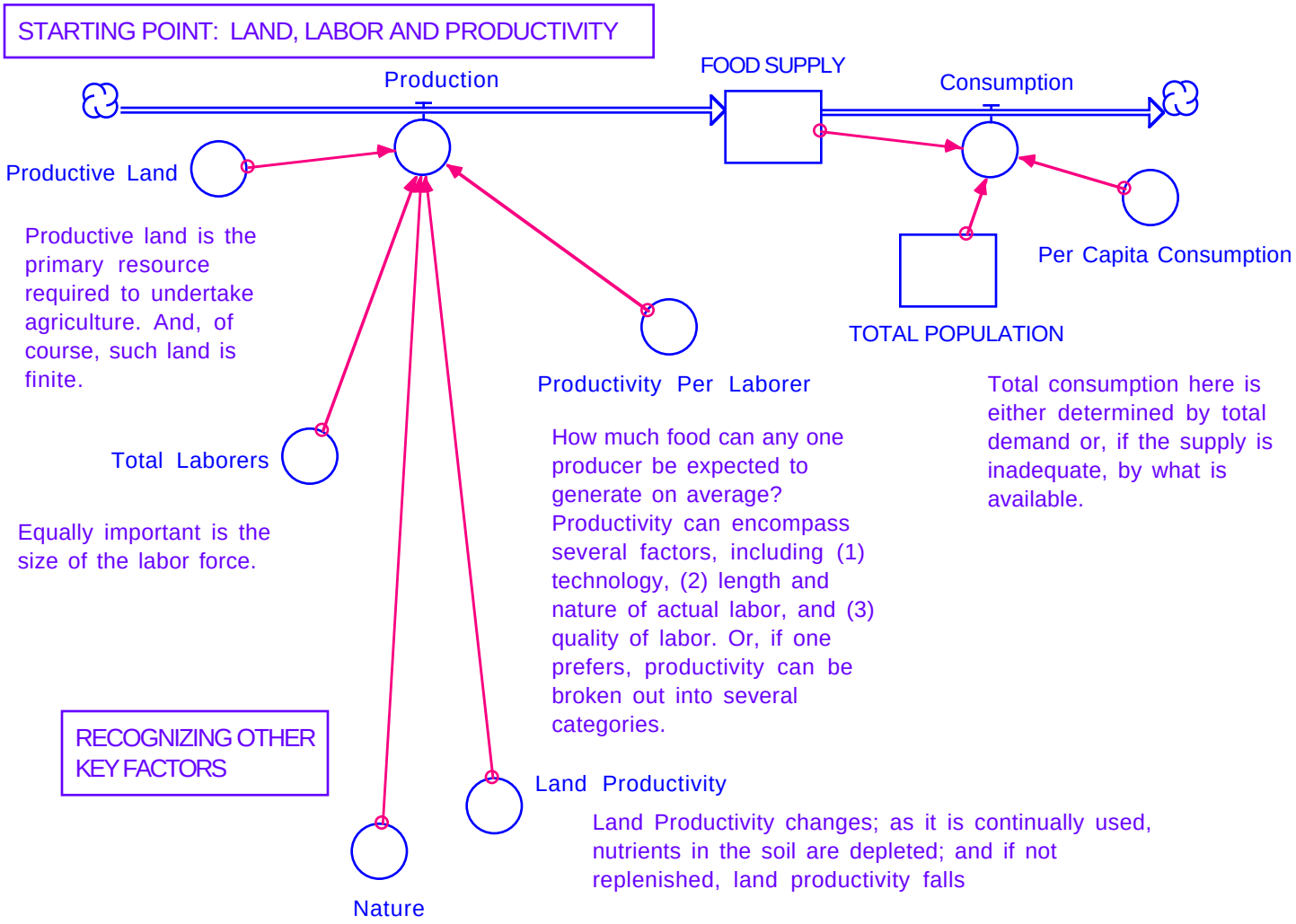
Changes in mortality fractions have been effected through changing medical care, life expectancy, and sanitation improvements, among other factors.

History emphasizes the importance of events such as disease epidemics, wars, and other cataclysms in which considerable numbers of lives are lost.

History is filled with tales of colonization, conquest, war, urbanization, and epidemics; one critical factor frequently overlooked when discussing these events is population and the dynamics of growth and decline. Building and defining a model such as is presented above will enable students to appreciate how population dynamics are both a driving force in causing or shaping local, regional, and global developments; and, equally important for understanding modernity, how population is effected by these other factors.

Figure 2. The Dynamics of a FOOD SUPPLY

Human survival dictates that people consume a certain quantity of food on a regular basis. What are the key factors which govern the system of food production? Consider the mapped model below, focusing upon critical convertors. How and where have such limiting factors influenced human existence?



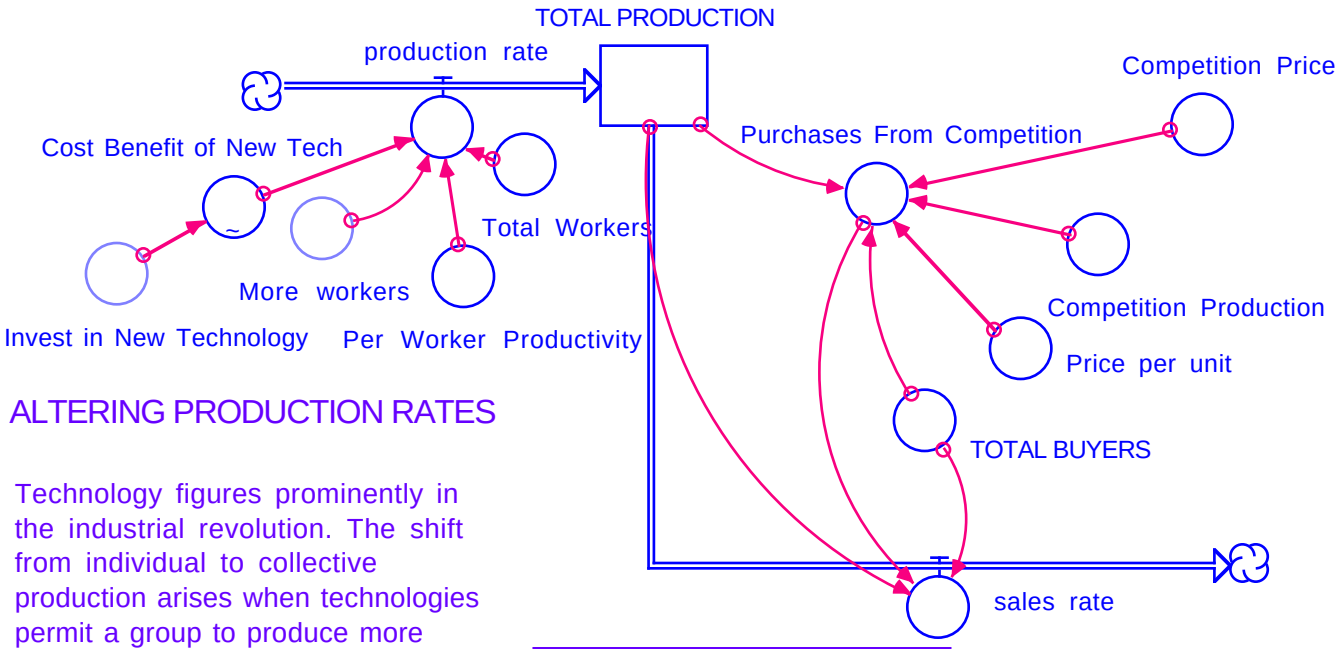
Nature is an ever present factor which effects production. Seasonal variations in climate produce normal variations in production, ranging from bumper crops to those which are significantly below average (such variations can readily be bult into STELLA models using the "RANDOM" feature). Nature can also wreak havoc with production through irregular and unpredictable disasters, ranging from drought to flood to desease.

How and where has food shaped human history? Consider just how and when technological breakthroughs in food production permitted massive increases in population growth. But also think about food production as a limiting or inhibiting factor: What about famines? What about conquest motivated by demands for greater production?

Models which address some or all of the factors cited above can be used to study such areas of history as the Irish Potato famine, the Industrial Revolution and its impact on agricultural production and population, economic structures in Colonial America (including tobacco and other non-food agricultural produce); in terms of modernity, this model can be used to illuminate significant differences between industrial countries and underdeveloped nations, as regards capabilities for feeding their respective populations.

Figure 3. Industrialization

One of the most significant developments in recent history involves industrialization. Regrettably, traditional histories tend to isolate one of the pieces (i.e, invention, increased production) without fully identifying the interconnected components. An overview of the "system" provides a better appreciation for the multiplicity of developments which accompany one or more changes.



ALTERING PRODUCTION RATES

Technology figures prominently in the industrial revolution. The shift from individual to collective production arises when technologies permit a group to produce more efficiently than if they labored independently. Recognition of this factor, in term, spurs the quest for technological innovations, with invention intensifying as a result.

Yet, efforts to increase production and productivity do not function in a vacuum. The impulse to increase production reflects a perceived discrepancy between supply and demand; efforts to change productivity frequently reflect efforts to reduce costs, either increasing demand or bolstering the margin of profit.

As such, decisions around how many people one hires, how much emphasis one places upon seeking technological innovation -- are governed by other elements of the system.

SALES AND MARKETS

Industrialization arises at a point when external markets are likely to have grown far more important than the immediate locale. Likewise, industrialization presumes that there are others who already do produce like goods or will, in the case that a market for the goods develops, will enter at some later point.

Thus, industrialization recognizes that sales will be governed by consumers electing to purchase one product over another. Factors which influence this decision include (1) the number of people who can and would purchase the good at a particular cost; (2) the comparative price of one's good relative to others like it or substitute items.

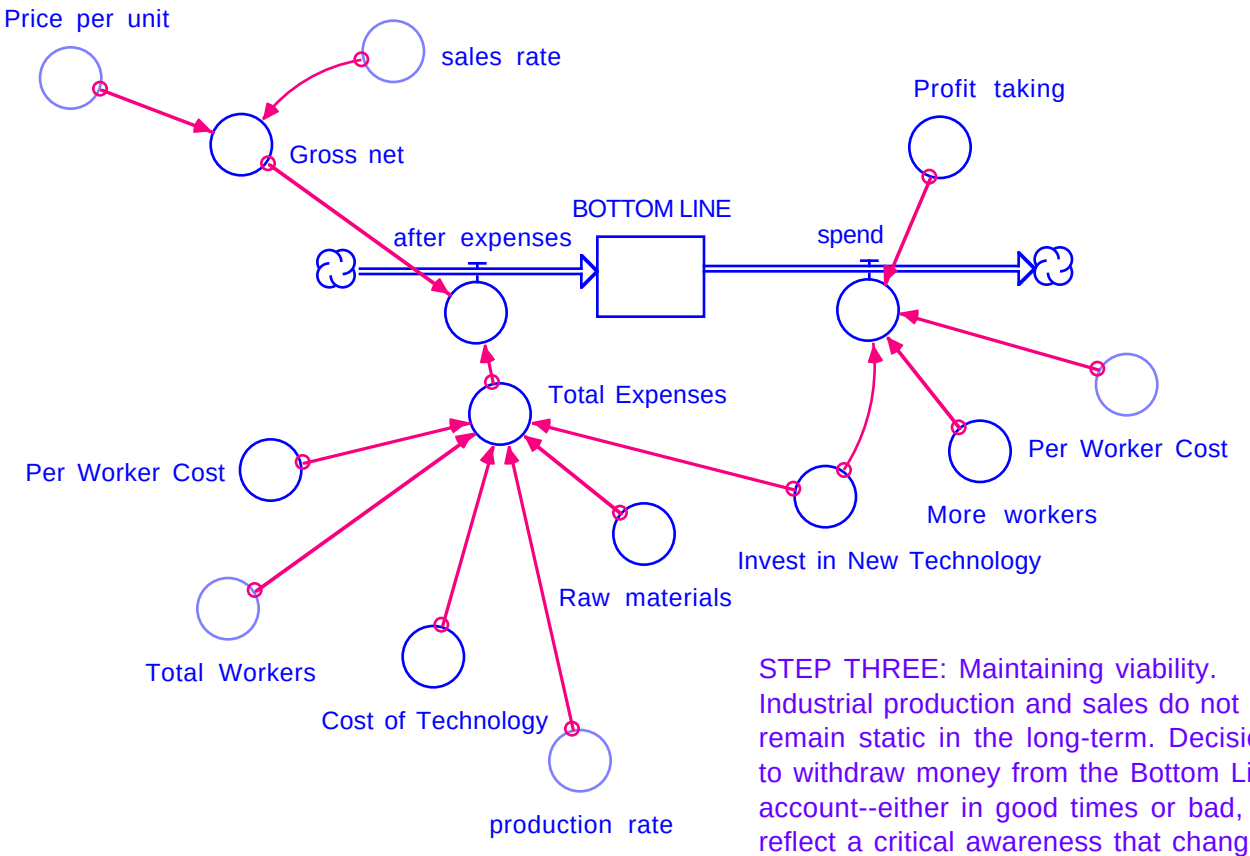
In turn, these two issues are influenced significantly by a number of factors, including (a) spending power of consumers (which, itself, embraces the health of the economy, purchasing power of differing social groups); (b) factors effecting price (ie, variable costs of transportation, duties, marketing, etc.).

Once again, sales of goods in a complex marketplace can vary significantly depending upon circumstance

THE "BOTTOM LINE": ASSESSING VIABILITY

The capacity to make and sell goods is ultimately linked to a third system, which is profitability. Viability dictates that, at the very least, money which comes in must (in the long term) match that which is spent to pay workers, and to build and maintain machinery, buildings and the like. A preferable scenario--for t he industrial manufacturer--is one in which profits flow to those who ventured the initial capital to pay expenses and, who, presumably, seeks benefits from making decisions linked to production and sales.

STEP ONE: Viability begins by calculating "gross net," which is the total amount of money which comes into the company as a result of sales.



Graph 1

STEP TWO: The next step involves paying bills. All the expenses associated with the production process -- cost of labor, raw materials, technology, etc -- all need to be paid. Failure to do so (over the long term) will result in one or more of these critical elements of production being withdrawn which, in turn, could hinder or halt production.

STEP THREE: Maintaining viability. Industrial production and sales do not remain static in the long-term. Decisions to withdraw money from the Bottom Line account--either in good times or bad, reflect a critical awareness that changes must be anticipated and preparations must be made. Options include drawing money out to increase production, either through investment in new technologies (designed either to boost production and/or reduce production costs), more workers, or to withdraw profits as a reward for effective sales.

UPDATES . . . *continued from page 2*

Because some subject areas did not lend themselves naturally to certain themes or topics, the curriculum in those areas became contrived and did not fit into the flow of the unit. As a result, the Core Team has concentrated on creating smaller Learning Environments to insure that there is a natural connection in the subject areas involved.

Additionally, teacher training has become a major thrust of GIST project. Our emphasis is taking two directions. First, we are teaching teachers how to use the Learning Environments that are ready for classroom use. Core Team members want these teachers to know that they are not on their own and that they will be supported as they use the Learning Environments in their classrooms. Second, Core Team members have, over the year, conducted Staff Development courses to teach teachers from all grade levels systems thinking skills and theories and the processes involved in developing systems thinking units. The hope is that these newly trained teachers will become involved in using existing Learning Environments as well as working with Core Team members in creating new Learning Environments. Our primary aim is to get teachers from elementary and high schools involved in the GIST project and begin to use these skills and theories to augment their curricula.

Throughout all of our changes and new directions, we still firmly believe that the success of our project depends upon classroom teachers. The classroom teacher must recognize that the LE's and systems thinking skills can facilitate the teaching of state-mandated objectives, offer students realistic applications and practice, and provide students with a concrete reason to learn. The more students practice applying systems thinking to situations in the classroom, the more likely they are to apply these skills to situations and problems that they will face outside of the classroom and in the future.

CC-STADUS

Diana Fisher and Ron Zaraza, co-principal investigators for the CC-STADUS NSF grant project, were invited to Washington to present a poster of their project as an exemplary project. They were surprised and delighted to find that the interest in their project was high. Many people stopped and talked with them, often staying long periods of time. They found it to be a gratifying and exhilarating experience!

The success of the project over the last two years has encouraged them to contemplate extending it beyond the confines of the Northwest, if funding is available. The training that they have done for teachers has proved very effective. The Creative Learning Exchange's List of Materials bears witness to their productivity. Many of the new items have come from the CC-STADUS project.

Any questions or conversations should be directed to: Diana Fisher at Franklin High School, 5405 SE Woodward St., Portland, OR 97206 or Ron Zaraza, Wilson High School, 2544 SE 16th Ave, Portland, OR 97202.

Systems Education Consortium

The school systems of Concord, Carlisle, Acton, and Harvard, Massachusetts formed a consortium at the Systems Thinking and Dynamic Modeling Conference last June. They have had a number of meetings of the consortium. Presently, with the facilitation of Gould Kreutzer, Associates, the consortium is exploring a systems approach to a problem currently at the forefront in education. They are using scheduling as a subject around which to brainstorm. The consortium members look forward to pursing the connection with Gould-Kreutzer in a discussion about the sequence of concepts in a K-12 systems education. Many school systems across the country are wrestling with this issue. Any input from those of you who are in the CLE list would greatly enhance this endeavor.

Please write, phone, or e-mail your editor if you would like to participate. E-mail—stuntzln@tiac.net.

Catalina Foothills

The Catalina Foothills district is a good example of the effectiveness of the mentoring system. They have one mentor at the high school, and three in the middle and elementary schools. Will Glass-Husain, the mentor at the high school, is also functioning as a system dynamics expert, utilizing his knowledge to help the other mentors help the teachers. Sam DeVore is also adding his two years of experience with system dynamics to assist the teachers and other mentors.

The big push this year in the Foothills district is in the elementary schools. There is a concentrated effort to help all of the elementary teachers explore system dynamics through release time during this school year.

Simulations that have been used in previous years in the District are being used with perhaps even greater frequency. One middle school class, instead of studying *Animal Farm* using the simulation which had been created several years ago, used a simulation of the original experiment which generated the idea of Animal Farm—the Zimbardo prison experiment. Modification such as this shows the power of creating pieces of curriculum which fit in with what is taught in a school system. Teachers can then modify and improve on the various peices to best serve the needs of students.

INTERNET CONNECTIONS

The Creative Learning Exchange is connected to three different sites on the World Wide Web. One is at MIT and is being run by the System Dynamics in Education Project under the direction of Jay Forrester. The undergraduate students are busy establishing the page and making materials accessible through it. The address is:

http://sysdyn.mit.edu

The second site which has offered the Creative Learning Exchange a home to put our material is the Serendip site at Bryn Mawr. We are connected with them through Trust in Diversity and Exchange, the original source of our funding.

Serendip is a "place" on the Internet where you can explore many of the concepts and documents underlying Trust in Diversity and Exchange. It is embodied in a computer at Bryn Mawr but you can reach it from any Internet connection that supports the "world wide web."

How to connect to Serendip on the Internet:

If you have a text-only connection to the Internet (that is, if your session is seen by your Internet host as a VT-100 terminal), and if your Internet host has the "lynx" program, you can visit Serendip by typing:

lynx http://serendip.brynmawr.edu

If you have a full Internet connection, then use Mosaic or any other graphical browser for the world wide web, with the address:

http://serendip.brynmawr.edu

Once you are connected with Serendip, it is self-explanatory . Enjoy!

The third site is one we referenced last newsletter—a page set up by Robert Gotwals (Gotwals@mcnc.org) in North Carolina. The address is:

http://tfnet.ils.unc.edu/~gotwals/stella/stella.html

Your editor's e-mail address has been changed in order for her to have graphical access to the Internet. Her new address is: **stuntzln@tiac.net.** She welcomes mail!

INTERESTED IN INVESTING?

All of us are interested in promoting the use of systems education in our schools. A number of you have asked if there is a charge for the services of the Creative Learning Exchange, or what you can send to help defray the costs of printing and mailing to you.

The Creative Learning Exchange will continue to send out materials free of charge to all those on the mailing list, regardless of their desire to invest at this time. However, if you would like to invest in our effort here at the Creative Learning Exchange, your contribution would be appreciated. You may donate any amount you wish; perhaps $25 is a reasonable amount for a year. All contributions are tax-deductible.

I am sending _____ to *The Creative Learning Exchange* to help invest in the future of systems education .

Name_____

Address_____

Thank you!!

***The Creative Learning Exchange*, 1 Keefe Road, Acton, MA 01720**

The Creative Learning Exchange
1 Keefe Road
Acton, MA 01720
Phone (508) 287-0070 Fax (508) 287-0080

The Creative Learning Exchange is a trust devoted to encouraging exchanges to help people to learn through discovery. It is a non-profit educational institution and all contributions to it are tax-deductible.