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Size and Duration of Empires: Systematics of Size

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Areas of the world's three largest empires or states at any given time are listed at 100- or 50-year intervals, from 3000 B.C. on. Area measurement definitions and techniques are described. Major empire size has tended to increase, approaching the world's dry earth area in an approximately logistic way. This pattern suggests that a world state is still many centuries away. Sudden increases in empire size have occurred around 2800 B.C. due to emergence of cities, around 600 B.C. due to a power delegation breakthrough, and around 1600 A.D. due to a communication speed revolution. A graph of the world's largest empire areas throughout times offers somewhat novel perspectives on world history, making one realize the Western bias of many "world history" texts. Areas of 20 largest states that ever existed are listed. Subsequent papers will deal with historical periods in more detail.

BASIC QUESTIONS

"Roman empire was the largest empire of its time." —"The United Nations is trying to become a world government." —"Hopefully we will soon have a single world state." —"Imagine Iran dreaming of becoming a superpower just because it has oil." —"Will the Soviet Union survive until 1984?" Such statements and questions are often heard. Our thinking about past, present, and future national and international affairs is full of considerations of size, growth trends, and duration of relatively sovereign political entities, be they called empires, states, or nations. Consciously and subconsciously such considerations affect popular opinion and government decision making.

Yet historical impressions of size are often wrong, and extrapolations of future trends are based on fuzzy visualizations. Rome was surpassed in

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area (and probably in population) by China during most of its duration. When looking back at the history of the last 25 centuries, it looks almost abnormal that Iran presently is *not* the center of a major world empire—since most of the time it has been the core of one of the world's three largest empires. If the Soviet Union disintegrated by 1984, that would make the growth-decline pattern of the Moscow-centered empire very different from the pattern followed by most of the preceding empires. And a world state in the close future would represent an unlikely quantum jump in the size of empires which up to now has edged upwards rather gradually over 5000 years. These are some suggestions arising from the systematic study of empire size and duration of which this paper is the first part.

Human history has seen a trend toward ever larger empires and other sovereign states. With an area of 0.1 million square miles, ancient Egypt was the major empire of the world 5000 years ago; nowadays most United Nations members have comparable or larger areas. About 2500 years ago, Persia was the first empire ever to control 2 million square miles—a size greatly surpassed by half a dozen contemporary states (USSR, Canada, China, USA, Brazil, Australia). During the last 800 years, three empires (Mongol, British, Russian) came to reach more than 8 million square miles. Hart (1931, 1945) was the first to suggest that the area of successive record-breaking landborne empires may increase in time in agreement with a logistic (drawn-out S-shaped) curve. If so, does the agglomeration trend make a world empire or confederation likely in centuries to come? While such extrapolations must be treated with caution, we cannot escape the question altogether. There are people who do speculate about the likelihood of the world state and who base their attitudes and actions regarding the United Nations and international co-operation on this likelihood. Irrespective of whether this perspective attracts or repulses them, their data base has been impressionistic because no studies have been carried out, except for Friedman's (1976) study of the economic determinants of the size of nations. A more precise knowledge of past world trends would improve the quality of the guesswork.

Hart's record-breaking empires (of which none exist presently) are bound to become ever larger, by the very definition of a "record." But what about the non-record-breaking empires which have dominated throughout most history? In retrospect, the Mongol and British empires occupied large areas but only brief time spans. Besides their peak area, we should also consider the stability of states.

Few empires or states in human history have lasted for a thousand years. Empires have tended to collapse or shrink after only a few centuries or even years at near-maximum size, to be replaced by new entities with a different name, ethno-cultural identity and geographical focus. Is there a trend toward longer or shorter durations? Are small states more or less durable than large empires? On statistical basis, how many of the

present states can be expected to be around 100 years from now? No systematic studies seem to have been carried out. Some empires grow to huge size during a single century or even a decade (Napoleon's, Hitler's), only to crumble as quickly. Some others have grown over several centuries, and have then lasted at a relatively stable size for many other centuries (Roman, Han Chinese). Is there some connection between the speed of growth and the speed of decay, as suggested by Olsons (1963) and Taagepera (1972)? If so, could the duration of the present states be roughly projected from their past growth data? Obviously, it would only be a questionable probabilistic answer. But since some people do ask questions such as "Will the Soviet Union survive until 1984?" (Amalrik, 1970) and many more have been willing to read such discourses, we could not do worse by using systematic background information based on duration of past empires and on the growth performance of the empire under consideration.

The growth of several relatively isolated empires (Roman, Ottoman, Russian, the U.S.) has followed the simple logistic pattern remarkably well (Taagepera, 1968). This pattern involves a slow start, a speed-up of expansion, and finally a slow approach to a stable maximum size. The same symmetrical pattern is followed by bacterial colonies grown under steady conditions, while growth of individual vertebrates already is more complex. To what extent can the observations be generalized to other empires, states, and federations? Could one, for instance, extrapolate the future expansion of the European Community on the basis of its previous growth and the logistic model?

OUTLINE OF THE PROJECT

The objective of this study project is to generate and analyze data that may help to answer questions such as have been presented. The primary task is to compile numerical information on the extent of empires and states at various times. In most cases this is done by measuring areas on historical maps. The numerical data are then plotted for each state separately, area versus time, to yield a visualization of the growth-decay patterns. In order to compare various empires, major characteristics of the growth-decay curves have to be defined and measured: the maximum stable size, duration of growth, duration at stable size, etc. These second level data can then be used for world-wide and history-deep comparisons between various empires and states.

A few words should be said about what this project is *not* concerned with, at least not directly. It does not consider the internal structure of empires. For this aspect the reader can consult, e.g., Eisenstadt's (1963) and Ruloff's (1976) studies of bureaucratic empires, Sorokin's (1937) study of social dynamics, and also the volumes on building states and nations edited by Eisenstadt and Rokkan (1973). My study does not even

deal with the growth and decline of an empire's power but merely of its geographical extension. Since power is a central concern of political science (in conjunction with ability to steer that power, as stressed by Deutsch, 1966), neglecting it may seem to make this project pointless. Real estate controlled by empires may be valuable or worthless. It may be densely populated by skilled people or practically uninhabited. Why not start by measuring population instead of area, assign some efficiency indicator values to people and to leaders, and thus compute power? The answer is that much better information is available on area than on population of empires, not to mention the impressionistic nature of assigning power ratings. The dilemma between conceptual importance and measurability is shown in Table 1. In face of this dilemma, I prefer to analyze genuine data related to a concept of limited importance (area) rather than use impressionistic pseudo-data related to a crucial concept (power). In general, though, area reflects the power of an empire to some extent: A large but powerless empire would soon cease to be large.

At this point the opposite objection may be presented, namely that even areas of historical empires cannot be determined exactly and unambiguously, since the degree of control over a given area may change gradually and intangibly. The answer is that no science based on measurement can be exact (cf. Taagepera, 1976a). Measurement always involves an error margin. Calling physics an "exact science" is a misnomer that has survived only because all physicists know what it stands for, namely, quantitative science striving for as precise measurements as the state of the art allows. In our study, a 10% error on all areas reported should be expected. In cases of wider disagreement between different sources or different ways of looking at the situation, the range will be expressly indicated. Such error does not invalidate the results obtained, provided that the range of its possible impact is kept in mind and reported.

We will encounter other difficulties in defining certain terms. To begin with: How do we recognize that one empire or state has terminated and another one begun, in the case of a continuing civilization such as China? Is the Soviet Union the same empire as tsarist Russia or a new one? How about Rome and Byzantium? Did Alexander create an empire or merely

TABLE 1
Why Study Empire Areas?

Characteristic	Political importance	Precision of definition	Feasible level of measurement
Area	Very indirect	Fair	Can measure
Population	Indirect	Fair	Largely guessing
Power	Direct	Poor	Pure guessing

seize control of the existing Persian one? If two states fuse, such as Lithuania and Poland around 1500, which one should we consider absorbed by the other? Even the apparently simple notion of maximum stable size is not easy to define operationally: When Romans occupied Westphalia for 40 years, should we count this area as part of the stable size of the empire or consider it as a temporary unstable occupation? I will offer my definitions. Often they are not self-evident. There will be arbitrary quantitative thresholds beyond which a phenomenon is considered to have entered a new qualitative phase. I will not argue about the philosophical "correctness" of these definitions, although, of course, they have been reworked until they expressed the features which are thought to be qualitatively important. Beyond that, the main demand is that the definitions be operational: self-consistent and such that results based on them can be reproduced by anybody.

This is a large project, and it will take several papers to make the processed data and results available to scholars and statesmen in a usable form. Rather than start with methodology—a very important but also the most boring aspect—the present first paper will present a broad overview of the largest empires existing at any time throughout human history. We will thus investigate only a small part of the basic questions asked in the introduction. We will have to define what we mean by an empire and its size. But we will avoid for the moment the thorny questions about how to define the duration, or stable size, or continuing identity of an empire. The methodology will later be presented gradually as the need rises.

The second paper in the series will deal with growth-decline curves of individual empires, from 3000 to 600 B.C., and will present detailed data tables and sources. A similar chronological sequence will be followed in several subsequent papers. The series is expected to conclude with further broadly analytic papers such as this first one. A geographical rather than chronological delineation would be preferable in order to trace continuity and change within the same geographical theater, such as the Middle East or Western Europe. Apart from pre-Columbian America, however, interactions between all world regions were found to be so extensive that no satisfactory separation line could be drawn between, say, the Middle East and the Far East or Europe or Africa.

DEFINING AND MEASURING EMPIRE SIZE

The specific objective of this paper is to determine how the size of major empires of the world has varied throughout history. Several terms in this statement need clarification.

By "empire" I mean any large sovereign political entity whose components are not sovereign, irrespective of this entity's internal structure or official designation. Since the emphasis is on the very largest of such entities, one does not have to worry about a size cut-off below which the term "empire" would seem to be misplaced.

By empire size I always mean the dry-land area controlled by the empire. This area is by no means clearly defined. Empires often take control of new territories through a gradual process leading from tributary status to province status. In such cases the earliest date of uninterrupted tributary status is taken as the date of conquest, although the assimilation process may be slow and never be completed. Empires often decay through gradual feudalization in the course of which provinces imperceptibly gain effective sovereignty while still paying homage to the now powerless emperor. In such case the date of territory loss is taken as the date at which reassertion of ever increasing autonomy first becomes noticeable. There are also vague spheres of influence outside the official borders; these are neglected in our study. Official borders may not even exist when an empire gradually fades into the nothingness of an uninhabited desert or forest. In these cases the average consensus of historical atlases is accepted. Indeed, such consensus is accepted in all doubtful cases. In case of wide disagreements, the average as well as the extreme estimates are reported.

There are times in history when the sovereign units are well-nigh impossible to delineate due to complex vassal-suzerain relations. Personal unions due to marriage of rulers or to inheritance further confuse the situation. Should France under the early Capetiens be considered a single state or a collection of separate counties and duchies? From the viewpoint of momentary power constellation the duchies were practically independent. Their rulers could undertake conquests of their own (e.g., Normans in England), and their new territories did not always fall under the formal suzerainity of the King of France. Yet such a power was brittle. A single military defeat or the extinction of the male line could abruptly end it. In the long run the tenuous suzerainty of the King often prevailed: The France as it consolidated itself by 1600 was largely the same territory that was assigned to the West Frankish kingdom in 843.

Our approach in such cases is to give the benefit of doubt to the larger or more durable entity. This means neglecting "times of trouble" between periods of consolidation within essentially the same borders.

Actual area measurement was usually carried out on maps in historical atlases. In most cases a planimeter was used—this is an engineering instrument which measures the area within an irregular contour while the tip of the planimeter arm follows this contour. In other cases a more primitive but equally effective "square-counting" technique was used

(see Taagepera, 1968 for details). In both cases proper conversions from map area to real area have to be carried out, using map scales. Historical maps sometimes neglect giving the map scale which then has to be reestablished by measuring distances between prominent geographical landmarks. Areas of modern empires often could be obtained directly from handbooks. On the other hand, for many an ancient empire the sequence of conquests and losses had to be laboriously established from encyclopedias and history texts before a historical map of area changes could be drawn.

Among the historical atlases used, it was found that the three-volume Grosser Historische Weltatlas edited by Engel (1953–1970) was the most versatile and inclusive. But a large number of others supplied invaluable data to complement and check on Engel: Shepherd (1956), Muir (1961, 1963), Hammond (1968), Vries (1965), Putzger (1961), Palmer (1957), Stier (1963), Leonhardt (1951), Kinder and Hilgemann (1964), and Gustafson (1974) on world-wide history, and Chew (1967), Herrmann (1966), Davies (1949), Sellman (1954), Fage (1958), and Roolrink (1957) on individual regions or countries.

More-or-less complete growth-decline curves were plotted in this way for more than 100 historical empires and states, not to mention the contemporary ones. Four examples of such area versus time curves (Rome, Ottoman Turkey, Muscovy-Soviet Union, and the United States) are shown by Taagepera (1968). Detailed data, sources, and analysis will be given in subsequent papers.

As an area unit of convenient size, megameters squared (Mm^2) were chosen. Since 1 Mm = 1000 km, we have 1 Mm^2 = 10^6 km^2 = 386,000 square miles.

For the present purpose curves for all empires were plotted superimposed, on the same area and time scales. By taking the highest of the curves at any time, we obtain the "world's largest empire curve" where the largest empire's identity changes frequently. This curve is shown in Fig. 1 where the area scale is logarithmic so that equal *percentage* growth corresponds to equal vertical distances. If a regular scale were used, all ancient empires would be dwarfed by the size of the modern ones, and no details could be seen. On our "semilogarithmic" plot exponential growth would appear as a straight line. Does the world's largest empire curve follow such a pattern? This is hard to tell because random fluctuations are wide.

In order to reduce these fluctuations the combined area of the three largest empires at any time is also plotted in Fig. 1. A major empire often grows at the expense of another so that the sum of areas does not vary. The three-empires curve in Fig. 1 is, indeed, smoother than the single largest empire curve. Numerical data corresponding to these curves are

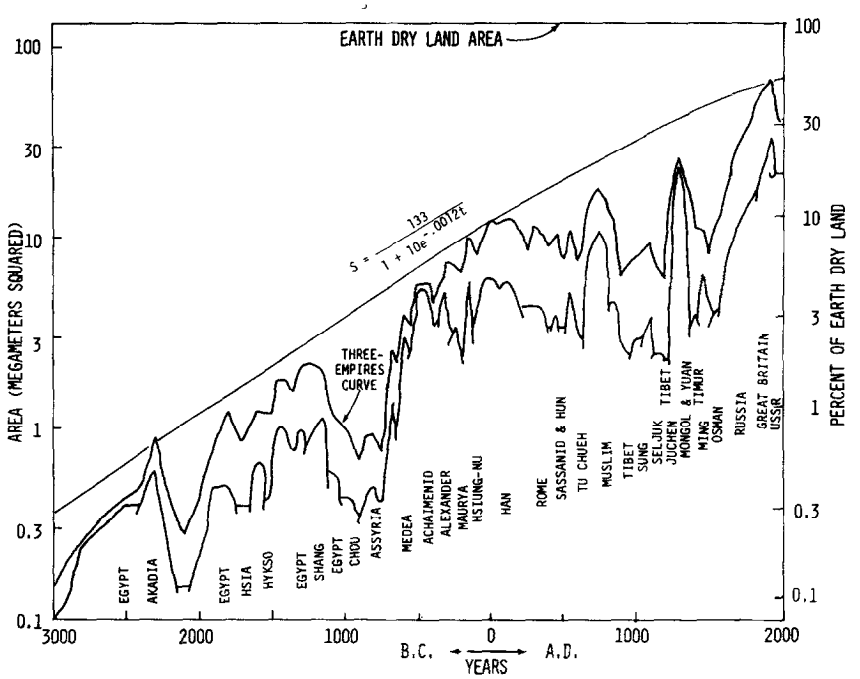

FIG. 1. Size of empires versus time: the continuum approach. Lower curve represents the area of the single largest empire. Middle curve is the sum of areas of three largest empires.

shown in Table 2 where the areas of the world's largest three empires are listed at 100-year intervals from 2500 to 1500 B.C., at 50-year intervals from 1500 B.C. to 1900 A.D., and at 25-year intervals thereafter.

There are at least three levels at which the data in Fig. 1 and Table 2 could be analyzed: persistent continuous trends prevailing throughout human history; historical phases; and observations on individual empires and regions. All these levels will be discussed next.

HOW LARGE EMPIRES HAVE BECOME LARGER: A CONTINUUM APPROACH

Is there any persistent trend to be seen in Fig. 1? One could assert that this is the case: Both the single largest empire and the three-empires curves tend to rise throughout history. For the last 1000 years, even during the periods of relative fragmentation (such as around 1100 or 1500 A.D.), the curves have been markedly higher than the peak values were prior to 1000 B.C. Could the growth be roughly exponential? This would correspond to a straight line in Fig. 1.

We should first ask which parts of the curves we should give most weight. The automatic reflex would be to find the best-fitting straight line, thus giving equal weight to the peaks and the valleys of the curve. But

TABLE 2
Areas of the World's Three Largest Empires Throughout History (in Mm^2)

Years	Largest empire[a]		Second largest empire[a]		Third largest empire[a]	
B.C.						
3000	~.1	Upper Egypt	~.05	Lower Egypt	.00	Sumer (M)
2800	~.25	Egypt, Old	~.01	Sumer	—	
2500	.4	Egypt	~.03	Sumer	—	
2400	.4	Egypt, Old	~.05	Lagash (M)	(.05?)	Harappa (Ind)?
2300	.6	Akadia (M)	.2	Egypt, Old	(.1 ?)	Harappa
2200	.2	Akadia	.1	Egypt	(.1?)	Harappa
2100	(.15?[b])	Harappa?	.1	Egypt	.03	Sumer
2000	.2	Egypt, Middle	(.2?)	Harappa?	.1	Sumer
1900	.5	Egypt, Middle	(.2?)	Harappa?	(.1)	Hsia (C)
1800	.5	Egypt	.45	Hsia	(.3?)	Harappa?
1700	.4	Hsia	.25	Egypt, Middle	.2	Babylon (M)
1600	.65	Hykso (A)	.4	Shang (C)	.2	Babylon
1500	.65	Egypt, New	.4	Shang	.2	Mitanni (M)
1450	1.0	Egypt, New	.5	Shang	.3	Mitanni
1400	.9	Egypt	.55	Shang	.3	Mitanni
1350	.75	Egypt	.65	Shang	.2	Hittite
1300	1.0	Egypt	.7	Shang	.4	Hittite
1250	.9	Shang	.85	Egypt, New	.45	Hittite
1200	1.0	Shang	.75	Egypt	.4	Hittite
1150	1.1	Shang	.65	Egypt	.2	Elam (M)
1100	.6	Egypt, New	.55	Chou (C)	.15	Assyria (M)
1050	.5	Egypt	.5	Chou	.1	Hittite
1000	.45	Chou	.4	Egypt, New	.15	Babylon
950	.4	Chou	.3	Egypt, New	.15	Babylon
900	.35	Chou	.2	Egypt	.15	Babylon
850	.45	Assyria	.3	Chou	.15	Babylon
800	.5	Assyria	.25	Chou	.2	Urartu (M)
750	.4	Assyria	.2	Phrygia (A)	.15	Chou
700	.9	Assyria	.5	Egypt, Late	.45	Medea (I)
650	1.0	Assyria[c]	.65	Medea (I)	.5	Egypt, Late
600	3.0	Medea	.55	Egypt, Late	.4	Lydia
550	2.5	Achaimenid (I)	.65	Egypt	.5	Lydia, Babylon
500	5.5	Achaimenid	.15	Ch'u (C)?	.15	Carthage (Af)
450	5.2	Achaimenid	~.3	Ch'u?	.3	Maghada (Ind)
400	3.5	Achaimenid	~.8	Maghada	.3	Ch'u?
350	4.0	Achaimenid	~1.0	Maghada	.5	Ch'u
300	4.0	Seleucid (I)[d]	2.5	Maurya (Ind)	1.0	Ptolemee (Af)
250	3.5	Maurya	2.8	Seleucid	.9	Ptolemee
200	2.5	Han (C)	2.5	Maurya	1.8	Bactria (I)
150	5.7	Hsiung-Nu (CA)	2.3	Han	2.0	Bactria
100	4.0	Han	2.3	Parthia (I)	2.0	Hsiung-Nu
50	6.2	Han	2.5	Parthia	2.0	Rome (E)
0	6.2	Han	3.5	Rome	2.8	Parthia

[a] Location code for empire core: A = Anatolia, Af = Africa, Am = America, C = China, CA = Central Asia, E = Europe, I = Iran (and Western Himalaya), Ind = India (and Indochina), M = Mesopotamia.

TABLE 2 (*Continued*)

Years	Largest empire[a]		Second largest empire[a]		Third largest empire[a]	
A.D.						
50	5.5	Han	4.0	Rome	2.5	Parthia
100	6.5	Han	4.4	Rome	2.3	Parthia
150	5.7	Han	4.4	Rome	2.5	Parthia
200	4.5	Han	4.4	Rome	2.5	Parthia
250	4.4	Rome	3.0	Sassanid (I)	1.3	Kushan (Ind)
300	4.4	Rome	4.0	Chin (C)	3.5	Sassanid
350	4.4	Rome	3.5	Sassanid	2.8	E. Chin (C)
400	3.5	Sassanid	3.0	Huns (E)	2.8	E. Chin
450	4.0	Huns	3.5	Sassanid	2.8	Toba (C)
500	3.5	Sassanid	2.5	Toba	1.9	Byzantium (E)
550	5.2	Tu Chueh (CA)	3.4	Sassanid	2.3	Toba
600	3.0	Tu Chueh	2.5	Sassanid	2.3	Byzantium
650	5.2	Muslim (M)	3.6	T'ang (C)	2.8	Tibet (CA)
700	9.0	Muslim	5.2	T'ang	2.3	Tibet
750	11	Muslim	5.2	T'ang	2.3	Tibet
800	8.3	Muslim	4.5	Tibet	3.0	Uighur (CA), T'ang
850	4.7	Tibet	4.5	Muslim	3.0	T'ang
900	2.8	Tibet	2.0	Samanid (I)	1.5	Kiev (E)
950	2.5	Tibet	2.5	Liao (CA)	2.3	Samanid
1000	3.0	Sung (C)	2.5	Liao	2.5	Tibet
1050	3.0	Seljuk (A)	3.0	Sung	2.5	Tibet, Liao
1100	4.0	Seljuk	3.0	Sung	2.5	Tibet
1150	2.5	Tibet	2.3	Almoravid (Af)	2.3	Juchen (C)
1200	2.3	Juchen	2.0	Sung	1.8	Tibet
1250	18	Mongol	2.0	Sung	1.3	Delhi (Ind)
1300	24	Mongol	1.5	Delhi	1.0	Mali (Af), Khmer (Ind)
1350	11	Yuan (C)	5.5	Golden Horde (CA)	2.8	Delhi
1400	4.0	Timur (I)	4.0	Ming (C)	3.5	Golden Horde
1450	6.5	Ming	2.5	Golden Horde	2.3	Shahrukh (I)
1500	4.7	Ming	2.0	Inca (Am)	1.8	Russia (E)
1550	4.3	Ottoman (A)	4.0	Russia	3.5	Ming
1600	6.0	Russia	5.2	Spain	4.5	Ottoman
1650	9.5	Russia	7.8	Spain	6.5	Manchu (C)
1700	12	Russia	10	Spain	9.0	Manchu
1750	14	Russia	12.5	Spain	10.5	Manchu
1800	17	Russia	15	Manchu	13.5	Spain
1850	23	British (E)	21	Russia	13.5	Manchu
1900	30	British	22	Russia	14	France (E)
1925	34	British	21	USSR (E)	15	France
1950	22.5	USSR	14	France	10	Canada (Am)
1975	22.5	USSR	10	Canada	9.7	China

[b] "?"Indicates cultural areas of questionable political cohesion.

[c] Assyria peaked at 1.4 Mm^2 in 660 B.C.

[d] Alexander 323 B.C.: 5.2 Mm^2.

their qualitative meaning is quite different. Peaks may indicate the limits of the social organization potential at the given time while valleys may represent more or less random levels below that limit. This is not to suggest that humankind *should* strive for maximum possible power concentration. On the contrary, empire building may prove to be a major foolishness of the species. All that is implied here is that peak levels in our curves may have a simpler and more regular structure than the valley bottom levels. If this were so, then it would make more sense to consider the upper "envelope curve" (i.e., the curve joining the peaks) rather than the average of peaks and valleys.

An exponential fit (straight line in Fig. 1) to the peaks, from 3000 B.C. to 100 A.D., would clearly yield excessively high projections for later times. Indeed, by 2200 A.D. it would project to more than 100% of the total dry land area of the Earth. This disagreement should be expected. No exponential growth can continue forever. A ceiling is eventually approached which cannot be pierced. Unless we consider colonization of outer space a realistic possibility, the Earth dry land (133 Mm^2, without Antarctica) is our absolute limit. This limit is shown in Fig. 1, and in recognition of its importance the area scale at the right shows areas as percentages of the total area available. Growth approaches such ceilings usually in a gradual way, since the ceiling's presence is felt in terms of a decrease in further available space (or whichever other factor limiting the growth). Originally exponential growth later often tends to approximate a simple logistic form (a "drawn-out S" shape). Individual relatively isolated empires tend to follow this form (Taagepera, 1968). On semilogarithmic plot such as Fig. 1 logistic curves appear as initially straight lines (exponential phase) which gradually bend downwards and approach the ceiling without ever reaching it.

A logistic envelope fit to the peaks of the three-empires curve is also shown in Fig. 1. The corresponding equation is

$$S = \frac{133}{1 + 10e^{-0.0012t}} \tag{1}$$

where size (S) is in Mm^2 and time (t) is in years A.D. Note that the ceiling (total dry land area, 133 Mm^2) has been taken as a given restriction in this fit. The logistic fit is somewhat better than the exponential one. This envelope curve may reflect the gradually increasing ability of the human political structures to organize ever wider reaches, due to development of physical and social technology. If this were so, several interesting and possibly useful suggestions arise regarding the recent past and the immediate future. In view of the apparent novelty and the relative simplicity of the picture in Fig. 1, these suggestions are expressed here as potentially fruitful hypotheses to be cross-checked using other methods. But they

should not be mistaken for firm assertions. These suggestions are based on the unprovable (and undisprovable) belief that certain long-range mechanisms (such as development of technology) are acting throughout human history. They further assume that the logistic envelope fit in Fig. 1 is an adequate reflection of such long-range trends. Under these assumptions the following observations can be made.

(1) The peak of the three-empires curve around 1700–1900 was unusually high, perhaps due to the extraordinary advantage that commercial and industrial revolutions gave to European powers (especially Britain, Russia, Spain, and France). Even the recent decolonization has not brought the three-empires curve down much below the expected upper envelope level.

(2) In this light, consolidation of new larger entities in the close future is somewhat less likely than further breakup of the present largest states (in particular the Soviet Union, Canada, and China). The contemporary decolonization-type unrest in those entities (e.g., the continuing Ukrainian and Baltic national underground, separatist gains in Quebec, and the Tibetan guerrilla of 1960) might appear in this respect to be more than rearguard action. However, it will be seen in subsequent papers that the individual growth decline curves for Russia, Canada, and China suggest, on the contrary, continuing stability, as far as area is concerned.

(3) The logistic envelope curve is by now approaching the ceiling quite slowly. According to Eq. (1) the three largest empires (or federations) would englobe only 75% of the whole dry land by 3000 A.D. The time of a single world state (be it an empire imposed through conquest or a federation evolving from the United Nations) would seem to be even further away.

Once more—these are data-suggested possibilities rather than firm assertions. We will now investigate a different framework for analyzing the same data, and results will be of a different type.

A HISTORICAL PHASES APPROACH TO EMPIRE SIZES

Instead of a continuous growth in maximum size, one could also visualize the data as a sequence of discontinuous phases during which empire size did not increase appreciably. Figure 2 shows the previous empirical data plotted in the same way as previously. But the new analytic categories superimposed to the data now stress certain discontinuities. We can distinguish the following phases.

Phase 0. Prior to 2850 B.C. It seems that no political entities larger than 0.1 Mm^2 existed during that phase.

Phase 1. 2850 to 700 B.C. The single largest empire during that phase always maintained a size of at least 0.15 Mm^2 but never went beyond 1.3 Mm^2. The combined area of the three largest empires varied between 0.3

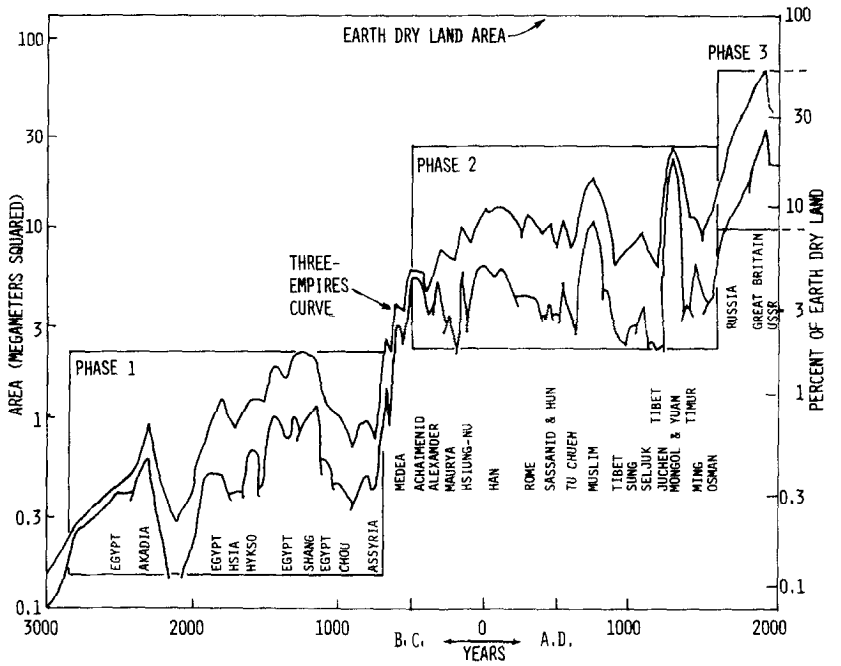

FIG. 2. Size of empires versus time: The phases approach.

and 2 Mm^2. The range from the smallest single empire to the largest three-empires area is shown by frame labeled "Phase 1" in Fig. 2. After a transition period of two centuries, the next phase started with markedly larger areas.

Phase 2. 500 B.C. to 1600 A.D. The minimum area of the single largest empire during that period was 2.3 Mm^2, above the maximum of the previous phase for the combined area of three largest empires. The maximum empire size reached 24 Mm^2. For the combined area of three largest empires the range was from 5 to 28 Mm^2. Within Phases 1 and 2 new records of area were repeatedly established, but the interphase increase (700 to 500 B.C.) is one of the most marked ones.

The contrast between the two phases is especially striking when one considers the bottom parts of the curves (the aspect neglected in the continuum approach). During Phase 1 the world's largest empire's area keeps falling underneath the level of 0.5 Mm^2, up to the very end of the phase. During Phase 2 the bottom suddenly is raised from 0.5 to about 2.5 Mm^2. Again, this bottom level is reached repeatedly, practically from the beginning to the end of the phase. Most area values appear repeatedly on both curves, due to wide fluctuations during the phases. But the area value of 2.2 Mm^2 occurs only once on either curve—during the interphase

transition period. This is the only such single occurrence on the graphs (apart from the poorly known Phase 0). As such, it definitely distinguishes between the two phases.

Phase 3. From 1600 A.D. on. This phase has lasted for such a short time that one cannot be certain of its existence: Maybe it is just a continuation of Phase 2. Both curves reach new peaks during that period, but this has occurred before, within Phase 2. The largest present empires can decline, leading to new low points on the curve. However, it was pointed out earlier that during Phase 2 disintegration periods the largest empire area repeatedly fell as low as 2.5 Mm^2, even toward the very end of the phase. Similarly the three-empire curve kept falling back to the 5 Mm^2 level. Is it likely to occur again in the future? The world now has eight states larger than 2.5 Mm^2 (USSR, Canada, China, USA, Brazil, Australia, India, Argentina). It is unlikely that all of them would break apart at the same time. Therefore, it seems that the bottom level of the curves has again been lifted since 1600, possibly in a major way, thus justifying the introduction of a Phase 3.

This analysis would suggest a limited number of crucial organizational inventions or breakthroughs during human history, instead of a gradual development. The start of Phase 1 may correspond to occupational differentiation and the use of the city as a center and tool for centralized leadership. Within the city–countryside symbiosis either of the two components may predominate. According to Franfort (1951), in Mesopotamia the city was the object of prime loyalty and structured the countryside around it, while in Egypt the city was an easily shiftable market center, and the king was primarily the king of the country. Either way the rule was centralized because no methods had been devised to delegate power in a withdrawable way. Governors who were not tightly supervised tended to become independent princes. Since communication takes time, the geographical range of centralized decision-making is limited. The maximum empire size during Phase 1 (1.3 Mm^2) corresponds to a mean range of control of about 650 km (assuming approximately circular countries). The maximum speed of messages (by horse, without systematic relays) would have been 100 km per day at most. Thus the central control tended to fade when the communication time with the capital exceeded a week.

The start of Phase 2 may have resulted from a breakthrough in the art of delegating power in a withdrawable way, primarily through bureaucratic hierarchy of roles filled by people, rather than through purely personal relationships. The successful introduction of satrapies may have been the secret weapon which suddenly enabled the Medes and the Persians to build an empire of 5 Mm^2 in a world that up to that time had seen no empire surpass 1.3 Mm^2. According to Eisenstadt's (1963) criteria Persia

was not yet a bureaucratic empire but a prebureaucratic one while ancient Egypt was bureaucratized. Yet the boost in size suggests some basic advances. An area of 5 Mm^2 corresponds to a mean action range of about 1300 km. Part of the increase was due to higher communication speeds through use of relay stations which represented a major organizational achievement. But Persia must also have developed organizational means to extend the range of control not only in terms of kilometers but also in terms of travel days. The next thousand years saw apparently little change in long-distance organization ability.

The start of Phase 3 may have been triggered by the European commercial–industrial revolution. The main new factor may have been an increasingly rapid pace of technological development. When this pace is slow, the technology gap between the conqueror and the conquered is small, because conquest tends to proceed slowly, leaving time for diffusion of technology. The pace of technology development has increased throughout human history at an ever accelerating rate (cf. Taagepera, 1976b). A critical speed may be reached at a certain point where the technology difference enables the technologically most advanced populations to conquer their neighbors so rapidly that technology diffusion cannot keep abreast with conquest. The further such conquest proceeds from the centers of technological innovation, the larger the technological disparities become between conquerors and the conquered people, so that conquest becomes easier. The expansion of European empires overseas may have been triggered by such a conquest-diffusion speed reversal, while long-distance communication speed did not increase appreciably until the telegraph was invented. But the basis of the European conquest of the world was unstable: It was not so much based on the organizational ability of the Europeans than on the relative technological weakness of the others. This expansion into relative vacuum was bound to reverse itself as the diffusion of technology continued, enabling the conquered to meet the conquerors on a more equal technological basis. Thus the European colonial empires have disintegrated, often after an unstable commonwealth stage, with the exception of the Russian empire.

Meanwhile a new bottom level to empire size may, however, have been supplied by the telegraph (and later radio) which cut worldwide communication time down from months to hours, and with the airplane which had an almost as spectacular effect on transport speeds. Today's large and even small powers (witness Israel's action in Uganda and Cuba's in Angola) can strike anywhere in the world in fewer days than it took the pharaoh to send a message to his border guards.

The tentative conclusion is that there have been three major phases in human empire building, each based on a breakthrough of a different nature. Phase 1 was a result of beginning urbanization. Phase 2 was made

possible by delegation of power and bureaucratization. Phase 3 was triggered by a temporary imbalance in technological development but it is kept going by drastic shortening of communication and transport times.

The historical phases approach may seem to be in conflict with the continuum approach discussed previously, but it is not. The overall curves of technological development are often observed to be the upper envelope curves for subcurves representing the development of specific techniques. Thus the curve for maximum speed achieved by humans consists of a sequence of logistic subcurves for horseback, steam engine, automobile, airplane, and rocket techniques. As one specific technology reaches its full potential, another one appears. The envelope curve for such specific logistic curves tends itself to be logistic, with an eventual maximum at the speed of light which is the theoretical maximum speed. Within our continuum approach the historical phases may represent the leveling-off periods of such subcurves.

OBSERVATIONS ON INDIVIDUAL EMPIRES AND REGIONS

Besides trying to distinguish continuous trends or phases, Fig. 1 could also be perused just to see how it agrees with our previous ways of looking at history. It may come as a shock, for instance, that Rome hardly appears on the world's largest empire curve: It only makes it for about 200 years, after the disintegration of the Chinese Han empire. The inadequacy of area as a measure of an empire's power or impact may be one reason. But could it also be that our Europocentric world view has boosted Rome's importance excessively?

The list of the world's largest empires includes some of which I had never heard before this project: Tu-Chueh Turks, Tu-Fan Tibetans, and Juchen Manchu. If these can be discounted as sparsely populated desert realms on which little information is available, the same could not be said of some runners-up such as Bactria or Kushan. Checking on a few contemporary high school and college history textbooks suggests that is not purely my own fault, nor can my students be completely blamed for being completely unaware of even such momentous political and cultural landmarks as Asoka's India, Sassanid Persia, or Baghdad Caliphate. Our history education seems to be somewhat biased geographically.

We cannot even justify our bias by claiming that more attention is given to those cultures which are the roots of our own Western civilization, because we arbitrarily ignore some of our roots. The treatment of the Middle East is especially striking. Its most ancient history is well represented in our history texts: Egypt, Babylon, and Assyria figure prominently, and even the Hyksos are mentioned. But after the rise of the Greek civilization our textbooks implicitly suggest that the culture that started in Egypt, Anatolia, and Mesopotamia completely shifted to Greece, leaving behind a cultural vacuum. Achaimenid Persia marginally

enters our "world history" but only as far as it attacks Greece or is briefly taken over by an adventurer originating from the European marches of the empire. The modest peak of Alexander's empire compared to the total Medean-Persian one in Fig. 1, both in duration and in maximum height, should give us pause. The area, population, resources, and culture remained basically the same. Yet we choose to glorify one of the rulers more than all others combined. It is as if a historian with narrowly Germanic bias treated all of the Roman empire as a mere introductory footnote to some Germanic soldier-emperor of the Roman decay period. Our textbooks even tend to leave the impression that Alexander's realm was much larger than the preceding Persian empire, especially in view of his "conquest of India" (which plays on the confusion of the Indus River region with the Indian Peninsula). A look at Fig. 1 shows that Alexander never reached the peak size of the Persian empire. (A comparison with only the decay phase of the Persian empire would manifestly be unfair.)

A further rabbit jump in the location of our roots occurs after the creation of Rome. Now civilization seems to depart from Greece, too. Even when the political and cultural center of the empire shifts to Constantinople, our attention remains riveted on the declining Western part. The continuing Greek civilization receives a last casual mention when the Byzantine refugees trigger the Renaissance. The term Renaissance itself is instructive. It is as if the scientific–technological–cultural phoenix flew from the Middle East to Greece, then to Rome, and then died, only to arise from the same Italian ashes a thousand years later. But the phoenix did not die—it returned to Byzantium, spread out all over the Arab world, picked up a few feathers from India and China, and then returned to Italy. The "Dark Ages" were pretty bright east of Europe. It seems that our historical thought has not been concerned equally with all the numerous roots of our civilization, but has stressed the importance of a single main root. Within the maze of our cultural ancestors, it has tried to elucidate a clear patrilinear succession. And even then, when the line shifted back toward the East, it was declared illegitimate, in favor of a claim of virgin Renaissance.

Nothing in the preceding discussion denies our major linguistic dependence on Latin and Greek, which has served as a vehicle for literary and philosophical influence. But this is no reason to ignore the rest of the Western culture's roots.

The preceding discussion may seem to be out of order, in view of the general topic of this paper. However, those ideas were suggested by an inspection of Fig. 1. Although this figure is restricted to a very narrow concept, its depth in time apparently enables us to see history in a somewhat new light.

Which regions have been most prone to produce large empires? Over the total 5000 years investigated, the world's largest empire has been

centered in Egypt for 1300 years, in China for 1000 years, in Anatolia or Mesopotamia for 900 years, in Europe for 600 years, in Iran for 500 years, in Central Asia for 500 years, and in India for 100 years. Thus the location has been in the present Muslim world (Egypt, Anatolia, Mesopotamia, Iran) for 2700 out of 5000 years, and in or close to the present China (China and Central Asia) for 1700. However, emphasis has varied as history unfolded itself. It is convenient to consider separately the three phases delineated earlier.

Phase 1 (including Phase 0 since 3000 B.C.) could be said to be the Egyptian phase: out of its total 2300 years, Egypt was the world's largest state for at least 1300 years. Anatolia-Mesopotamia and China share the rest about equally. Egypt does not reappear among large empires thereafter.

Phase 2 (2300 years, including the transition period from 700 to 500 B.C.), is quite evenly divided between Iran, Central Asia, China, and Anatolia-Mesopotamia, with 400 to 600 years for each. Each of these four regions keep reappearing throughout the duration of the period. In addition, India and Europe briefly appear in the top list.

Phase 3 (400 years up to now) has been a European and specifically Russian phase. Russia has been the world's largest empire for about 300 years, and Britain for about 100 years.

Thus China and Mesopotamia-Anatolia are well represented throughout the two phases now completed. Iran and Central Asia have appeared up to now only in Phase 2, Egypt in Phase 1, and Europe nearly only in Phase 3.

If instead of the single largest empire we analyzed the list of the three largest ones, the differences between regions tend to blur because none of the regions mentioned can easily accommodate more than one large empire (although exceptions do occur), so that three different regions almost always are bound to be part of the list. The main conclusions still are the same, except that China now predominates (with 3200 years on the list) over Egypt (2200 years) and Anatolia-Mesopotamia (2600 years); Iran, Central Asia, Europe, and India follow with 1500 to 1100 years each.

Finally, Table 3 shows a list of the 20 largest empires and states that ever existed. The predominance of modern times is clear: There are six states in the list (USSR, Canada, China, USA, Brazil, and Australia) which still exist at or close to their peak size. There are three other empires (British, Spanish, French) of which the rump state still exists.

CONCLUSIONS

In this first part of a series the general objectives of the project have been described. The notion of empire size has been defined operationally, and a table of the world's largest empires throughout history has been given. A fairly steady increase in size throughout times is observed and summed up in a logistic equation. Yet size increases during the last few

TABLE 3
The 20 Largest Empires or States That Ever Existed[a]

Rank	Name (and location)	Maximum size (Mm^2)	Approximate peak date
1	British (E)	34	1920
2	Mongol (CA)	24	1309
3	Muscovy-USSR (E)	23	1905
4	French (E)	15	1920
5	Manchu (C)	15	1800
6	Spanish (E)	14	1800
7	Baghdad Caliphate (M)	11	750
8	Yuan (C)	11	1320
9	Canada (Am)	10	1970
10	China	9.6	1970
11	United States (Am)	9.4	1940
12	Hsiung Nu Huns (CA)	9	180 B.C.
13	Brazil (Am)	8.5	1970
14	Australia	7.7	1960
15	Han (C)	6.5	100
16	Ming (C)	6.5	1450
17	Tu Chueh Turks (CA)	6	580
18	Golden Horde (CA)	6	1310
19	Achaimenid (I)	5.5	500 B.C.
20	T'ang (C)	5.2	700

[a] See Table 2 for empire core location code. Dates are A.D. unless otherwise indicated.

centuries seem to have come too rapidly, leading to a compensatory period of empire break-up which may still continue. Within the size increase trends three separate phases have been distinguished and tentatively ascribed, respectively, to the formation of cities, to the creation of bureaucratic power delegation, and to the industrial–communicational revolution. The present Muslim world has been the location of the world's largest empire during more than half of human history. The predominance of little-known non-European empires in our tables and figures raises the question of possibly excessive Europocentrism in our world-view and history education. Figure 1 may be useful to history students as a means of putting some aspects of human history into a more balanced perspective. In view of the scope embraced, it is expected that the lists presented contain errors, especially errors of omission. Any corrections would be appreciated so that they could be incorporated into later papers which deal with limited time periods. The overall conclusions of this paper are not likely to be reversed by such errors.

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