War and the Cycle of Relative Power

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Relative nation-state capability follows a generalized nonlinear pattern over long periods. Empirical evidence indicates that between 1816–1975 nine major powers have traversed at least a segment of this relative capability cycle of political ascendancy, maturation and decline. Specific changes in a state's relative capability dynamics increase its propensity to initiate extensive war. Whether the extensiveness of a war is defined in terms of duration, intensity or magnitude, major powers are likely to initiate more extensive wars at the critical inflection and turning points on the curve of relative capability where the linear role perceptions held by government and society change pervasively. This analysis involves a new theoretical focus for examining the causes of war, shifting attention from interactions between nations to the consequences of changes in relative power and to the political evolution of the nation-state itself.

In this study we probe empirically the impact of long-term nonlinear changes in a state's relative power on its propensity for extensive war, shifting the research focus from the more conventional assessment of interactions between states. The theory of relative capability dynamics and extensive war emerged from examination of the hegemonic behavior of the major powers for the period after 1450 (Doran, 1971).

The Cycle of National Power

We employ a minimal definition of cycle as "a period of time during which something becomes established, reaches a peak, and declines" (*Webster's Dictionary*). The political development of the major power is manifest in this cyclical conception. As a nation gains in power relative to others, its capacity to exercise leadership grows; as it falls behind, the capacity to influence international politics wanes. Repetition of the cycle by a state, although theoretically possible, is not relevant to this discussion; hence, when we speak in the plural of "cycles of development," we refer not to such repetition but to a particular nonlinear pattern of change that seems widely generalized across the principal members of the modern state system (Doran, 1971, pp. 2–11; 1980). Some analysts, however, do use cycle in the sense of a regularly recurring succession of events over the extremely short term (Alcock, 1972), or in the long-term, systems-wide, Kondratieff sense where the repetition is less frequent (Denton and Phillips, 1968; Modelski, 1978). The conception of cycle as a generalizable pattern of long-term evolutionary change is apparent in the writings of George Liska (1967), who considers the cycle specific to a nation's foreign policy role but does not link it to capability, role transformation, or political violence.

For an example of the cycle of relative power, consider the tiny country of Holland, which rose to the height of its power at the end of the sixteenth century, dominating foreign exploration and commerce whle financing the military resistance to Louis XIV's several wars, only to plummet to comparative political obscurity in the century thereafter (Rosecrance, 1968, p. 88). Similarly, Austria-Hungary, one of the five Great Powers in the nineteenth century, succumbed to partition at Versailles and to collapse in the face of Nazi pressure a generation later. Although the periods and amplitudes (heights) of ascendancy differed for these two nations, the dynamic of the path followed was the same. That path, reflecting the capacity of the state to assume a major role in systemic affairs, is termed the *cycle of relative capability* and is depicted in the idealized Weberian sense in Figure 1.

Capability itself is composed of two principal dimensions: *size,* which is most often indexed by GNP, territory, armed forces, military spending, and population, and *development,* which includes such variables as per capita income, urbanization, and technological sophistication. With the obvious exception of territorial size, most of the power variables register in the absolute sense some form of exponential increase for most states (Rus-

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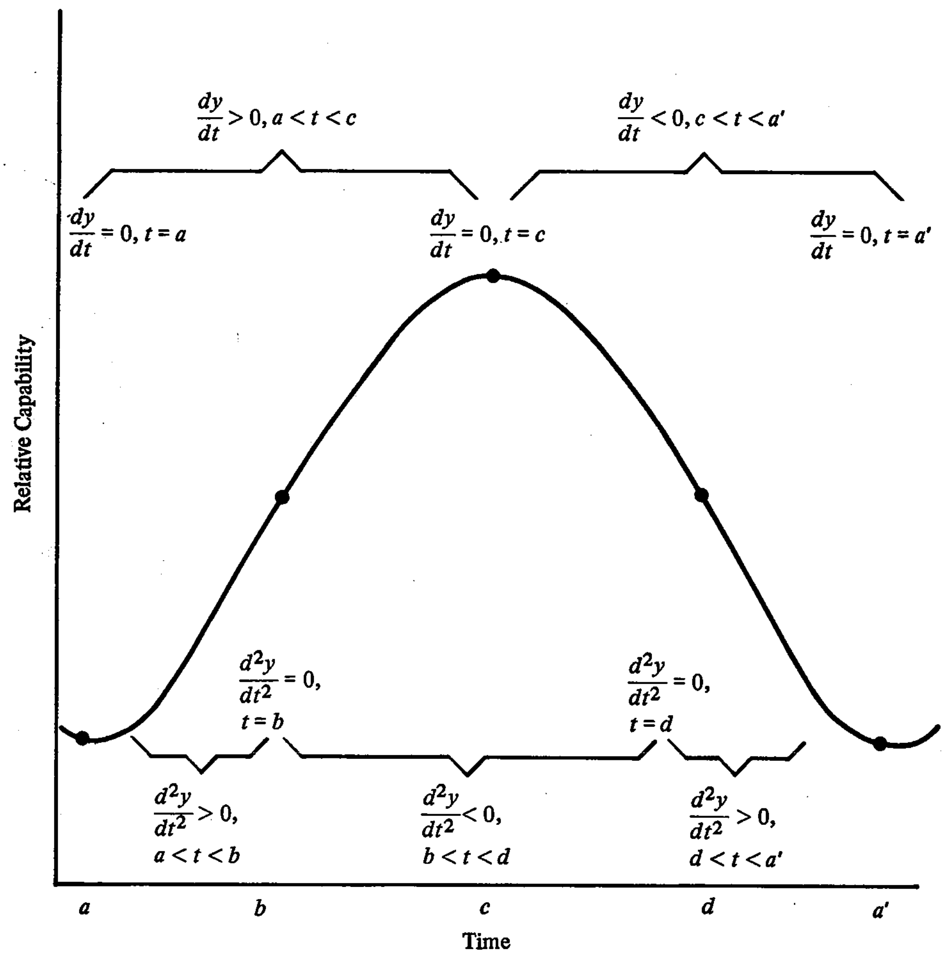
sett, 1974). But the state cycle in our conceptualization involves *relative,* not absolute, capability and hence differs fundamentally from that of Fucks (1965) and others. The view that relative capability is an important element underlying major power behavior is well accepted, but conceptions of relative power differ widely regarding choice of significant reference group and/or operationalization (Singer, Bremer and Stuckey, 1972; Wallace, 1973; Weede, 1973; Ferris, 1973; Choucri and North, 1974; Galtung, 1966; Rummel, 1971). The concept as used here is again somewhat different: the relative capability of a major power at any time is the percent of the total capability among the major powers it holds at that time. The dynamics of relative capability thus encompasses changes in the interacting state-units and changing systemic structure as inseparable parts of a single



Source: Conceptualized by Charles F. Doran, *The Politics of Assimilation* (Baltimore: Johns Hopkins, 1971, pp. 46–51, 191–94), utilizing principles of the calculus.

Key: a, b, c, d, a' = critical points
t = time
y = relative capability of the state
$\frac{dy}{dt}$ = rate of change (velocity) in relative capability over time
$\frac{d^2y}{dt^2}$ = rate of change of change (acceleration) in relative capability over time

Figure 1. Generalized Curve of Relative Capability

process, to avoid both second-image overgeneralization (Waltz, 1979) and the ecological fallacy.

According to the theory, relative capability follows a cyclical dynamic (Doran, 1971, pp. 45–51, 191–93). Since capability is limited in part by the size of the nation's territory and initial capital and natural resource endowments, an upper limit on relative growth is somewhat pre-ordained. Institutional factors encouraging saving, investment, and efficiency contribute positively to the early growth phase and may subsequently inhibit the rate of growth if rigidity and overcentralization occur. Diffusion of power away from core development may take place as well in the later phases, for example, through migration (Rostow, 1978, p. 21) or through the export of capital and technology to newer centers where the prospect exists of a higher return to investment (Kindleberger, 1970). Meanwhile, other states, industrializing later but more rapidly, may be in a more advantageous position. The cycle results from differing rates of internal economic and political development experienced by different actors.

The length of the period and the height of the ascendancy will vary from state to state, but the pattern of change remains the same. A major power can escape this dynamic of cyclical change only by remaining at or fluctuating around the same proportionate increase in relative capability as that experienced by the total major power system. While in theory all states are subject to the full cycle of growth, maturation and decline, many states have traversed only a small section of the curve in their entire systemic experience, either relatively new members of the system or older members with longer periods. Hence curve-fitting can be very misleading in the absence of an understanding of the dynamics of the generalized relative power curve. By the same token, each state must be treated in terms of its own individual dynamics within each interval, with the longer intervals yielding a better approximation of the generalized results.

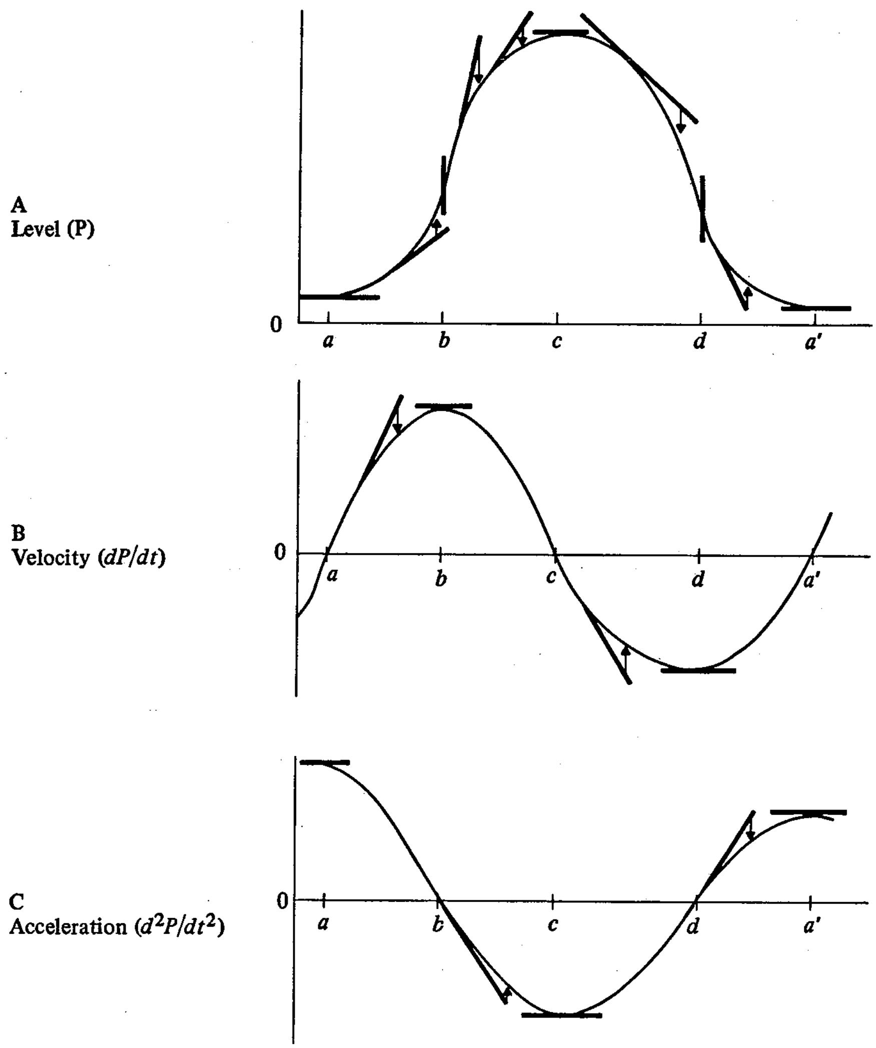
War and the Cycle of Relative Capability: The Theory

The theory of relative capability holds that the capacity of the state to influence international politics and to adopt a principal foreign policy role is determined in large part by its position on the relative capability cycle. As the cycle evolves and the role changes, significant adjustments are required of the government and the society. The theory further asserts that the trauma of role change is most severe for state leaders at each of four critical points on the cycle where an abrupt and ineluctable inversion occurs within the dynamics (Doran, 1971, pp. 193–94, 210). The critical points are the two inflection points *b* and *d* and the two turning points *a* and *c* (Figures 1 and 2). It is at these points according to the theory that the government is most vulnerable to overreaction, misperception, or aggravated use of force which may generate massive war. Several aspects of the theory require further amplification.

Relative power calculations are important to policy makers who conceptualize the role of the state within the international system. Normative expectations of the members of the system, regularized by social and political tradition and shaped by the realities of capability, determine a nation's role (Holsti, 1970). In the late nineteenth century, Great Britain adopted a formula, for example, that attempted to maintain its naval capability at twice the level of the next two naval powers, France and Russia (Art, 1973, p. 22). Admiral Tirpitz argued that Germany had to have sufficient naval capability to reduce the British ratio of superiority below the level of the two-power standard (Berghan, 1973, p. 31). Notwithstanding this precise monitoring of capability, relative capability theory does not require such careful calculation, since the practice of day-to-day diplomacy will itself provide signals regarding the degree of a government's relative ascendancy or decline as perceived and acted upon by other principal competitors. Hence, to some extent its competitors do not allow a government to misread the implications of its changing capacity to implement statecraft.

Accordingly, for the policy maker the principal dichotomy in conceptualizing foreign policy roles is between the leader nation whose security is in large part internally provided, and the follower nation whose security must for the most part be externally obtained. Either role may be stable, but transition from one to the other requires difficult governmental and social adjustments. According to the present theory, these transitions are triggered by passing through the critical points on the relative capability cycle.

Figure 2, depicting three types of change simultaneously operative in the cycle of relative capability, helps explain why the changes occurring at critical points have such an abrupt and unsettling effect on a nation's self-image and foreign policy perspective. Role stability is not seriously threatened between the critical points because during these periods governments can plan. Within these intervals, changes in slope of the tangent lines are not great, so that even simple linear projections from existing conditions provide a fairly good approximation of future capability. The policy maker anticipates future conditions with confidence and success. Even if information accumulates to show that the state's relative capability is



Source: Conceptualized by Charles F. Doran, *The Politics of Assimilation* (Baltimore: Johns Hopkins, 1971, pp. 191–94, 210), utilizing principles of the calculus.

Key: *a, b, c, d, a'* = critical points
a, c, a' = turning points (maximum or minimum value)
b, d = inflection points (points where tangent reverses direction) and hence turning points with respect to the derivative
↑ = actual value greater than linear projection
↓ = actual value less than linear projection

Note: Figure 2A is the relative capability curve itself, graphing *level.* Change of level involves either an increase (curve rises) or a decrease (curve falls) in relative capability score. The *rate* at which the level is changing, signified by the slopes of the lines drawn tangent to each point on the curve of Figure 2A, itself varies. Figure 2B graphs this *rate of change* (velocity or first derivative) for each point on the curve; positive velocity signifies rise in level, negative velocity indicates decline. The rate of change graph is also nonlinear and non-monotonic, rising or falling to different degrees (with differing slopes) over time. Figure 2C illustrates this *rate of change of change* (acceleration or second derivative), graphing the changing slopes of tangent lines of the velocity curve; acceleration likewise is neither constant, linear, monotone, nor always positive.

Figure 2. Level, Velocity and Acceleration of Relative Capability: Concurrent Changes

changing in a nonlinear fashion, the tendency will be to view it as monotonic increasing (never decreasing) or monotonic decreasing (never increasing)—until the turn is imminent or past (Jervis, 1976, p. 310). Temporary fluctuations in the process do not destroy the monotonicity of the projected trend, and indeed their possibility further weakens the policy maker's ability to predict crises or turning points. But, again, monotonic projections serve satisfactorily so long as there are no inversions in the process.

Figure 2 shows that each of the critical points involves such unavoidable and unpredictable violations of monotonicity and linearity in level, velocity and/or acceleration of relative capability (as detailed in the next section). The significant change in slope, indeed, inversion within the relationship, which occurs at each of the critical points, calls for a completely different role from that projected along the preceding tangent lines. A nation's role stability thus breaks down at the critical points because there the linear or monotonic projections of the state leaders suddenly become counter to the real trend in direction as well as degree. The leaders perceive that role transformation is needed (or, if foreseen, can no longer be postponed) with equivalent suddenness since turning points defy both early and certain detection. Perception of this now-certain imperative may occur just prior to the impending inversion for the more alert states, perhaps after a short delay for those less observant of their changing relative power.

Forced unexpectedly to search for new foreign policy roles, the state feels threatened by uncertainty and is vulnerable to over-reaction. An analogy between an automobile driver following an unmapped road at night and a government responding to changes in power is perhaps helpful. Even if the driver anticipates an oncoming curve in the road correctly, the dangers of over-steering or under-steering normally become critical only when the curve is reached, although they may be perpetuated for an interval thereafter, depending upon the speed of the vehicle and the ability of the driver to adjust. Intoxication, whether with alcohol in the one case or with power perquisites in the other, further increases the probability of serious accident at these points.

The objective changes in relative capability and the perceptions of them (Deutsch and Merritt, 1965) are thus at once "gradual" and yet involve "abrupt" changes. Mathematically continuous, gradual change occurs throughout the relative capability cycle even at a critical point, but the dynamic relationships are completely inverted on either side of that point where a change in sign abruptly occurs. (Substantively, change at these points is abrupt in the sense that it occurs in an interval of a year or so set against perhaps a century and a half of experience.) Likewise, the leaders' perceptions of change in relative capability cumulate gradually, but a gradual trend may always be interpreted as part of a temporary fluctuation until the approach to the inversion is imminent; and as for the night driver on an unfamiliar road, over-reaction often accompanies abrupt perception. It is our belief that most major powers are similarly constrained regarding early identification of critical points, similarly sensitive to their imminent arrival, and similarly subject to abrupt over-reaction.

Probing the Dynamics of Relative Power: Behavioral Responses. A state's progress through the cycle of relative capability must be measured simultaneously in terms of level, velocity, and acceleration to discover the inversions which abruptly alter the dynamics of the cycle and the leaders' perspectives regarding the role. The continued rise in relative power between points *a* and *c* (Figure 2A) masks an inversion within the process which takes place at *b* and is depicted in Figure 2B. While relative power growth continues after *b*, its rate of growth has maximized and gradually slows to a halt at *c*; monotonicity has been reversed for velocity, although it is retained for relative power level itself. Figure 2C shows the positive acceleration that makes growth approximately exponential prior to *b*; but at *b*, the accelerating growth to which the state has become accustomed ends, and the rise in relative ascendancy increasingly slows until it reaches its maximum level at *c*. Critical point *c* separates the region of growth in relative capability (*a*, *c*) from the region of decline (*c*, *a'*); at *c* monotonicity is reversed in the level of relative power itself. The increasing negative acceleration prior to *c* which slowed growth begins to diminish after *c*, changing back to positive acceleration at *d*. The continued decline in relative capability between *c* and *a'* undergoes a critical inversion at *d* as the rate of decline peaks (low point on Figure 2B where monotonicity of velocity is reversed) and then turns up. This upturn in rate of power growth at *d* (although the rate is still negative) and the change from negative to positive acceleration of growth (although the growth itself is still negative) is a complex combination of psychological stimulants to behavior.

How are the state's perceptions of these changes translated into foreign policy responses which lead to extensive war? At the beginning of the cycle, recent entrants into the system reveal expansionist proclivity and heady nationalism (Kohn, 1944) as linear projections of continued growth are shown to be underestimated. If war occurs at this point, it is likely to be serious because the territorial status quo of the system appears threatened. At *b* and *c* the inevitability of decline in the rate and level of relative power, respectively, often generates a sense of insecurity, defensiveness and vulnerability to chauvinism (Wallace, 1973, p. 20) as real growth falls below linear projections. At *d*, cross-pressured between its increasing dependence on alliances with more powerful states for security, and renewed aspirations for a leadership-oriented role for which it may be ill prepared both psychologically and militarily, and disquieted by its continuing real decline in relative power, the government is subject to foreign policy over-reaction and misperception regarding the intent and scope of other governments' actions (Taylor, 1954; Pruitt, 1969). Perhaps these tendencies which contribute to imprudent use of force and the adoption of unyielding foreign policy positions are most severe at points *b* and *d* where the shock of role adjustment is most wrenching.

Each of the four critical transitions is thus damaging to a policy's role stability. For the *risk-acceptant* actor, the first inflection point and the upper turning point are very disturbing, since rivals are threatening the leadership role of the polity in new and unsuspected ways. Beyond the upper turning point, the government is reminded that postponement of an "inevitable" conflict will mean contemplating even greater power disadvantages in the future. Here expansionist arguments may increase the probability of the most serious variety of war, major hegemony. Hitler, for example, warned the Germans in 1939 after several decades of decline that, if they passed up this opportunity for supremacy (Bullock, 1964, p. 503), they would never again have the requisite capability, since the polity faced even more severe relative decline thereafter.

But even comparatively *risk-averse* actors are likely to be much more apt at the critical points to initiate extensive war. At least three of the critical points (*b, c,* and *d*) may engender feelings of powerlessness, determinism, and subsequent helplessness in a governing elite anxious about security. A government may respond to such feelings with aggressiveness and violent coercion, despite room for independent action (Soloman, 1970). Paranoid attributes establish the conditions for aggression in such contexts because slippage in relative power position may reinforce mistaken projections of hostility unto rivals.

Interpretation: Refinements and an Hypothesis. The decision to use some level of force in a dispute, no matter how minimal, is a function of a host of internal and external situations and structural factors. For this reason we do not believe that relative power changes at the critical points help explain the frequency of war initiation in general. Instead, the theory of relative capability addresses the impact of the critical points on the extensiveness of war initiation and use of force by the major power; a major power is more likely to become involved in *bigger* wars at these points than at other times. Stated somewhat differently, relative power dynamics may tell us something of the *timing* of the *bigger* wars in which a major power becomes ensnared. At critical points on the relative power curve, expansionist tendencies are greatest and attempts at hegemony are likely to occur. Furthermore, we believe, even normally prudent leaders are more likely to overreact at these points, thus precipitating more massive confrontations than at other times, confrontations that (1) attract a larger number of major combatants, (2) result in more casualties, and/or (3) entrap the participants in a longer period of hostilities. We will use the term "extensive war" in referring to these more massive confrontations, and our research design will incorporate three distinct variables to index the extent of war.

Hence the theory of relative power change has significance not for the frequency of the outbreak of war but for the timing of the more extensive wars which a nation initiates. A major state may initiate wars that do or do not involve other major actors, wars that are long or are short, and wars that are comparatively bloody or benign. To ask whether one might be able to determine *when* a major power is likely to trigger bigger wars and wars involving a number of other major states is thus no trivial question. In asking it, we in no way deny that factors other than the intent or the political vulnerability of the initiator, such as the type of weaponry or the behavior of allies (see below), contribute to the full explanation of the severity, magnitude, and duration of war. Conversely, although war is not a unilateral action, conditions peculiar to a principal belligerent may critically influence the timing and nature of war. Hence, a valid research objective is to determine whether the more extensive wars are more likely at certain times because of the changing power position which the state holds relative to its competitors in the system. This theory was deduced from historical examination of three major power hegemonies prior to 1815, and we now test empirically its predictive power regarding major power experience in the nineteenth and twentieth centuries.

This study thus seeks to test the following proposition and hypothesis for the group of major powers:

PROPOSITION 1. *Major powers pass through a cycle indexed by relative capability.*

HYPOTHESIS 1. *At critical points during this* *cycle where change is most rapid and disruptive of past trends, namely, at the inflection and turning points, the probability is highest of major power initiation of extensive war (that is, of wars which escalate beyond the level of those initiated at other times).*

Indeed, we may state the hypothesis even more strongly, namely, that the level of extensiveness of such wars varies inversely with the war's temporal distance from the initiator's preceding critical point.

To clarify this hypothesis even further, visualize a time line from 1816 to 1975 with markers indicating the critical points in relative capability for each of the major powers. We plot dots along this line every time a major power initiates a war, color coding dots and markers to distinguish between nations. Our theory suggests that the dots would be more or less randomly distributed for each power; that is, frequency of major power war initiation is not related to proximity to the initiator's critical point. However, if one were to draw three such time lines, one for each measure of war extensiveness, and make the size of each dot proportional to that war's score on the respective extensiveness measure, then, according to our theory, on each line the bigger dots would fall closer to the initiating state's preceding critical point. In fact, according to our more rigorous statement of the hypothesis, the size of the dots will diminish as one moves away from the critical point.

Examining the Cycle of National Power Empirically

Actors and System. Historically the largest amount of political activity, including conflict, has occurred among the nations known as the Great Powers or the major powers (Singer and Small, 1972, Salmore and Hermann, 1969). We have studied the nine members comprising the major power system from 1816 to 1965: Great Britain, France, Russia (USSR), Prussia (W. Germany), Austria-Hungary, Italy, the United States, Japan and China (PRC). We generally follow accepted historical practice in deleting certain states as they drop out of the central system while recognizing the entrance of others (see Table 1). Only Great Britain, France, Russia and Prussia were members for the entire period. While the complete political cycle of each actor is often not encompassed by this interval, the domain is broad enough to include at least one of the critical periods on the curve of each actor's relative power capability.

Table 1. Nations Classified as Major Powers, 1816–1975

Nation	Period of Membership	No. of Years
Great Britain	1816–1975	160
France	1816–1975	160
Prussia/(W.) Germany	1816–1975	160
Russia/USSR	1816–1975	160
Austria-Hungary	1816–1918	103
Italy	1860–1943	84
United States	1898–1975	78
Japan	1894–1975	82
China/PRC	1950–1975	26

Source: Compiled by the authors.

Indicators. Criteria of theoretical relevance and practical availability guide the selection of indicators of national capability. Gross national product is a useful measure of overall economic performance, but problems of exchange rate comparability, the incorporation of qualitative technological change, and the effect of uneven rates of inflation reduce the value of the concept when applied over long periods. Data on GNP and military expenditures, moreover, are either nonexistent or of very poor quality for the nineteenth century. For all of these reasons, we follow Fucks (1965) and use non-monetary units of measure wherever possible.

We drew data from over 40 sources for indicators of *size*: (1) iron and steel production, (2) population, and (3) size of armed forces; and for indicators of *development*: (4) energy use (coal production), and (5) urbanization (the proportion of people living in cities with greater than 100,000 population). Armed forces size is very stochastic, particularly before and after major wars; it also reflects actualized military capability (Knorr, 1973, p. 44) whereas the other indicators reflect primarily latent capability. Urbanization is a somewhat under-used index of social change that has profound effects on the rate of economic development through impact upon labor productivity and constraints on population growth (Lewis, 1978).

The question of the appropriate weight to be applied to each indicator was explored empirically. Ferris (1973) recommends using the squared variances associated with each variable on a single factor extracted by the principal components method because this method maximizes the contribution of each component to the variance in overall power. Since these squared variances did not diverge significantly from unity, however, neither an empirical nor a theoretical argument could be found to give the indicators other than unitary weights. This decision conforms to the observation by Wainer (1976) that weighting components is unlikely to alter the nature of the final index. This is especially true when, as in this study, one is interested not in absolute capability levels but in the pattern of change in relative capability.

Operationalizing Relative Power. For each indicator of power, p_i, the relative capability of State A at time t, P_{Ai} is the percent of the total major actor systemic capability on that indicator held by State A at time t:

$$P_{Ai} = \frac{p_{iA}}{\sum_{k=1}^{N} p_{ik}} \times 100,$$

where N is the number of major actors in the system at time t. State A's total relative power score is the average of its relative power on each of the five power indicators:

$$P_A = 1/5 \sum_{i=1}^{5} P_{Ai}$$

Relative power scores are obtained for each of the nine actors at intervals of 5 years from 1816 to 1975. This operationalization captures change in the system as well as in the nation-state, yielding a record of the changing relative capacity of the nation-state to sustain its role in the system.

Fitting the Curve of Relative Power. There are several possible choices for a functional form to fit the capabilities data. The curve must be specified in such a manner that highs, lows and inflections are readily determined, allowing for a straightforward test of our hypothesis; maximizing R^2 is of secondary importance. Indeed, a 33-degree polynomial function could be applied to Great Britain with a perfect fit ($R^2 = 1.0$), for instance, but would have far too many local highs and lows to allow coherent hypothesis testing. The curve must also approximate the shape of the cycle of relative capabilities and be theoretically well grounded.

One curve which reflects this general dynamic is a logistic function describing the growth of a population in a limited environment (Heiss, Knorr, and Morgenstern, 1973; Kuznets, 1966). The logistic growth curve was explored by biologist Raymond Pearl (1924) who deduced that human populations grow nearly exponentially until reaching an inflection point and then level off to approach an asymptote. Because the Pearl logistic curve models growth in the context of limited resources (homologous with growth of a major power's share of relative capability in the international system), it provides a theoretically justified, readily applicable method of finding critical points in the growth of a nation's capability.

The following equation applied to relative capability data incorporates this notion:

$$P_t = \frac{k}{1 + m \cdot \exp\,[F(t)]} + d$$

where P_t is a state's relative power score at time t; t is the year minus 1816 (hence $t = 1, \ldots, 160$); the constants $(k+d)$ and d are upper and lower asymptotes, respectively, established by the state's scores; $F(t)$ is a nonlinear time function of the form $b_1t + b_2t^2 + b_3t^3$ and m is a regression parameter whose values will be determined in the run. This equation is linearized algebraically to

$$ln \; \frac{k}{P_t - d} - 1 \; = ln\; m + b_1t + b_2t^2 + b_3t^3$$

and the dependent variable (left-hand side of equation) is regressed on the independent variables t, t^2 and t^3 to produce the beta coefficients, b_1, b_2 and b_3, and $ln\; m$, the linearized intercept.[1] We thereby find the parameters for the nation's Pearl function, given the asymptotes, that minimize the sum of the squared deviations. Finally, from the resulting least squares fitted equation for the state, one can determine the critical points by the calculus, observing the value of the first and second derivatives with respect to time at each year 1816–1975. The first derivative with respect to time is

$$\frac{dP_t}{dt} = -\frac{k \cdot m \cdot \exp\,[F(t)] \cdot (b_1 + 2b_2t + 3b_3t^2)}{[1 + m \cdot \exp\,[F(t)]\;]^2}$$

When this derivative is at zero, there is a local or global maximum or minimum. When this derivative is at a maximum (local or global), the second derivative is zero and there is an inflection.

[1]To run this on any standard regression routine, one need only set the lower and upper asymptotes (chosen to be slightly outside the smallest and largest data points for the state). For some of the major powers we constrained the linearized equation by setting b_1, b_2 or b_3 equal to zero so that highs or lows calculated to be just outside our 1816–1975 range would fall within that range. Since such a constraint results in one *less* degree of freedom, R^2 goes down, and we thereby reduce the statistical significance of our fit and in no way help us verify our hypothesis.

Findings for the Major Polities. Figure 3 reports for each major actor the regression results for the fitted logistic curve through the actual data on relative power, and the years of the high, low and inflection point(s) of that curve. For each state's graph, values on the vertical axis show its percentage of the total power in the principal actor system at various time points as calculated by the relative power equation.

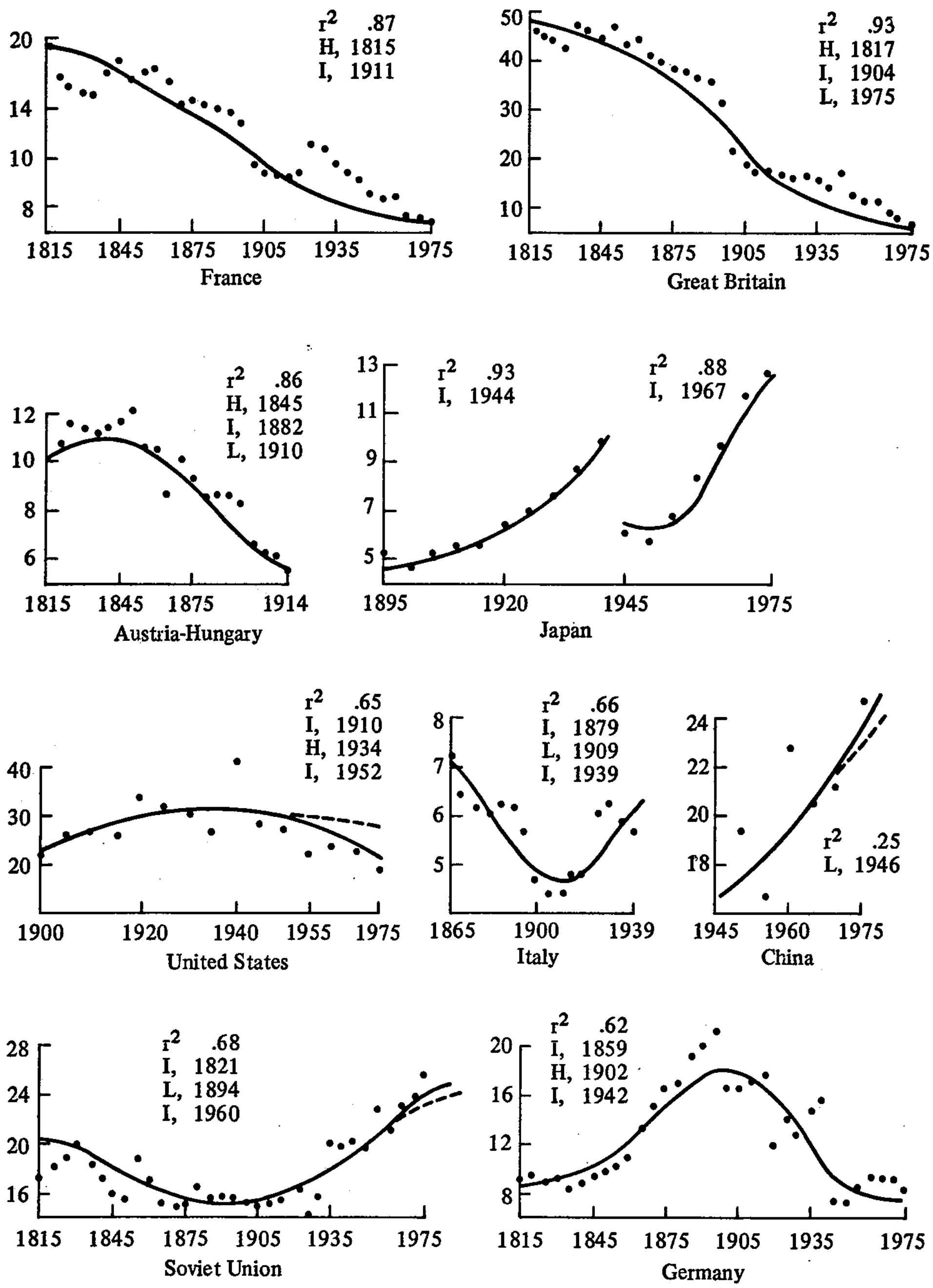
As reported in Figure 3, regression coefficients for the fitted logistic curve and even the R^2 are quite large (R^2 ranging from .65 to .93) in all cases except China where we have only 6 data points. Since we are not fitting curves through each individual nation's points by trial and error, but have employed theory to define a well-specified equation that is applied to each country in the same fashion, it is not likely that these high R^2s have been obtained by chance and the validity of the generalized relative capability cycle is reinforced. It is strengthened further when one compares the nonlinear results against *linear* regression results. The nonlinear results are better for all cases except China and post-World War II Japan (1945–75). In three cases where only a small portion of the nation's cycle is represented, the nonlinear R^2s are, as anticipated, only slightly better than the linear R^2s. Really significant disparities in R^2, however, occur in the four cases where a large segment of the cycle is encompassed in the interval under study, namely, for the United States (.65 versus .05), Prussia/Germany (.62 versus .00), Italy (.66 versus .23), and Russia/Soviet Union (.68 versus .22). Such substantial margins in favor of the nonlinear analysis support the notion that these governments are subject to a similar cyclical dynamic of relative power.

Theory predicts, and the empirical findings sustain, that at any given time a government falls into one of three categories of the general dynamic of relative power: decline, ascendancy, or maturation. The results in each case also are consistent with the historically observed path. France, Great Britain, and Austria-Hungary provide the best examples of nations in relative political decline. An interval of 160 years is insufficient to encompass more than a segment of the cycle of French participation in the system which must have peaked in the eighteenth century before the Revolution and the Napoleonic Wars (Doran, 1971, p. 127). Great Britain shows the greatest fluctuation in amplitude during this interval, namely, a ninefold decline in relative capability from a peak in 1816 to a trough in 1975. Impressionistic historical surveys of British colonialism (Porter, 1975) appear to be upheld in that the bulk of late nineteenth-century imperial activity took place *after* the nation had already embarked upon a downward political trajectory, not before. Austria-Hungary struggled unsuccessfully to maintain its role as one of the five Great Powers of the nineteenth century; these findings reveal that relative political decline preceded and facilitated territorial partition and that partition was not the primary cause of decline.

Ascendancy is most marked for the two eastern powers, Japan and China. Both were comparative latecomers to the modern system. Both have risen rapidly. Neither shows signs of an ascent that has peaked. Japanese growth reveals the phoenix effect (Organski and Kugler, 1977) of an abrupt, roughly 60 percent reduction in relative capability caused by defeat in World War II, followed by recovery some 20 years later beyond the original level of relative status and influence. Although the nature of Japanese and Chinese capability is quite different than for the "superpowers" in that Japanese strength is essentially commercial and Chinese power is inwardly focused on a single region, both states are upwardly mobile and are significant contenders for greater world leadership.

Political maturation on the cycle of relative capability may be differently characterized for the United States and the Soviet Union. Although Russia has been a member of the main system far longer than the United States, the Soviet share of world power, starting from a large base, has increased only gradually and somewhat irregularly in the twentieth century. While relative U.S. capability grew rapidly between 1900 and 1946, short-term fluctuations in that capability during the post-1946 interval have been even more pronounced than for the Soviet Union. These large fluctuations result from a tendency not to support a high level of actualized military potential during peacetime. The Soviet Union, for example, devotes twice as much of its GNP to military expenditures as the United States does, thus maintaining rough military equivalency, but at far greater cost to society. Although both the Soviet Union and the United States appear to be operating at or near the peak on their relative capability curves, the difference is that the Soviet Union seems to be approaching its peak while the United States may have passed that apex (see next section for qualifications).

Italy and Germany require special comment. Italy is the only actor in the system that experienced a serious dip in power during the first decades of the twentieth century followed by something of a resurgence thereafter. This perturbation probably resulted from Italy's inability to keep up with the rapidly industrializing members of the system at the end of the nineteenth century and from a major effort to mobilize military potential later during the interwar period. Germany, on the other hand, displays perhaps better than any actor one complete cycle of the relative capability curve



Source: Drawn from over 40 sources, the data on our 5 indicators of capability are available from the authors upon request.

Key: L = year of low point
H = year of high point
I = year of inflection point

Figure 3. Relative Power of the Nine Major Powers, 1815–1975: Data Points and Fitted Curves

during this interval. The curve peaks in the last decade of the nineteenth century and follows a rather steady decline thereafter, punctuated only by the effort to mobilize German military strength prior to World War II.

To the extent that relative capability is accurately depicted by these curves, the German *revanche* under Hitler was remarkable not for its proximity to victory but for its recklessness and high probability of defeat (Scott, 1965, p. 31) in the face of overwhelming latent military capability elsewhere in the system.

A last interpretive observation is that despite possible exaggeration of Chinese relative capability because of the size of its population and its armed forces, the emergence of the People's Republic of China in the 1970s as a counterbalance to rising Soviet power is perhaps foretold by the apparent slippage in the relative U.S. position, on the one hand, and by the unavoidable recognition of Chinese prominence on the other (Eckstein, 1977). By 1975 the system in some ways had become far less rigid at the top. China became the new "holder" of the external balance.

U.S., China and Russia: A Reliability Check with Updated Indicators. Each of the empirically determined relative power curves is supported by the historical record from 1816 through 1970. Only during the last decade do some scores appear counter-intuitive: in 1970, for instance, the USSR apparently enjoys 24.9 percent of the system's power, China some 24.7 percent, and the U.S. only 20.0 percent. As already suggested above, the use of population and armed forces size undoubtedly exaggerated China's relative capability score. Furthermore, such indicators rapidly became archaic with the advent of high technology and nuclear capability. To test the reliability of our findings for the most recent period, we constructed a second index over the period 1966–75 (two-year intervals) from recently released data. Defense spending replaced arms forces size and GNP per capita replaced urbanization.

Comparison of the two indices for China, USSR and the U.S. (Figure 4) reveals two important facts about relative power dynamics. (1) More relevant data in the contemporary period do yield intuitively meaningful scores for the magnitude of relative power held by each state. U.S. relative capability increases while Soviet and especially Chinese capability are translated downward. (2) On the other hand, the new data do not change the patterns of relative capability; here U.S. relative capability again trends downward while both Soviet and Chinese relative capability gradually increase. Indeed, a correlation of the slopes across new and old data reveals as *r* of .98. Hence only the intercepts changed, not the slopes (and it is the slopes of the relative capability curve which are at issue in our war hypothesis). The dynamic of relative capability appears to be quite invariant across a broad mix of power indicators.

War and the Cycle of National Capability: Empirical Findings

In this section we examine empirically our hypothesis that wars initiated by a major power at critical points on its relative capability curve are likely to be more extensive than wars it initiated at other times. Our research design incorporates a dependent variable carefully defined to allow a rigorous test of this hypothesis.

Defining the Dependent Variable. The data set for the dependent variable consists of 77 cases of war initiation by a major power, each coded in terms of magnitude, severity and duration.

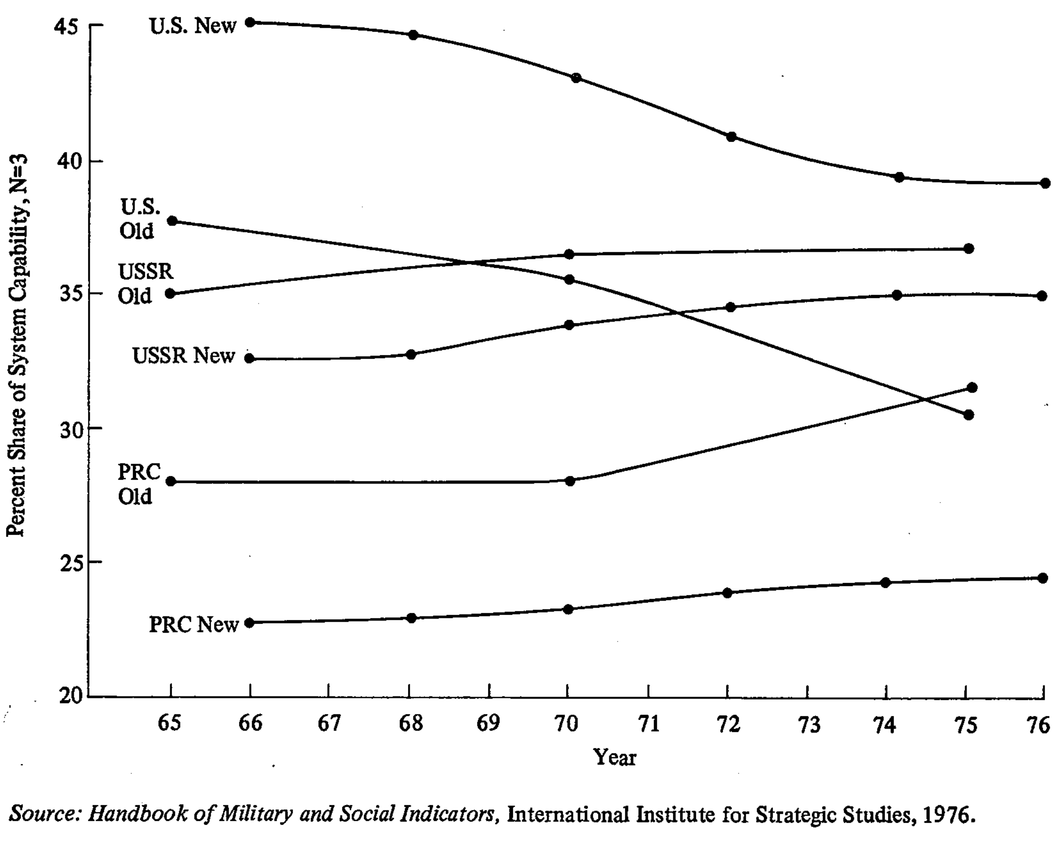
We define the war initiator as the actor that (1) has the capacity to use force against an enemy's territory or population and (2) either strikes first with massive force or allies with the government that first uses massive force and thus abets its military action. The *Correlates of War Project* (Singer and Small, 1972) uses a slightly more restrictive definition of "initiator," but neither definition seeks to identify an aggressor. We believe the definition of war initiation should be sufficiently inclusive to allow consideration of (a) wars that the major powers have waged against minor powers, states on the edge of the system, and colonies, and (b) the role played by formal military allies in support of hostilities.

Our dependent variable is drawn in part from the *Correlates of War Project*, in our opinion the highest-quality data collection of its kind available. Using our definition of war initiation for the nine major actors in our sample, we have compiled a list of 77 cases. These include the 25 cases of interstate war initiation in the Singer and Small collection in which a major power is considered to be the initiator. To these we have added 17 cases in which other major powers have been associated as military allies and 6 cases that result either because Japan and the United States were considered to be major powers as of 1895 or because we extended the end point beyond that of the original collection to 1975. In addition, in concurrence with our definition of war initiation, our study includes 29 cases of so-called extra-systemic war involving a major power and a minor power outside the principal system.

We next coded each case of war initiation according to severity, duration, and magnitude in order to obtain measures of the extent of each. In one sense, all of the wars are extensive wars by definition. The minimum threshold for inclusion in the data base from which the bulk of our wars were drawn was deployment of 1000 troops by the major power and a total of more than 1000 battle deaths; these criteria precluded establishment of a minimum duration threshold (Singer and Small, 1972, pp. 35–36). We wish, however, to refine the concept of extensive war so as to distinguish varying degrees of escalation within this set of wars along three indicators. In our research design, we define extensive war as a violent foreign conflict that ranks high on the variables duration, severity and magnitude. Duration is indexed in months. Severity is measured by the number of resulting battlefield deaths. War magnitude is similar to the characterization Blainey uses to describe "general war," namely, the sum of the inverted quintile diplomatic ranks of the participants (1973).[2] A further index of war, frequency, is measured in terms of wars per unit of time and is a fundamentally different type of indicator from duration, severity, and magnitude, which are measured as extent per war. Our hypothesis, it will be recalled, involves the extent and not the frequency of war. Extensive war is therefore a foreign conflict of long duration, great severity, and/or high magnitude.

[2]For example, a war involving France, Denmark, and an international system nonmember would have a magnitude of 9.5 for France's first quintile, 3 for Denmark's third, and 1 for the system nonmember. Quintile ranks were obtained from Singer and Small (1966, pp. 236–82).

Research Design and Findings. According to Hypothesis 1, the probability of a major power's initiating a war that becomes extensive is highest at "critical points" on the cycle of relative capability where the rate of relative power growth (or decline) reaches a maximum or where relative power itself peaks or bottoms out, disrupting past trends and the linear or monotonic role aspirations of state leaders and societies. In operational terms, these changes occur, respectively, at the two inflection points, where the second derivative is zero, and at the two turning points, where the first derivative is zero. An outline of the various tests of the basic hypothesis is found in the appendix.



Source: Handbook of Military and Social Indicators, International Institute for Strategic Studies, 1976.

Figure 4. Relative Power Curves, 1965–76: U.S., USSR, China

Our research design confronts a problem facing all events-data research, a problem inherent in the nature of behavior/perception and actor/observer relationships and not peculiar to this analysis. The problem is to encompass four types of theoretical variation: (1) objective change in relative power, (2) perception, perhaps anticipated or delayed, of objective change by the actor, (3) the behavioral response of the actor, and (4) measurement of the objective change and behavioral response as recorded by the analyst. Since perceptual data are not available, we collapse these types of theoretical variation into categories (1) and (4), yielding for purposes of discussion objective critical points (OCP) and empirically determined critical points (ECP). We recognize, however, that categories (2) and (3) may affect category (4) such that OCP and ECP do not always correspond, and our research design therefore directly addresses how this possible disparity would affect the statistical test of our causal hypothesis.

The research design treats all of the data points as real in theoretical terms; none are to be considered statistical outliers. Although we discuss some actor war experience in its historical context to answer questions of alternative explanations or causal direction, the purpose of the research design is to emphasize the *generality* of the theoretical proposition and hypothesis concerning major power behavior and not to dwell on the idiosyncracies of individual cases. Given the problems of collecting data on the independent variable over such long periods, measurement error, and inability to deal with perceptions directly, only very general findings *on the statistical average* can be reported to support rejection of the null hypothesis. Support for causality includes theory and a series of carefully designed tests explicitly addressing the causal issue. Although the work here is subject to the same qualifications regarding causality experienced throughout the social sciences, alternative hypotheses have been considered, multiple tests using a variety of techniques have been performed, and every precaution of which we are aware has been taken throughout to assure validity of results.

Test A. Comparing the Initiation of Extensive War in Critical Periods and Remaining Intervals

As a first test of our hypothesis, we isolate critical periods around the inflection and turning points of the nation-state curves, and then compare our measures for wars initiated in these periods with corresponding war measures for the remaining interval using a comparison of means test. A critical period is defined as a 16-year interval beginning 3 years prior to any turning or inflection point and extending 12 years beyond. The purpose of the interval was to provide sufficient room for error in identifying the critical point since the analyst has only a sample (collected at 5-year intervals) of rather crude indicators of the changes in relative power spanning some 150 years of history. The problem is one of reliability and not of validity. Regardless of whether the analyst is able to identify its precise location, an objective critical point may exist in historical fact as well as in theory, and state leaders of the period may have far less difficulty in noting its occurrence because of access to more sensitive indicators and because of virtual day-to-day diplomatic "tests" of these fundamental relationships and of their implications for policy.

Hence for reasons of measurement error alone, one might expect that the objective critical point (OCP) may in fact have occurred within 5 years either side of the empirically determined critical point (ECP). In addition, however, perception and response by state leaders to the OCP may in some instances also affect the location of the ECP. For instance, leaders may perceive the OCP at or slightly before its occurrence and respond by initiating a major war. The ensuing mobilization effort, especially a very extensive one, may tend to *increase* relative capability scores. The effect of this rise in relative capability on our determination of the ECP depends on the type of critical point.

Three of the four critical points involve a *decrease* in relative capability level itself (high and second inflection) and/or a *declining* rate in relative capability growth (first inflection and high). Increases in relative capability due to massive war mobilization are counter to the trend at these three critical points and hence *cannot cause them.* Furthermore, because the data on relative capability incorporate this temporary aberration in the trend line during the early years of such wars, *the ECP is likely to fall after the OCP.* In other words, the greatly increasing relative capability scores which occur when massive mobilization follows the OCP may mask the OCP to such a degree that statistical analysis will yield an ECP occurring at a later date. Thus for such cases, the response itself introduces a measurement error which can only be overcome by extending slightly backward the temporal interval around the ECP. The problem occurs not for the actor, we reiterate, but for the subsequent analyst attempting precisely to identify the critical point. The situation is reinforced slightly by the fact that perception of the OCP itself may precede the OCP by a very short interval.

Thus, because of both measurement reliability and the mediating effect of perceptions and behaviors on our events data and analysis, a rigorous test of our hypothesis can and perhaps must incorporate a small region of error *prior* to the empirically determined critical point. Problems of causal direction would arise only if our data include cases of war initiation within this prior interval which are associated with the fourth type of critical point (low point). A review of our data revealed that the three years prior to our ECPs encompass only three war initiations (Germany and Japan in World War II and the United States in the Korean War), each of which is associated with one of the three types of critical points which could not be caused by the war initiation, and each of which involved in the early war years a disproportional mobilization effort by the initiator and disproportionate war losses by the opponents sufficient to push forward the location of that critical point in the statistical analysis. Furthermore, including the fourth year prior to our ECPs adds only two more war initiations, each of which again is associated with one of the appropriate kinds of critical points. We thus can choose 3 or even 4 years prior to the ECP as part of our region of uncertainty without violating the causal direction of our hypothesis.

The region of uncertainty should also include at least 5 years after the ECP, given our sampling interval. But perceptual lags and delayed responses may postpone the *effect* of the critical point another several years. We decided to include 12 years after the ECP as part of our interval to encompass these factors. The number 12 was chosen since it yielded a 16-year critical interval, one-tenth of the total 160-year period.[3]

Although we reduce the problem of identification error by establishing such a critical interval, we increase the likelihood that our results will not be statistically significant because more years of random variation have been encompassed. For the nine major powers there were 23 critical periods from 1816 to 1975 in which 26 wars were initiated. The remaining intervals contained 51 initiations of war. We compare the wars in the two intervals on each of the indexes of war extensiveness.

As reported in Table 2, the means for magnitude, severity, and duration are much higher in the critical periods than in the remaining intervals. The principal conclusion is that *a major power is more prone to initiate a war that becomes extensive (i.e., escalates) during one of the critical periods on the cycle of relative power than at other times.* This is true at an acceptable level of statistical significance for all three measures of war extensiveness; the level of significance is highest when war is measured in terms of magnitude.

Although our data collection for both the dependent and independent variables began with 1816, theoretical and historical observation which suggested the theory covered as well the prior 200 years of the modern state system (Doran, 1971). Major hegemonic wars were initiated at historically recognized critical points in their relative power by the Hapsburgs in the early sixteenth century, by Louis XIV at the turn of the eighteenth century, and by Napoleon at the turn of the nineteenth century. Hence the larger wars in our sample, such as World Wars I and II, are not outliers in the theoretical or the statistical sense. Indeed, that some of the biggest wars of the present century tended to fall in critical intervals for initiator states is in fact strong support for the theory relating critical shifts in relative capability and extensive war of the hegemonic type.

Test B. Extensive War and Temporal Proximity to Critical Points

We here test the more rigorous statement of our hypothesis, namely, that the level of extensiveness of wars initiated by major powers varies inversely with the temporal distance from the critical point. This test is much tougher than Test A not only because it examines a specific inverse relationship between proximity to a critical point and war extensiveness, but also because it does not incorporate a margin of error around the ECP. In particular, the three wars included in Test A by use of an interval beginning 3 years prior to the empirical critical point operate against the hypothesis in this test since they now have negative distance scores.

In discussing the research design, it is helpful to recall our visualization of a time line with markers locating critical points and dots locating war initiations, both color coded to distinguish between nation cases. According to our hypothesis, if the size of each dot is proportional to that war's score on a given measure of war extensiveness, then the size of the dots of a given color will diminish as one moves away from the preceding marker of that color. Since we use three measures of war extensiveness, we would have three such lines. We used linearized least squares to test this hypothesis. The function that describes the inverse variation is $W = 1/T + v$, where W is either magnitude, severity or duration of war; T is the

[3]To ensure robustness for this statistical test, we selected a second narrower interval of 10 years (3 years prior and 6 years after the ECP) as a control. If the results are statistically significant for this interval as well, we can have some confidence that the results are not a mere artifact of one artibrarily selected set of temporal limits. The findings were indeed significant at or below the .05 level for the control on all three measures of extensiveness.

Table 2. Extensiveness of Wars Initiated by Major Powers: Comparison of Means Between Critical Intervals and Remaining Intervals

Variable	Group	No. of Wars	Mean	T-Value	One-Tail Probability
Magnitude	Critical Periods	26	28.4	3.07	.003
	Remaining Interval	51	11.1		
Severity	Critical Periods	26	337357	2.02	.027
	Remaining Interval	51	22169		
Duration	Critical Periods	26	28.0	1.36	.092
	Remaining Interval	51	18.6		

Source: For each war initiated by a major power, the authors compiled measures of duration, severity, magnitude and distance from the preceding critical point on the initiator's relative power curve. The initiators of 25 of the wars were coded from J. D. Singer and Melvin Small, *The Wages of War* (New York: Wiley, 1972), pp. 368–69; the other 52 cases were coded by the authors and resulted from differences in the definition of initiation and in the major power subsystem.

distance in time from the critical point to the war; and v is an intercept whose value is determined by the data.

We distinguish three cases to encompass possible perceptual or behavioral mediation and alternative causal explanations. Case 1 is a straightforward test of the hypothesis and assumes that the effect of the critical point on extensive war initiation can begin at the critical point itself; hence it calculates distance of each war from the ECP (markers on the line are not shifted). Case 2 tests whether the effect of the critical point is necessarily postponed due to perceptual lags, delayed responses, or efforts at adjustment; in other words, whether one obtains better results if the ECP markers on the time line are shifted to the right by k years, $k = 1$ to 15. Case 3 addresses counter-causal explanations, namely, the possibility that war initiation (or, given large enough leads, defeat) might cause the critical point. Although examination of the data in the previous section revealed that these explanations are not valid for the 4 years prior to our ECPs, one must determine whether a significant relationship exists for war initiations leading the ECP by 5 or more years (markers shifted to left by $k \geqslant 5$ years). In each of the three cases, the independent variable is the ECP or the shifted ECP, and the dependent variable is war initiation by a major power.

Results of all three cases support our hypothesis. In Case 1, although the correlations were smaller than in Test A as anticipated, all three indexes of extensive war yielded Rs that were positive and statistically significant: magnitude ($R = .541$, $p < .001$), severity ($R = .208$, $p = .036$), and duration ($R = .194$, $p = .045$). For Case 2, correlations in general remained positive but decreased through the tenth year, and only duration at Lag 10 was statistically significant after year 6. All correlations beyond 10 years are numerically as well as statistically insignificant. These results suggest that some of the effect of the critical point may in fact be delayed. But because the results in Case 1 are stronger than those involving lags, and because the highest coefficients for lags occur nearest the no-lag of Case 1 and hence may merely reflect uncertainty in location of the critical point, the impact of the critical point appears to be a rather abrupt one. Finally, even though Case 3 (counter-causal hypothesis) is the only test in this series which gave a positive distance score for the three massive wars of Test A's prior interval, only one out of more than 25 correlations was positive and significant, that for severity at Lead 5 ($R = .20$, $p = .05$); no other correlation was statistically significant and, except for three which were near .10, all the others were near 0 or negative. Since *no* relationship was found for any of the other leads or other measures of war extensiveness, the result for severity at Lead 5 may be interpreted as a consequence of the extremely high severity scores for the two World War II initiations located at $T = 2$ for Lead 5. Recalling that these wars contributed negatively to the correlations in Cases 1 and 2, correlations which were positive and significant and supported the direction of our causal hypothesis, we can conclude that the series of tests made here render our hypothesis valid.

Test C. War Frequency

We have thus demonstrated that the relationship between relative capability and war initiation holds for extensive war initiated by a major power, but does it hold *only* for extensive wars? In other words, is the relationship true for all wars initiated by major powers regardless of size? Since the frequency measure does not discriminate among wars according to size, a relationship between frequency and relative capability would cast doubt on the "extensive war" hypothesis. However, the raw scores clearly indicate that war frequency and relative capability are *not* associated. Little difference exists between the mean number of wars initiated by major powers in the critical intervals and the mean number of nation years comprising the critical periods. Of the 77 instances of war initiation between 1816 and 1975, a total of 26 (34 percent) fall in critical periods. Of the 1017 total nation-years of war in the 1816–1975 interval, some 312 (or 31 percent) occurred during critical periods. These results indicate that about the same frequency of major power war initiation occurred per nation-year for the critical periods as for the interval as a whole; hence frequency appears unrelated to the rate and direction of change in relative capability. But wars initiated by major powers near critical points escalate beyond major power wars further removed.

Test D. At Which Point Is Extensive War Most Likely?

We address one more question about the relationship between relative capability and major war. At which of the four critical points is a nation *most* likely to initiate extensive war? Of the critical periods located around turning points and inflection points, which is the most dangerous? Each of the war indicators (magnitude, severity, duration, and frequency) is summed for wars initiated in each type of critical period (lows, first inflection points, highs, and second inflection points). We divide each sum by the number of each type of period to normalize for varying international system experience (Table 3). The inflections, where $d^2y/dt^2 = 0$ and dy/dt attains its maximum plus or minus value, are clearly most prone to extensive war, ranking first in the four measures of war. Turning points, where $dy/dt = 0$ and y attains its maximum plus or minus value, place second in the same measures.[4] Thus major powers are most likely to initiate war that escalates as the *acceleration* of growth (or decline) in the relative power slows to a halt and changes sign; or expressed in terms of the first-order derivatives, a major power is most likely to initiate extensive war as its *rate* of growth in relative capabilities (dy/dt) reaches a maximum (first inflection) or minimum (second inflection). Likewise, of the four critical points, the second most likely time when the nation will initiate extensive war occurs when the *rate* of change in its relative capability has reached zero, that is, when the relative capability itself (y) has attained its maximum or minimum value (high and low points).

In sum, the key idea of our theory is that major power involvement in extensive war results in large part from over-reaction in the crisis setting imposed by power changes at critical points in a country's history, thus precipitating serious disputes and war that escalates because the government feels seriously threatened and refuses to withdraw. The theory does not deny that a war is extensive in part because a powerful actor is in-

[4]We also compared types of critical periods by using a regression format. Each high, low, or inflection is represented by a dummy variable and then correlated with the measures of war. The results corroborate Table 4, namely, inflections do best, then highs, then lows. In addition, we regressed the types of critical periods as independent (along with T, the distance in time from war to the critical point) on the measures of war; in each case the rise in multiple Rs over the bivariate Rs is virtually nil (ranging from .002 for magnitude to .101 for duration), again substantiating our findings.

Table 3. Relationship of Four Critical Intervals to Mean Levels of Extensiveness of Wars Initiated by Major Powers

	Low	First Inflection	High	Second Inflection
Wars/Period	$\underline{.86}$	$\boxed{1.00}$	.56	.75
Severity/Period	306,576	217,702	$\underline{383{,}324}$	$\boxed{607{,}023}$
Duration/Period	$\underline{31.4}$	29.0	21.4	$\boxed{48.2}$
Magnitude/Period	21.4	$\boxed{50.6}$	39.2	26.2

Source: For each war initiated by a major power, the authors compiled measures of duration, severity, magnitude and distance from the preceding critical point on the initiator's relative power curve. The initiators of 25 of the wars were coded from J. D. Singer and Melvin Small, *The Wages of War* (New York: Wiley, 1972), pp. 368–69; the other 52 cases were coded by the authors and resulted from differences in the definition of initiation and in the major power subsystem.

Key: $\boxed{}$ – Most Extensive Measure

$\underline{}$ – Next Most Extensive Measure volved (e.g., minor actors are unlikely to generate extensive war in isolation), or because of other factors such as type of weaponry used or the behavior of allies. But the theory asks why powerful governments fight some wars that are large and others that are small, because they have in practice done both, and more importantly, *when* they are likely to fight extensive wars. The central issue is not *who* but *when*. *When* will a major government use sufficient force and resolve to initiate a war that becomes extensive? Without denying that there are other collateral causes of war escalation, our findings show that most extensive wars involving major powers are not initiated at the top of their relative capability curves as is popularly supposed. Nor, despite the fact that war in general is distributed randomly over the 1816–1975 period, are the extensive wars initiated by major powers distributed randomly. Rather, it is at critical points along the national cycle of relative capability that the propensity by major powers to initiate wars that become extensive is highest.

Implications of the New Research Focus for Future Analysis

During critical intervals on a nation's curve of relative capability, secondary forces may catalyze or constrain the actor's propensity to initiate extensive war: (1) structures and attitudes *internal* to government and society; and (2) *external* behavior at work within the international system.

Internal Catalysis and Constraint. Properly modeled and coded, regime type and social class structure may be found to have profound secondary effects on the propensity to get involved in wars that escalate. The pluralism of democracy (Grew, 1978, pp. 31–37), and the liberal, commercial outlook of the middle classes often hinder the unanimity of outlook necessary for the kind of expansionist foreign policy witnessed under a Louis XIV, a Napoleon, a Hitler, or an autocratic Japan. Nineteenth-century Britain, for example, was no less subject to hegemonic pressures than Germany, but the government was less able to exploit these pressures because of parliamentary opposition, an inability to subordinate commercial to power concerns, a critical press, and other internal checks and balances common to democracy. The greater the degree of totalitarian control over foreign policy, and the greater the extent of cultural and class support for the military ascendancy of the state, the more dangerous the critical point in the cycle of relative capability.

Impact of External Systemic Factors. One important external influence on the propensity to initiate extensive wars during the critical period is the nature of alliance association (Singer and Small, 1968; McGowan and Rood, 1975; Silverson and Duncan, 1976; Job, 1976). Opinion is divided regarding whether, in general, alliances increase the probability that a participant will get involved in war (Choucri and North, 1974, p. 220) because other members drag it into extraneous entanglements, or whether alliances decrease the probability of war for the participant because membership helps ward off powerful potential aggressors. Alliances are not likely to discourage the determined initiator of war and hence the kind of war that tends to escalate. Indeed, alliances may spread the effects of such war throughout the system, thereby escalating the conflict further.

Singer and Small (1968) have found that alliance association and war are directly associated in the twentieth century but inversely associated in the nineteenth century. Since the larger wars after 1815 have occurred in the twentieth century whereas wars tended to be smaller in the prior century, the size of wars, suitably measured, may indeed be a function of alliance characteristics. Alliances may hinder small wars (negative association) and catalyse larger wars (positive association). Alliance participation may also reduce the potential of war initiation in non-critical intervals and/or further increase the initiation of war in the critical intervals when the probability of extensive war initiation is higher.

Conclusions

Since the origins of the modern state system, nations have followed a cycle of relative capability marked by political ascendancy, maturation, and decline. Applying a single theoretically justified equation to nine major powers, we have demonstrated that each has traversed at least a segment of this cycle in the nineteenth and twentieth centuries. Variance explained ranged from 25 to 93 percent and yielded far better results than the linear, null equivalent.

At critical points on the capability cycle, namely, at inflection points and turning points where the linear role perceptions held by the government and society (reflected in the slopes) are abruptly changed, the probability that the state will initiate extensive war was also greatest. This was true whether war extensiveness was defined in terms of severity, duration, or magnitude. It appears that governments and societies find adjustment to new behavioral roles difficult and become vulnerable to hyperinsecurity and aggressiveness at critical points where the direction of the evolutionary outlook changes pervasively.

The theory, suggested to explain three major-power hegemonies in the pre-1816 period, was successful in predicting major-power war behavior for the years 1816–1975. The initiation of extensive war by a major power is not a random event. An understanding of the major power cycle of systemic participation may thereby bring us somewhat closer to an understanding of the causes of some of the most serious wars. Further study of this relationship may provide clues to the prevention of extensive war at the points of its highest probability.

Appendix: Research Design for Testing Hypothesis 1

Test A

Purpose: To compare the propensity of major powers to initiate extensive war in critical and noncritical intervals.

Special Considerations: Delineates a critical interval to reduce error associated with possible incorrect statistical identification of an objective critical point (OCP) due to uncertainty in measurement (5-year data points) and to mediating effect of perceptions and behavioral response of state leaders.

Verifies that the 4 years prior to our ECPs contain only cases which logically cannot support a counter-causal hypothesis.

Establishes critical interval 3 years prior to and 12 years beyond the empirically determined critical point (ECP) rather than equally around it.

Technique: Comparison of means (t-test).

Findings: Initiation of major power extensive war (reflected on each of three indicators) is more likely in the critical intervals than at other times.

Test B

Purpose: To establish the importance of proximity to critical points for the initiation of extensive war by major powers (causation from CP to war).

Special Considerations: No margin of error in ECP incorporated (poorer correlation results likely.)

Case 1. Assumes the effect of CP on extensive war initiation need not be delayed and hence calculates distance of the war from the ECP.

Case 2. Calculates war distance from a point lagged k years ($k = 1$ to 15) after ECP, to test whether effect of CP is *necessarily* postponed due to perceptual lags, delayed responses, or efforts at adjustment.

Case 3. Calculates war distance from a point leading ECP by k years ($k \geq 5$) to test for counter-causal relationships (war initiation or defeat as cause of CP).

Technique: Linearized least squares.

Findings: Case 1. Positive correlation with statistical significance for all three measures of extensive war.

Case 2. Continued positive correlation (some of effect of CP may be delayed), but no improvement over results of Case 1 (impact of CP is hence comparatively abrupt).

Case 3. No relationship, hence counter-causal arguments rejected.

Test C

Purpose: To determine whether critical points influence the frequency of war initiated by major powers, regardless of extensiveness.

Technique: Least squares regression.

Findings: No relationship.

Test D

Purpose: To determine which of the critical points is most likely to affect major power propensity to initiate wars that become extensive.

Special Considerations: Incorporates critical interval as in Test A.

Technique: Analysis of means.

Findings: First and second inflection points are most critical.

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