

ENVST 225b/ANTHR 281b Human Creation and Destruction of Environments
Spring 2002 Prof. H. Weiss
The Experiment: Models and Simulations

What are models? Models are simplified constructions of more complex phenomena. *Leggo* models of vehicles or buildings are examples. Motorized vehicles are complicated assemblages of mechanical and chemical systems creating and transferring energy. A model allows us to build one, simply, and see if works. If it doesn't, the model allows us to alter some properties, add some parts, replace others, and see if it works.

Applied to the social and historical world, models allow us to construct "on paper" an historical situation or a social process or an historical-social process, and then see if it "works." Examples abound. In fact, they are everyday occurrences in the academic world. In the field of history, for instance, historians write books about different periods of time in different places of space, and frequently describe a series of events, and then try to explain them. Their reconstructions and explanations are informal models, although their authors might only rarely understand that. They are not said to be "models," but the historian has, effectively, built a complex assemblage (a society), and subjected it to certain pressures (added on parts), and then suggested that it works, or worked, that way, i.e the way s/he said it worked.

"A model is a work of fiction. Some properties ascribed to objects in the model will be genuine properties of the objects modeled, but others will be merely properties of convenience." Nancy Cartwright, *How the Laws of Physics Lie* (1983). P. 151.

What about formal models? Formal models are models said from the outset to be such, and built as such. That is they are built knowing that each component is labeled a component, or a process, or a phenomenon or a part, and that the model, when "finished", will perform in a certain way, that is, (a) specific outcome/s is/are anticipated. Such models can be loosely arranged packages of variables (forces, vectors, such as "population," or "agriculture" or "population growth" or "taxes"), with or without quantification. That is, the variable might have a numerical value--or it might not.

The easiest to imagine models are those with variables that are both linked and quantified. Such as the following, where population and land each have values and so much labor can be applied to so much land, producing so much yield (food). Add space (more land), time (days, years, centuries), and population growth (as a rate), and you have a very dynamic situation---i.e., lots of different outcomes are possible. Why possible? Because they are dependent, dependent upon which values of which variables are set into the model. The society might grow, might expand beyond its "means" of subsistence, might adopt a new technology, might experience drought, or abundant agro-conditions. Who knows?

We are archaeologists. We know precisely what happened. The society became a "great" civilization, the society was reduced to poverty, and then migrated elsewhere, or was absorbed by some neighbor; the society had great agricultural wealth, but it was

unevenly distributed, the rich segment was very rich, the poor, very poor, and eventually a revolution ensued, Paris 1789, and a new society developed. Wait!!!

We have stated the outcome---because we know it. But is that all want to know? Of course not. We don't simply want to know "what happened in history" (as one archaeologist entitled a famous work). If that was all we wanted to know, then all we would have to do is read books. Right? Probably but one book, that is, if you want to know the "truth." But, we want to know how and why certain events, processes, societies, occurred, changed, interacted, arose, fell. In other words we want to explain history---and to do that we can either

- a. generate/create a narrative (an informal model), state what happened and the context within which it happened, speculate as to (or "prove") why it happened, publish it as a book, generate great sales, and become wealthy and famous ----, or
- b. create an informal model,
- c. a formal and quantified model,
- d. or even run a simulation!

What is a simulation?

"A simulation is the execution of a model, represented by a computer program that gives information about the system being investigated. The simulation approach of analyzing a model is opposed to the analytical approach, where the method of analyzing the system is purely theoretical. As this approach is more reliable, the simulation approach gives more flexibility and convenience. The activities of the model consist of events, which are activated at certain points in time and in this way affect the overall state of the system. The points in time that an event is activated are randomized, so no input from outside the system is required. Events exist autonomously and they are discrete so between the execution of two events nothing happens."

<http://ubmail.ubalt.edu/~harsham/simulation/sim.htm#rintroduction>

Why are we running these simulations?

"...simulation is an appropriate methodology whenever a social phenomenon is not directly accessible, either because it no longer exists (as in archaeological studies) or because its structure or the effects of its structure, i.e., its behavior, are so complex that the observer cannot directly attain a clear picture of what is going on (as in some studies of world politics). The simulation is based upon a model constructed by the researcher that is more observable than the target phenomenon itself." Rosaria Conte and Nigel Gilbert, *Artificial Societies; the computer simulation of social life*. (1995). p. 2.

Causality: what is the relationship between variables?

"Causes makes their effects happen. That is more than, and different from, mere association. But it need not be one single different thing. One factor can contribute to the production or prevention if another in a great variety of ways. There are standing conditions, auxiliary conditions, precipitating conditions, agents, interventions, contraventions, modifications, contributory factors, enhancements, inhibitions, factors that raise the number of effects and factors that only raise the

level, etc." Nancy Cartwright, *The Dappled World: a study of the boundaries of science*. (1999). p. 119

Akkad, the first empire, and the conquest of Subir (which engendered both the creation and the destruction of that empire!).

Akkade was the capital city of "*The Land of Akkad*," otherwise the Akkadian empire (ca. 2290-2200 BC) created and maintained by king Sargon ("True King") and his dynastic successors. The city and the empire are the nexus of several interrelated problems--- among which both natural and anthropogenic climate change are often invoked as *explanations*:

1. why and how did southern Mesopotamia undergo a centralization of regional power, passing from a loose urban confederation in the early third millennium to tight politico-economic imperialization under one city in the late third millennium?
2. were the third millennium cities of southern Mesopotamia self-sustaining, or were they dependent upon adjacent regions for essential resources?
3. what propelled the regional extensions of southern Mesopotamian political and economic power in the mid-third millennium?
4. how did the empire function?
5. why did it collapse?
6. where is Akkade?

These historical questions surrounding Akkade make the city the most important ancient West Asian site yet to be excavated and analyzed. **Its location is not known.**

History of the city and the empire

Knowledge of the city and the empire is mostly derived from settlements and material and epigraphic remains from regions imperialized by the Akkadians. Probably, Akkade was not founded by Sargon, although its origins are totally unknown.

Akkadian inscriptions describe Akkade as a bustling imperial capital with temples and palaces, a busy harbor, an imperial bureaucracy, merchants travelling to distant realms acquiring and dispatching exotic goods, and an army capable of marches to the Mediterranean, to the sources of the Tigris and the Euphrates, and the conquest of all urban centers in its path (**see map**).

The most famous of the Mesopotamian "city laments," the "Curse of Akkade," composed within a hundred years of the Akkadian imperial collapse, describes the collapse and abandonment of Akkade as symbolic of the collapse of the Akkadian empire. The collapse was one of the most significant events in Mesopotamian history---to judge from the dynasty's fame, and the copy-cat names of Mesopotamian kings up to fifteen hundred years later. Historical references indicate that the city Akkade was occupied for 1700 years following collapse of the empire. Typical of the reverence held for the city in later Mesopotamian reigns, archaeological expeditions were repeatedly undertaken in search of Akkadian treasure. The most famous of these excavations, a program that lasted three

years, was directed by a scribe of the king Nabonidus (7th century BC), who took a clay impression of an inscription excavated within a palace of Sargon's grandson Naram-Sin. The excavator labelled the impression with its provenience as well as his name. The city is last mentioned in a document dated to a Persian king of the 5th century BC.

Function of the empire.

The early characterization of the Akkadian empire stressed its campaigns of conquest for the acquisition of resources unavailable in southern Mesopotamia, such as metals and timber. The progression and the context of expansionary activities directed from Akkade are now documented in the archaeological and epigraphic records, as well as the still **earlier** sequence of repeated southern Mesopotamian expansions documented ca. 4000 BC, ca. 3200 BC, and ca. 2600 BC.

The detailed Akkadian data suggest that Sargon's long-distance military campaigns were only the first stage of the Akkadian expansion. These early military campaigns focused upon conquest of distant urban centers and the retrieval of plunder.

Subsequent military campaigns led by Sargon's successors, particularly Naram-Sin, conquered and then imperialized both *irrigation-agriculture southern Mesopotamia*



Euphrates River, cereal irrigation-agriculture at Dura, hand-harvesting, 15 kms north of Syro-Iraqi frontier, August 1984 (photo: H. Weiss).

and *dry-farming northern Mesopotamia* (below).

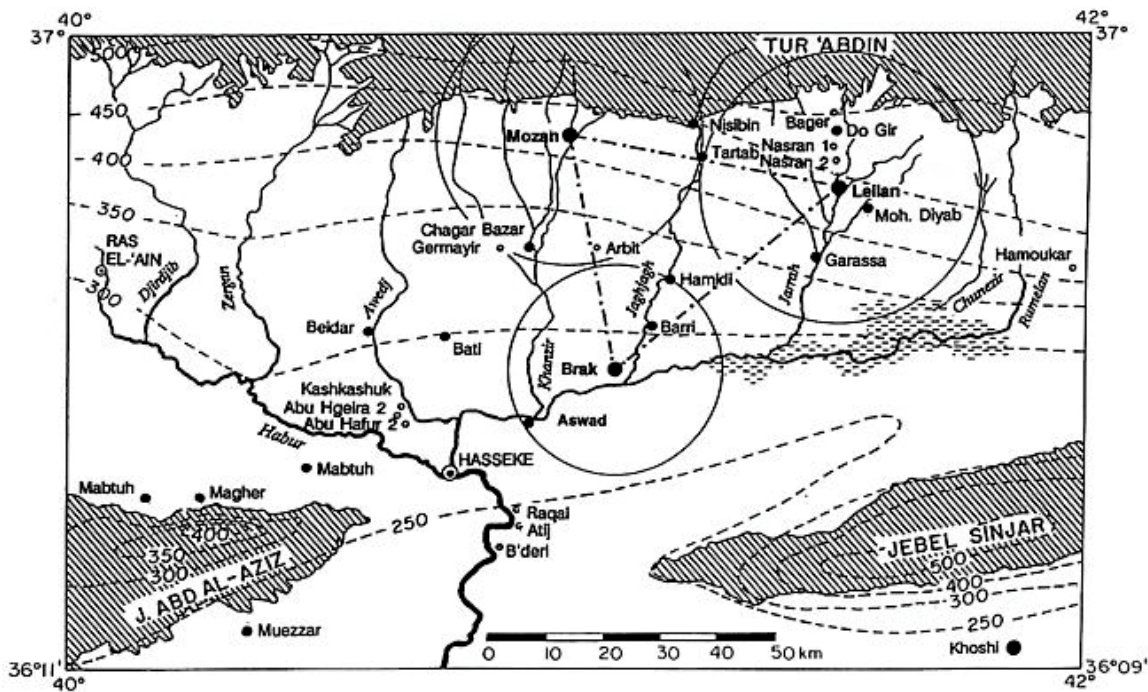


Northern Mesopotamia, looking east from Tell Aid, northeast Syria, 1984; note (a) fallow field in foreground under sunflower and lentil cultivation, (b) cereal-harvested field in back of mule-traction cart transporting straw, (c) flocks of sheep grazing on post-harvest stubble, and (d) archaeological site in background (photo: H. Weiss).

In this second stage of Akkadian expansion, the forces from Akkade first conquered local states and then constructed fortresses and temples for resident Akkadian administrators and functionaries.

Acting in each imperialized province, these Akkadian forces implemented five imperial strategies:

1. reorganized the administrative structure of agricultural production by establishing a streamlined administrative command responsible to authorities in Akkade,
2. reorganized the spatial structure of regional agricultural production by vacating second- and third-level population centers, concentrated labor forces in urban centers, and constructed city walls to enclose relocated populations,



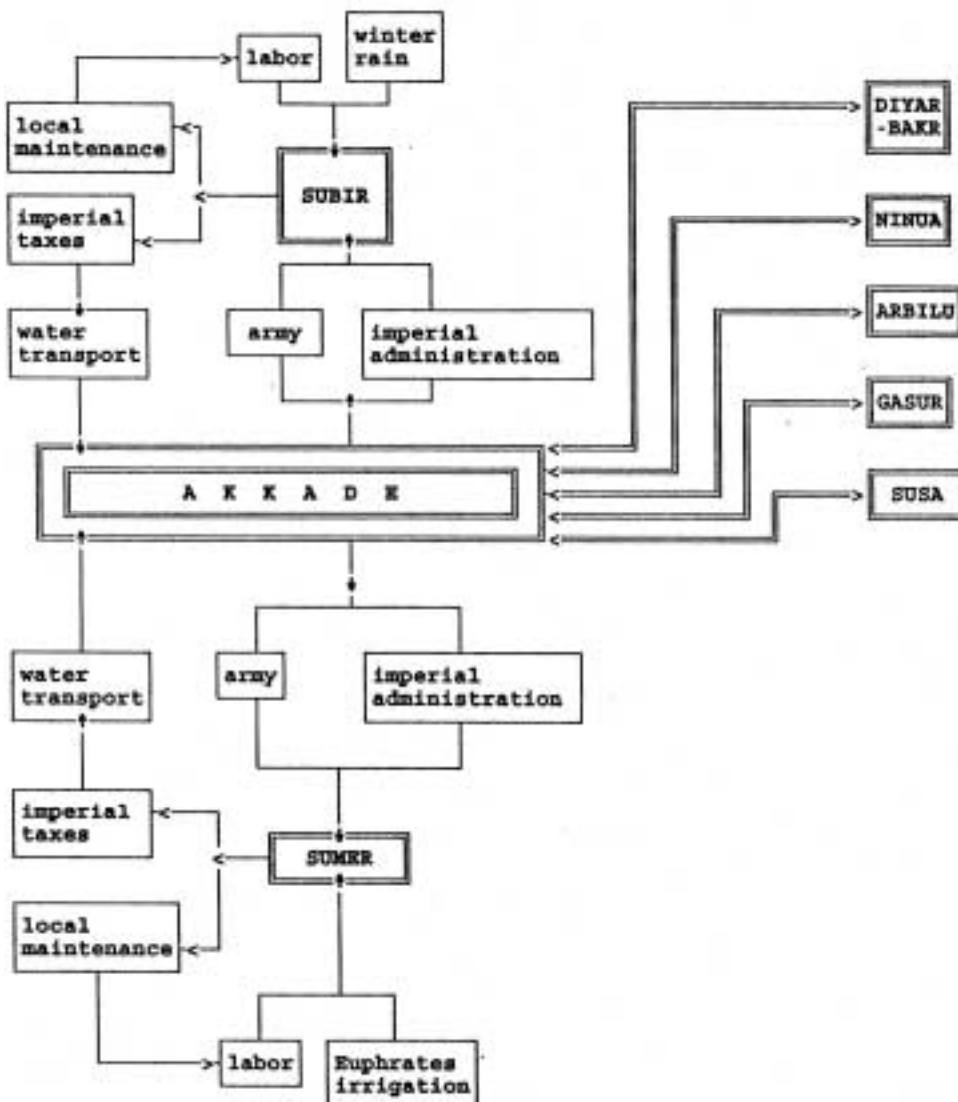
Reorganized spatial structure of regional agricultural production in Subir (H. Weiss).

3. intensified agro-production by creating imperial domains in Sumer and Akkad for the exclusive production of Akkade-directed taxes and by extended, and perhaps irrigated, cereal production in the imperialized dry-farming regions;
4. introduced and enforced imperial-standard units of measure for ration labor work gangs and for regional agricultural production;
5. extracted imperial taxes, as much as 70% of the intensified agro-production, from each reorganized administrative unit, and shipped these agricultural goods by water- or land-transport to Akkade.

*"Elam and Subir carried goods to her like packasses,
all the governors, temple administrators, and land registrars of the Frontier of the Plain
regularly supplied monthly and New Year offerings there.
Thus in Agade's city-gate...." Curse of Akkade ll. 50ff. (ca. 2100 BC).*

This flow of administrators, military forces, and imperialized agricultural produce into and out of Akkade can be *modeled* to illustrate the imperial accumulation of agricultural wealth (i.e., agro-imperialism) from both *Sumer* in southern Mesopotamia *and Subir, the dry-farming Habur Plains of northern Mesopotamia*.

THE AKKADIAN EMPIRE: AGRO-IMPERIALISM

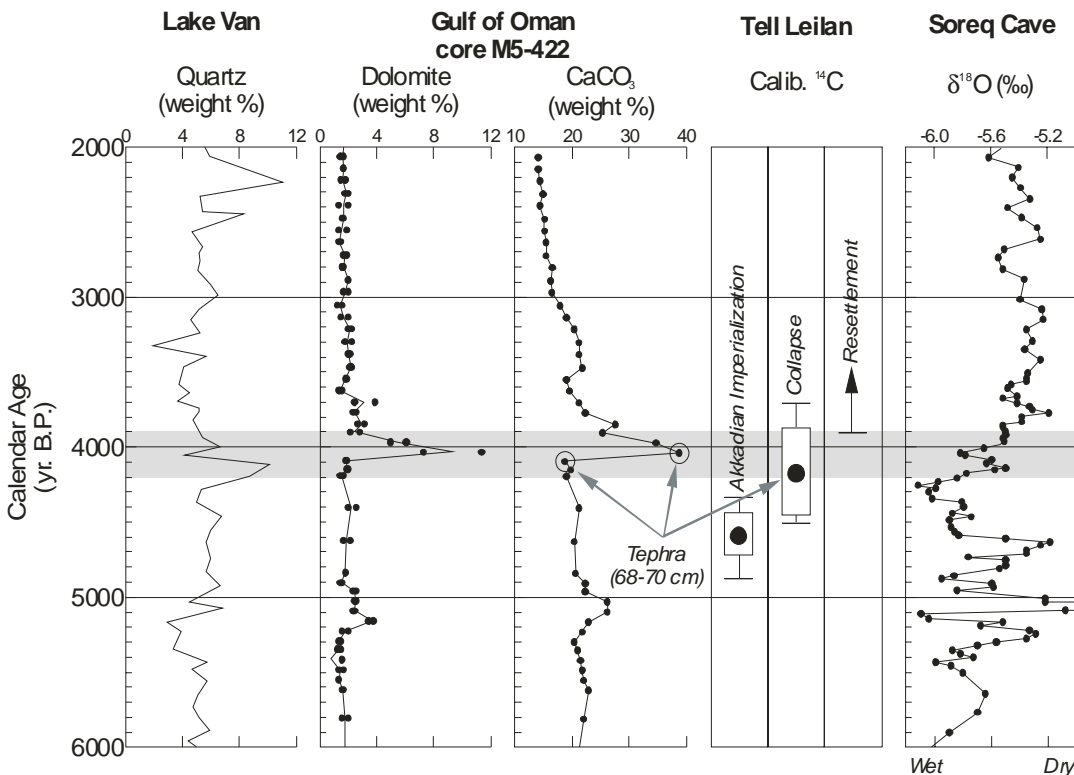


Simple flow-chart type model of Akkadian agro-imperialism of Sumer and Subir.
Note "steady-state," "functional," non-dynamic flow.

Similar relationships were structured at the other high productivity dry-farming regions (Susa, Gasur, Erbil, Nineveh, Diyarbakr) surrounding Akkade (see Map) where already urbanized polities with nucleated labor forces comprised a pre-adaptation for Akkadian agricultural imperialism.

The flow of imperialized and convertible agricultural wealth into Akkade from adjacent regions underlies the ideal of regional unification upheld by the Akkadians and successor Mesopotamian empires. **Collapse**

The description of the fall of Akkade in the poetic "Curse of Akkade" portrays a city suffering from reduced Euphrates flow, desiccated irrigation fields, famine, and the incursions of neighboring "barbarians" into the Akkadian heartland. These descriptions have been understood as poetic metaphors, but a few archaeologists consider the descriptions poetic but not metaphoric. **Why?** Southern Mesopotamian irrigation agriculture was dependent upon the frequently variable flow of the Euphrates. The documentary evidence for late Akkadian period agricultural failure in southern Mesopotamia, and for extended drought in northern Mesopotamia, conforms to the independent data for hemispheric aridification, an **abrupt climate change**, beginning at ca. 2200 BC and extending to ca. 1900 BC.



Collapse and **habitat-tracking** were the result.

