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*The Contagion of Great Power War Behavior, 1495–1975**

Jack S. Levy, *University of Texas at Austin*

Hypotheses regarding short-term contagion in the outbreak of war involving the Great Powers were tested using war data for the modern Great Power system, 1495–1975. The analysis demonstrates the likelihood of initiation of a new war to be slightly greater during an ongoing war but not after its termination. Neither war's incidence—its seriousness along any or all of several dimensions—nor its frequency had any impact on the subsequent outbreak of war in the period immediately following.

War has often been viewed as a disease, and several scholars have suggested that the study of war could profit from the adoption of some of the concepts and models of epidemiology, the study of disease (Beer, 1979; Boulding, 1965; Alcock, 1972). One example pertains to the diffusion of international conflict over time and space, much like the epidemiologic phenomenon of the spread of contagious disease. There has been considerable theoretical discussion of the contagion of wars and a number of recent attempts to formalize and test the general hypothesis that the occurrence of war at one point in time has an impact on the likelihood of subsequent war.

The aim of this study was to test the contagion hypothesis with respect to the war behavior of the Great Powers over the last five centuries of the modern system. There are many variations of contagion, however, and before we constructed an appropriate research design it was necessary to identify and categorize these various theoretical linkages.

Conceptualization of War Contagion

Theoretical arguments regarding war contagion fall into two categories, depending on whether war increases or decreases the likelihood of subsequent war. Explanations of how war might beget war include the following: (1) The victorious state may be stimulated by its success and its newly acquired power and seek to further its gains (e.g., revolutionary France); (2) The defeated state may move to recover its losses from an earlier war (e.g., Austria after the Silesian Wars) or overturn a punitive peace settlement (e.g., Germany after Versailles); (3) A dispute over the

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division of the spoils of war may turn the victorious states against one another (e.g., the Second Balkan War); (4) The expansion of an ongoing war by the use of military force against nonbelligerents may be perceived as necessary for victory or the achievement of other national objectives (e.g., the Japanese attack against Pearl Harbor as an expansion of the Sino-Japanese War); (5) Third states may intervene in order to defend an ally, protect their own interests, maintain the existing balance of power, or perhaps demonstrate their own credibility (e.g., World War I); (6) These nonbelligerents may perceive that their rivals have been militarily weakened or diplomatically isolated by war and decide to exploit this opportunity and intervene militarily (e.g., the Italian intervention in the Austro-Prussian War); or (7) Seeing that third states are engaged in a war that precludes their intervention elsewhere, a state may take that opportunity to advance its interests by force in another country (e.g., the French invasion of Mexico in 1862).

There are also a number of arguments why war, rather than begetting war, should reduce the likelihood of subsequent war: (8) War may deplete a nation's resources and leave it incapable of fighting another war; (9) War, and particularly unsuccessful war, may generate the belief that another war should not be undertaken unless the likelihood of victory is nearly certain; (10) War, and particularly unsuccessful war, may induce a change in the political elite and bring to power those committed to a more peaceful policy; (11) War, especially long and destructive war, may generate a general revulsion against violence and an immunity against subsequent war until the memory of war gradually fades. This is the well-known "war-weariness" hypothesis. Richardson (1960), for example, argues that "a long and severe bout of fighting confers immunity on most of those who have experienced it"; (12) This war-weariness may even inhibit subsequent war by others (e.g., the systemic effects of the U.S. use of the atomic bomb) though this may be rare; and (13) A war between states A and B rendering the subsequent use of force by state C unnecessary against the weakened loser and too risky against the strengthened winner is a more likely form of negative contagion.

Toynbee also speaks of war weariness (1954, pp. 322-323) and the resulting cycles of war and peace. He suggests, however, that these cycles can be better explained in terms of the underlying dynamics of the international system (1954, pp. 251-254, 323). A bid for world domination evokes a defensive coalition of all other Great Powers and a "general war" to maintain the balance of power. The result is the defeat of the "archaggressor" and a "breathing-space" of peace. This is an uneasy, transient, and improvised peace, however, for the unsettled issues over which the general war was fought are not yet capable of resolution. The result is a burst of short and relatively mild wars ("supplemental wars")

that resolve the outstanding issues and generate a tranquil and lasting "general peace." Ultimately, the gradual building of new forces explodes into a new episode of general war as a new Power seeks domination, and the cycle begins anew, approximately once every century.¹

There are, of course, other cyclical theories of war. Closely related to Toynbee's theory is Modelski's "long cycle" of global politics and wars, driven by the struggle for world leadership based on military power of global reach (Modelski, 1978). Doran and Parsons (1980) speak of a cycle of national power and wars governed by internal capability changes and political dynamics rather than international interactions. Other cyclical theories are based on business cycles (Macfie, 1938; Secerov, 1919), American isolationism and interventionism (Klingberg, 1952), and even astrological phenomena (Sorokin, 1937, p. 353).

It is clear that there are a number of ways in which the occurrence of war may affect the likelihood of subsequent war. These involve different kinds of contagion and different causal linkages operating at different levels of analysis and over different temporal periods. A state's participation in war may lead to subsequent war behavior by that same actor, as suggested in arguments 1-4 above. This is what Davis, Duncan, and Siverson (1978, p. 777) call "addiction" and Most and Starr (1980, p. 933) call "positive reinforcement." Also, war behavior by one dyad may increase the likelihood of war involvement by other actors (arguments 5-7 above). This contagion process involves new actors and is analytically distinct from addiction. It is referred to as "infection" (Davis, Duncan, and Siverson, 1978, p. 778) or "positive spatial diffusion" (Most and Starr, 1980, p. 933).² Contagion can also be negative. War participation by one actor may reduce the likelihood of subsequent war behavior by the same actor (arguments 8-11), which Most and Starr (1980, p. 933) call "negative reinforcement," or war behavior by some may reduce the likelihood of subsequent war behavior of others (arguments 12 and 13), referred to as "negative spatial diffusion" (Most and Starr, 1980, p. 933).

The cyclical theories mentioned above are more difficult to fit into neat analytical categories. The phenomenon of long-term periodicity or cyclical fluctuations in war is generally thought of as distinct from contagion and involving different causal linkages, but this distinction has not

¹ Toynbee (1954, pp. 234-287, 322-327) applies his theory to the post-Alexandrine Hellenic and post-Confucian Sinic international systems as well as the Modern Western System (1494 on).

² It would be useful to make the further analytic distinction between two kinds of infectious contagion: the intervention by external actors in an ongoing war and their initiation of a new war. This distinction involves the systemic level of analysis and the difficult question of how a single war is to be defined.

been adequately conceptualized.³ Davis, Duncan, and Siverson (1978, p. 776) differentiate between contagion and heterogeneity and appear to classify most cyclical theories of war as involving time-heterogeneous processes. Here the probability of war is a function of time; "the evolution of the process may be governed by different rules at different times" (Davis, Duncan, and Siverson, 1978, p. 776). This analytical distinction between contagion and heterogeneity is valid if the cyclical fluctuations in war are driven by factors themselves generated independently of war (e.g., climatological or seasonal changes). Yet many of the factors generating fluctuations in war behavior are themselves affected by previous war, and in this case the distinction between contagion and heterogeneity begins to blur. Davis, Duncan, and Siverson recognize the fact that "warfare changes the factors which determine the future incidence of warfare," and that these other sources of time heterogeneity are "not so easily handled" (1978, p. 776). Thus contagion and heterogeneity are very difficult to distinguish empirically.⁴ It appears that the implicit criterion most often used to distinguish between war contagion and cyclical theories of war is simply time. Contagion refers to relatively short-term causal effects (less than five or ten years at the most), while most cyclical theories posit wavelengths of at least twenty years. Without further development of this point we shall restrict this study to the analysis of short-term war contagion rather than periodicity, for the latter has been examined extensively in the literature.

Empirical Studies of Contagion

There have been several empirical studies of the war contagion hypothesis. It is consistently found that the *outbreak* of war is random rather than contagious, regardless of whether we look at short-term contagion or long-term periodicity. Sorokin (1937, pp. 352-360) finds "no regular periodicity, no uniform rhythm, no universal uniformity" in war during the ancient Greek system or in the European system. He finds little more than a "trendless shifting in the rhythm and in the number of recurring internecine wars" (p. 359). Nor does Richardson (1960, pp.

³Nor is this distinction always explicit in the empirical literature on contagion. Much of this literature is descriptive rather than explanatory, focusing on whether contagion exists rather than its possible causes. While the explanations for these phenomena may be different, many of the mathematical models are the same (with different parameters, of course) and the same statistical methods are used to analyze both phenomena.

⁴Given the interrelationships among many social phenomena, the main question is not the simple existence or absence of a causal connection with earlier war, but rather the relative strength or weakness of the causal effect and its proximity or remoteness along the causal chain. This is hardly conducive to a neat, analytical distinction or a practical operational criterion for differentiating between heterogeneity and contagion.

128–131) find any periodicity in the data of Wright (1965) for the last five centuries.⁵ Singer and Small (1972, pp. 205–207) reach the same conclusion for the 1815–1965 period, confirmed again by Singer and Cusack (1981).⁶ There is some tendency, however, for victorious states to be more inclined to embark on another war (Singer and Small, 1974). Singer ultimately rejects the notion of periodicity in warfare. He and Cusack (1981) argue that “the evidence does not support the cyclical view; the intervals are too irregular, and the occurrence of war entries have been indifferent to the passage of time since the prior war. Moreover, when we control for the outcome of the prior war or its duration or its fatality level, we still find that the probability of the next war entry is basically unrelated to the passage of time.” We also quote Sorokin (1937, pp. 359–360): “History seems to be neither as monotonous and uninventive as the partisans of the strict periodicities and ‘iron laws’ and ‘universal uniformities’ think; nor so dull and mechanical as an engine, making the same number of revolutions in a unit of time. It repeats its ‘themes’ but almost always with new variations. In this sense it is ever new, and ever old, so far as the ups and downs are repeated.” As Sorokin concludes (1937, p. 360), “So much for periodicity, rhythms, and uniformity.”

While the outbreak of war does not appear to be contagious or cyclical, evidence has been accumulating that the expansion of war is characterized by contagion. That is, a war already under way may expand by drawing in external actors through an infectious process. Davis, Duncan, and Siverson (1978) focus on the dyad rather than the nation as the unit of analysis and conclude that the outbreak of dyadic war over the 1815–1965 period follows an infectious contagion model. This infection is enhanced by geographical contiguity, as Richardson (1960, pp. 273–287), Starr and Most (1976, pp. 608–610), and Most and Starr (1980) have demonstrated. Alliances also play a key role in the infection process, as Siverson and King (1979) found. Furthermore, certain characteristics of alliances are particularly conducive to contagion (Siverson and King, 1980).

The weakest aspect of the empirical literature on war contagion is the analysis of short-term contagion in the outbreak (as opposed to expansion) of war. These analyses are usually the by-products of longer

⁵ Wright includes civil and colonial as well as interstate wars, so we must be careful in interpreting these results.

⁶ While there are no cyclical trends in the frequency of war, there is some evidence that the amount of war under way (operationalized in terms of nation-months of war) has followed a cyclical pattern since 1815, with peaks every twenty years or so (Singer and Small, 1972, ch. 9). Denton and Phillips (1968) find a twenty-year cycle in the aggregate amount of war before 1680 and a ten-year cycle since then. Wright (1965, pp. 227–232) finds a fifty-year cycle in the casualties from war since 1480.

term periodicity studies and lack the intensive focus on the short term that is necessary to uncover important but subtle relationships. In addition to the absence of this explicit short-term focus, there are other questions that these studies fail to answer. First, are the findings for the 1815-1965 period (based on the excellent Singer and Small data) also valid for earlier historical eras? The few studies for earlier periods are of questionable validity.⁷ Second, is the absence of contagion or periodicity also valid for the wars of the Great Powers? Many contagion studies fail to distinguish between wars involving secondary states and those involving the Great Powers. Given the central role of the Powers in international politics it is important to know whether their wars are contagious.⁸ Finally, are some kinds of wars more contagious than others, and does the seriousness of a war or series of wars have any impact on its contagious effects? Most of the contagion periodicity studies focus on the question of whether the outbreak of one war leads to another and fail to examine the possible effects of other dimensions of war.

For these reasons this study concentrated on the question of short-term contagion in the outbreak of war involving the Great Powers over an extended historical period,⁹ with particular attention to the question of whether war might be affected by the nature or seriousness of previous wars as well as their occurrence. This study was conducted at the systemic level. While some contagion hypotheses are most appropriate at the national or dyadic level (e.g., the social-psychological addiction hypotheses), others are quite appropriate at the systemic level. Given the interdependence of the Great Powers with respect to security issues, it is perfectly reasonable to ask whether the likelihood of interstate war anywhere in the Great Power system is affected by previous war in the system regardless of which Powers participate (as statesmen continually claim). For the question of whether war is contagious at the systemic level it is not necessary to make the distinction between addictive and infectious contagion. Furthermore, given the equal plausibility of the various arguments for positive and negative contagion presented earlier, this study is exploratory in nature, attempting to determine the net contagion

⁷These studies use either the Sorokin (1937) or Wright (1965) data and include civil and colonial as well as interstate wars, but these are not relevant to most of the contagion hypotheses. In addition, the Sorokin and Wright data sets are unreliable and have some major inconsistencies between them, as I have argued elsewhere (Levy, 1981).

⁸This is related to the previous point. It is difficult to study Great Power war behavior since 1815 by aggregate data analysis, given the relatively small number of cases.

⁹The extension of the temporal domain permits generalizations about international behavior prior to the 19th century. In addition, by increasing the number of cases it also improves any analysis of the restricted class of Great Power wars and provides a methodological justification for increased confidence in the validity of the findings.

effects of these diverse causal links. This descriptive question of whether or not contagion exists is important in itself.

This inquiry and research design was guided by the following theoretical questions, which were derived from the contagion literature and represent a series of refinements of the more general question of whether war begets war: First, Is the outbreak of war generally followed by the outbreak of subsequent wars, either while the first is still in progress or soon after its termination? Do the various dimensions of the first war have any impact on the subsequent outbreak of war? Are particularly severe wars more likely to be followed by relatively infrequent wars or by a more prolonged period of peace, as the war-weariness hypothesis might suggest? Do history's most destructive wars have a unique impact on subsequent war? Second, Is there any relationship between the frequency of war in one period and the frequency of war in the following period? Third, Are any of the key measures of the amount of war in one period related to the incidence of subsequent war? Which dimensions of war, if any, have the greatest contagion effects? Is the outbreak of war affected more by the number of earlier wars or by their destructiveness? Also, does the total amount of war in one period, measured by some aggregate index, have any impact on war in the subsequent period?

Research Design

Because of the importance of the Great Powers in international politics (Waltz, 1979; Levy, 1982) and because of the lack of direct attention to the Powers in most of the earlier war contagion studies, I focused on the contagion of wars involving the Great Powers.¹⁰ The modern Great Power system, centered in Europe and becoming truly global only in the last century, emerged late in the fifteenth century.¹¹ The composition of

¹⁰ A Great Power is defined as a state that plays a major role in international politics with respect to security-related issues. Operational indicators of Great Power status include the following: possession of a high level of power capabilities, providing for reasonable self-sufficiency in security matters and permitting the conduct of offensive as well as defensive military operations; participation in Great Power guarantees, territorial compensations, or partitions; and treatment as a relative equal by other Great Powers (in terms of general status, protocol, alliances, etc.). For more details see Levy (1982).

¹¹ This point marks the fusion of several separate historical processes: the internal centralization of power within territorial states, the decline of the universal secular authority of the Pope and Holy Roman Emperor, the coalescence of the major territorial states of Europe into an interdependent system of power relations, and the emergence of a global world economy centered in Europe and sustained by sea power. Our analysis will begin in 1495, denoting the formation of the League of Venice in response to the French invasion of Italy. This interpretation draws considerable support in the historical literature (Toynbee, 1954, p. 237; Hill, 1914, p. 209; Albrecht-Carrié, 1974, pp. 1081-1082; Mattingly, 1955, pp. 124-125; Oman, 1936, p. 16; Dehio, 1962, p. 23; Petrie, 1947, pp. 1-2, 11; Mowat, 1928, pp. 7, 28; Howard, 1976, p. 20; Wallerstein, 1976; Modelski, 1978).

the Great Power system, as determined by a historical analysis guided by the theoretical criteria from footnote 10 (Levy, 1981), is presented in part A of the Appendix.

The focus here was on interstate wars involving at least one Great Power. Civil, imperial, and colonial wars were excluded, for they were not relevant to many of the hypotheses suggested earlier, and they have been analyzed in earlier contagion studies (Sorokin, 1937; Richardson, 1960). The data base was one I generated earlier. It uses the Singer-Small compilation for 1815–1975 (with some modifications based on criteria outlined here) and applies the Singer-Small battle-death criteria to a combination of the Sorokin (1937), Wright (1965), and Woods and Baltzly (1915) compilations.¹² An extensive analysis of the data-generating procedures and the analytical and methodological problems can be found in Levy (1981). The resulting 119 interstate wars involving the Great Powers are listed in part B of the Appendix. The important class of “Great Power wars,” involving at least one Power on each side of the conflict, are denoted by asterisks. The most serious of these wars, involving nearly all the Great Powers and high levels of casualties, are the class of “general wars” (Wright, 1965, pp. 647–650; Blainey, 1973, p. 196).¹³ The sets of sixty-four Great Power wars and nine general wars are each useful in testing certain war contagion hypotheses.

The conceptualization of the multiple dimensions of war generally follows Singer and Small (1972), with some modifications. The dimensions of war include frequency, duration (elapsed time in years), extent (number of belligerent Powers), magnitude (nation-years), severity (battle deaths), intensity (battle deaths/million European population), and concentration (battle deaths/nation-year). Although the frequency, magnitude, and severity indicators are the most important, it is useful also to include the others in an exploratory analysis of this kind. These dimensions (except frequency) are attributes of the wars. They can also be aggregated to reflect the amount of war per period of time. Each of the wars is measured along each of these dimensions, using the Wright, Sorokin, and Singer-Small data. Those data and more can be found in Levy (1981).

¹² Wars prior to 1815 are included if and only if they involve a Great Power and 1,000 battle deaths among the Powers, are not civil or imperial in nature, and are included in at least two of the three basic sources.

¹³ General wars are operationally defined as wars involving at least two-thirds of the Great Powers and an intensity of over 1,000 battle deaths per million European population. They include the Thirty Years War, Dutch War of Louis XIV, War of the League of Augsburg, War of the Spanish Succession, War of the Austrian Succession, Seven Years War, French Revolutionary and Napoleonic Wars, World War I, and World War II.

Data Analysis

The Consequences of Individual Wars

The first question concerns the possible contagion of individual wars. Earlier I noted several arguments in support of the hypothesis that the occurrence of war increases the probability of the outbreak of another war while the first is still in progress. However, the empirical testing of this hypothesis is more difficult than would first appear. The most serious problem is a definitional one involving the aggregation (or disaggregation) of simultaneous wars. On the basis of what criteria is the second war *defined* as an extension of the first and when is it defined as a separate war?¹⁴ The literature provides little guidance here. The general problem of aggregation is often noted but no systematic solutions are proposed (e.g., Wright, 1965, p. 636; Singer and Small, 1972, pp. 79–80). I have given some attention to this problem elsewhere (Levy, 1981), but considerably more work needs to be done. It is sufficient to note here that my data-generating procedures involve the aggregation of simultaneous multilateral wars unless there are compelling reasons to do otherwise (e.g., separate states and distinct issues). Since many new conflicts are not identified as separate wars, there is a strong bias toward the null hypothesis.¹⁵

I tested the hypothesis by comparing the average frequency of war when war is under way with the average frequency of war over the entire span of the system, regardless of whether war was underway. I found that the yearly average number of wars occurring while another is under way is 0.37, compared with 0.25 wars per year over the period as a whole. This difference indicates a slight tendency for wars to be more likely to occur while another is under way, but it is not statistically significant at the conventional .05 level (t test, $p = .10$). Similarly, wars were somewhat more likely to occur while Great Power wars were under way (0.34 wars per year) than at other times (0.25 wars per year), but this was not statistically significant ($p = .15$). The average frequency of Great Power war was 0.13 wars per year, but this increased to 0.17 wars

¹⁴ This problem can be avoided by focusing on the dyad rather than the war as the unit of analysis (Davis, Duncan, and Siverson, 1978; Siverson and King, 1979, 1980), but our systemic-level orientation requires focus on the war as the unit of analysis.

¹⁵ A second problem, widely ignored in the literature, involves the questions of causality and spuriousness. If wars are frequently followed by war, is it due to the causal effect of the first war or are both wars caused independently by the same antecedent variables? This is related to our earlier discussion of the distinction between contagion and heterogeneity. We offer no answer here, for the empirical resolution of the problem would require a fully operational theory of the causes of war and the measurement of all relevant variables over the five-century span of the modern system.

per year while another war was under way ($p = .15$) and .21 wars per year while a Great Power war was under way ($p = .07$). There may be a slight tendency, therefore, for the likelihood of war to increase while another war is under way, particularly for Great Power wars, but these tendencies are not statistically significant.¹⁶

Does this possible contagious effect also hold true after the first war has ended, as many hypotheses suggest? Given our interest in short-term contagion, we looked at the three years following the termination of war. The average yearly number of wars occurring in the three-year period following war was 0.25 (or 0.26 following a Great Power war), compared with 0.25 wars per year overall. The incidence of Great Power wars during these periods is 0.16 wars per year, only slightly greater than their overall average of 0.13. Neither of these differences is statistically significant. We can conclude that the likelihood of war does not increase during the period immediately following the termination of a previous war.

If the rate of incidence of war might increase somewhat while other wars are under way but is unchanged in the short period immediately after the termination of war, the question arises whether the incidence of war is affected by the characteristics of the war that is under way. This set of relationships is best measured by a simple correlation analysis involving each of the war indicators and various measures of the incidence of subsequent war: the number of wars occurring within three years after the termination of war, the number of Great Power wars during and immediately after war, the time elapsed until the outbreak of the next war and next Great Power war, and similar measures of the number of wars following Great Power war. The resulting product-moment correlations are presented in Table 1.¹⁷

The results in Table 1 demonstrate the absence of any meaningful relationship between the seriousness of a given war and the outbreak of subsequent war. None of the correlations exceeds 0.3, indicating that no

¹⁶These particular findings should be interpreted with caution, given the definitional bias in the null hypothesis noted earlier and the fact that the p values fall into the ambiguous range (only slightly above the conventional .05 level of statistical significance). These relationships, and therefore the p values, are very sensitive to minor changes in operational procedures for the aggregation of wars. These results should therefore be taken as tentative until aggregation procedures are further refined and fully operationalized. It is for this reason that I do not unconditionally accept the null hypothesis of no contagion effects on the basis of p values ranging from .05 to .10, but conclude instead that there may be a slight tendency for the probability of war to increase during an ongoing war. (Note that this interpretation is consistent with the finding of Davis, Duncan, and Siverson (1978) of positive contagion in the expansion of war.) It should be noted also that this aggregation problem is of concern only for contagion during an ongoing war, not for the subsequent analysis.

¹⁷There is no significant difference if tau-b is used instead of r .

indicator of war can account for 10 percent of the variance in any measure of the incidence of subsequent war. It is true that many of these correlations are negative, indicating that the more serious wars were followed by a slightly lower incidence of war, but these correlations are too small to be meaningful. A few are statistically significant, but the absence of any consistent pattern lessens their substantive significance. While these correlations are weak, it is interesting to consider their general direction, for they run contrary to the popular war-weariness hypothesis that the most destructive wars are followed by the longest periods of peace. First, even the elapsed time indicator is inversely related to most of the war indicators, suggesting that more serious wars were followed by a *shorter* period of time until the next war. Second, the severity of war, which is generally regarded as the best measure of its destructiveness, has the weakest associations with subsequent war. All of these findings also hold for Great Power wars. We can conclude that none of the attributes of war had any significant impact on the number of wars occurring during or immediately after that war or on the length of the period until the next war.

Some would argue, however, that the war-weariness hypothesis does not imply a linear relationship between the seriousness of a war and the peacefulness of the following period but rather a threshold effect—once the seriousness of a war reaches a certain level, war-weariness and therefore a period of relative peace is induced. Such effects should still be reflected in the linear correlation method applied earlier, but a more direct and perhaps better test of this hypothesis can be performed by examining the consequences of “general wars” involving nearly all the Great Powers

TABLE 1

Correlations (*r*) between War Indicators and Measures of Subsequent War

Indicators of Subsequent War ($W_{t+1,i}$)	War Indicators ($W_{t,i}$)				
	Dur	Ext	Mag	Sev	Con
Wars involving the Great Powers (GP)					
Yearly number of wars during	-0.10	-0.10	-0.11	-0.04	0.04
Yearly number of wars within 3 years	0.04	-0.13	-0.04	-0.11	-0.17*
Yearly number of GP wars during	-0.04	-0.09	-0.11	-0.06	-0.08
Yearly number of GP wars within 3 years	0.04	-0.16*	-0.07	-0.10	-0.17*
Elapsed time to next year	-0.29*	-0.10	-0.22*	-0.08	0.10
Time to next GP war	-0.20*	-0.03	-0.10	0.00	0.18*

Note: Dur, duration; Ext, extent; Mag, magnitude; Sev, severity; Con, concentration.

* Statistically significant at .05.

and high casualties. For each of these general wars, I determined the number of wars and number of Great Power wars occurring within ten years after each war's ending and the length of time to the next war and the next Great Power war.¹⁸ The averages of these summary measures can then be compared with those for the typical ten-year period over the entire span of the system and with the mean duration of peace following the average war in the system in order to determine the relative peacefulness of the periods following general wars.

The results of this analysis were as follows. The average number of wars in the ten-year period immediately following the end of a general war was 2.0 wars and 1.3 Great Power wars, compared with the 2.5 wars and 1.3 Great Power wars that occurred during the average ten-year period over the last five centuries. These differences are not statistically significant, suggesting that, contrary to the hypothesis, the periods following general wars were on average no different than any other period in terms of the outbreak of war. This finding is confirmed by the use of another method. If wars occur randomly (independently of general wars) then the number of ten-year periods containing zero wars, one war, and so on can be determined by a Poisson probability model and compared with the observed distribution by a chi-square test.¹⁹ I found that the per-

¹⁸A ten-year period (instead of three years) is used because it is often suggested that general wars have more prolonged (as well as more intense) effects than most wars. A ten-year period allows a test of this hypothesis. It is true that if we look at the three years immediately after general wars we find that the incidence of war (0.55 wars per three years) was slightly lower than average (0.74 wars per three years); similarly, there were an average of 0.33 Great Power wars (compared with 0.40 normally). These differences are not statistically significant, however. In addition, the small number of cases (five) following within three years of general wars makes it very difficult to generalize.

¹⁹A Poisson process describes the number of events per unit of time generated from a random, independent, stationary, stochastic process. The basic method here is conceptually simple. If events are generated by a truly random process, then they must be distributed according to a Poisson distribution. In our case, if the distribution of war data deviates from the expected Poisson distribution, then we can conclude that the wars were not distributed randomly and that they were not independent (i.e., the occurrence of one war in some way alters the likelihood of subsequent wars). If on the other hand, the distribution of wars fits a Poisson distribution, then they were distributed randomly, and we can conclude that they were independent.

If events are generated randomly then the number of periods in which x events occur is given by

$$Ne^{-m}m^x/x!,$$

where N is the total number of observations (e.g., 96 five-year periods) and m is the average number of events per period (119 wars/96 periods = 1.24). The actual number of periods characterized by x wars (where $x = 0, 1, 2, \dots$) can be computed from the data. The observed and theoretical distributions can then be compared by a chi-square goodness-of-fit test. (Coleman, 1964, ch. 10; Yamane, 1973, ch. 20).

iods following general wars were no different in terms of the frequency of interstate war or Great Power war than what would be expected from a purely random distribution of wars ($p = .32$ and $.67$, respectively). Also, the median elapsed time between the end of a general war and the incidence of another war (or Great Power war) is five years, compared with a 1.8-year average time between the end of one war and the beginning of the next and 6.1 years until the next Great Power war. Thus, after general wars there was on average a few extra years of peace until the outbreak of a new war, but a slightly shorter period until the outbreak of the next Great Power war, compared with the average periods following interstate wars involving the Powers. The war-weariness hypothesis would have predicted, if anything, the opposite—a longer delay before a Great Power war, with perhaps a few minor wars in the interim. The thrust of this evidence, then, is contrary to any war-weariness hypothesis. There is no empirical evidence that periods following wars are more peaceful than other periods, nor is there any evidence that periods following the more serious wars are any more peaceful than those following less serious wars. This does not mean that no war ever induces an inhibition against war but only that this is not a general tendency that repeatedly occurs.

In this analysis of the consequences of individual wars we found that the incidence of war (or Great Power war) increased slightly after the outbreak of an earlier war but only while the first war was under way and independent of the attributes of that war. The incidence of war was unaffected by the outbreak of an earlier war once that war was concluded. It is conceivable, however, that the incidence of war is affected not by the existence or seriousness of a single preceding war, but rather by the number of wars occurring within a given period of time. It is to this question that we shall now turn.

Relationship between Frequencies of War in Successive Periods

The question here is whether the frequency of war in one period is related to the frequency of war in the period immediately following. Given the interest in relatively short-term contagion effects, I shall use a five-year period of temporal aggregation.²⁰ Longer time lags would be more relevant to questions of cyclical trends or periodicity than contagion.

There are several statistical techniques that can be used to test the hypothesis of empirical association. The most direct is a simple correlation analysis. The product-moment correlation between the frequencies of wars in successive periods is -0.07 for wars involving the Powers and 0.17 for Great Power wars. Both are relatively low and neither is statis-

²⁰ The use of ten-year periods yields similar results for each of our statistical techniques.

tically significant at the .10 level, suggesting the absence of any relationship. This finding is confirmed by a Durbin-Watson test for autocorrelation.²¹ The Durbin-Watson coefficients of 2.24 for all wars and 2.09 for Great Power wars are well within the limits denoting the absence of autocorrelation. This provides additional support for the argument that the number of wars in one period has no effect on the frequency of war in the years that follow. Still more evidence for the sequential independence of war initiations is provided by a Poisson test for randomness. If we compare the actual distribution of wars with a theoretical Poisson distribution for randomly-generated wars and use a chi-square test for statistical significance, we get significance levels of .5 for interstate wars involving the Powers and .35 for Great Power wars. This means that the occurrence of war did fit a Poisson distribution, that the wars were randomly distributed, and therefore that they were sequentially independent.

We see, then, a fundamental convergence in the results from our three different methods of analysis, a convergence that increases our confidence in the validity of these results. We must conclude that there is no relationship between the frequency of war in one period and the frequency of war in the following period, either for wars involving the Great Powers or for Great Power wars.

Effects of the Total Amount of War

We have found that the likelihood of war is not affected by the occurrence of a previous war, the seriousness of such a war, or by the frequency of these wars. It is conceivable, though, that the likelihood of war may be affected by the total amount of war in the period immediately preceding, in terms of battle deaths, nation-years of war, or any of our other indicators or combinations of them. Our question here is whether any measure of the aggregate amount of war in one period af-

²¹ The Durbin-Watson d statistic is defined in terms of the residuals e_t :

$$d = \frac{\sum_{t=2}^N (e_t - e_{t-1})^2}{\sum_{t=1}^N e_t^2}$$

By comparing the d calculated from the actual residuals with the d predicted by the theoretical sampling distribution (derived from a population characterized by no serial correlation), then the existence of serial correlation in the data can be determined (Ostrom, 1978, pp. 31-35; Yamane, 1973, pp. 1000-1006; Johnston, 1972, pp. 250-252).

fects the frequency of war in the period that follows and which dimensions of war have the greatest impact on subsequent war or peace.²²

The most direct way of determining whether the incidence of war is related to any of the temporally aggregated dimensions of war in the previous period is a simple correlation analysis. The correlations are determined for each of the war indicators using a five-year period of aggregation. The results, for wars involving the Powers and for Great Power wars, are presented in Table 2. The relatively low correlations and their lack of statistical significance demonstrate the absence of relationships between the frequency of war in one period and the amount of war in the previous five-year period for any of our dimensions of war.²³

These are only simple correlations, however. In order to compare the impacts of the various indicators and determine the total impact of all of the indicators we must turn to a multiple regression analysis. It would be redundant to include all of the war indicators in the analysis because of the intercorrelations among them. Instead, I used the analytically independent dimensions of frequency, duration, extent, and severity as lagged

²² When the indicators for each war are aggregated over time they must be reinterpreted. Duration refers to the total number of war years, weighted by the number of wars. Extent refers to the total number of Powers at war, weighted by the number of wars for each. Magnitude is the total nation-years of war. Severity refers to total battle deaths. Concentration is measured by the total nation-years of war.

²³ It is interesting that all but one of the correlations for interstate wars involving the Powers are negative and all but one of the correlations for Great Power wars are positive. This is precisely the opposite that a war-weariness hypothesis would predict, for the more serious Great Power wars should be more likely to retard other wars. The observed relationships are very weak, however. These results are nearly identical for a ten-year period of aggregation.

TABLE 2
Correlations (r) between Frequency (t) and Lagged War Indicators ($t - 1$)

Lagged War Indicator	Interstate War	Great Power Wars
Frequency	-0.07	0.17
Duration	-0.05	0.02
Extent	-0.10	0.02
Magnitude	-0.12	-0.09
Severity ^a	-0.02	0.08
Concentration ^a	0.03	0.09

Note: Five-year period of aggregation. None of the r 's is significant at .10.

^a The logarithms are used because of the highly skewed nature of these distributions.

predictor variables. The standardized beta coefficients and total amounts of variance explained are presented in Table 3.

It is clear that the incidence of interstate war among the Great Powers was basically unaffected by the total amount of war in the five-year period immediately preceding. Only 3 percent of the variance can be accounted for by the lagged war indicators. This is consistent with the earlier findings of the absence of war contagion.

The results for Great Power wars were more ambiguous. The frequency of Great Power war was affected to a certain degree by the total amount of Great Power war in the period immediately preceding, in that 11 percent of variance could be accounted for by the lagged indicators. While this is statistically significant, the low R^2 suggests a relatively weak relationship. It indicates that the contagion effects of Great Power war are limited and far less important than the causal effects of other substantive variables in the processes leading up to war. It is interesting to note that it is the frequency of previous war and the total number of Powers involved that have the greatest impact on subsequent outbreaks of war and that severity has the least impact but in a positive direction. Although these relationships are relatively weak, these findings contradict the implications of the war-weariness hypothesis that the bloodiest wars should have the strongest negative contagion effects.²⁴

²⁴ It is interesting to note that the positive frequency coefficient in conjunction with the negative extent coefficient suggests that it is numerous "small" (and short) Great Power wars that are more likely to be followed by subsequent Great Powers wars, whereas one larger war would be less contagious. These results must be interpreted with caution, however, for there may be some element of tautology here. A single, lengthy war involving

TABLE 3

Regression of Frequency of War on Temporally Aggregated Lagged War Indicators: Standardized Betas

Lagged Indicator	Interstate War	Great Power War
Frequency	0.02	0.71*
Duration	-0.04	-0.20
Extent	-0.28	-0.62*
Severity	0.24	0.18
R^2	0.03	0.11
Significance	.55	.03

* Statistically significant at .05.

Conclusion

This study focused on short-term war contagion rather than long-term periodicity in war and on the outbreak of new war rather than the expansion of ongoing war. It considered the impact of various attributes of war in addition to their frequency. More important, it explicitly focused on the behavior of the Great Powers and analyzed their war behavior over the entire five-century span of the modern Great Power system. The analysis was guided by a number of more specific hypotheses representing different operational perspectives on the general theoretical question of war contagion and utilized a multiplicity of statistical techniques. Regardless of how the question is defined or operationalized, the results are remarkably consistent. There was a slight tendency for the occurrence of war to increase the likelihood of the outbreak of a second war, but only while the first was under way and independent of the characteristics of that war. Once a war (or a series of wars) was over, neither its incidence nor its seriousness had any impact on the likelihood of war in the period immediately following. This was true regardless of whether we examined the consequences of individual wars or their characteristics, the frequency of these wars, or an aggregate index of the total amount of war in a given period. These findings were valid for Great Power wars as well as for interstate wars involving the Powers over the last five centuries of the modern Great Power system.

These findings are generally consistent with recent empirical research on war contagion, though they were generated by a rather different conceptual orientation and different operational procedures. These findings would appear to be consistent, for example, with those of Davis, Duncan, and Siverson (1978) regarding the infectious contagion of dyadic wars. While this study focused on wars (the unit of analysis) and theirs focused on dyads, it is clear that there is considerable empirical overlap between the concurrent outbreak of new war and the contagion of dyadic war.²⁵ In spite of the differences between these studies,²⁶ or perhaps because of them, the findings of positive contagion of ongoing wars reinforces their finding of the positive infection of dyadic war. This study demonstrates that this phenomenon operates at the systemic as well as

many Powers and extending into the following period may increase the likelihood that any new conflict initiation in that period be classified as a continuation of an ongoing war rather than a new war (because of the aggregation procedures). The observed relationship between small wars and subsequent war is consequently weaker than the statistics imply.

²⁵ Some of their dyadic infections would not be considered new war initiations in our analysis, but all of our concurrent war initiations would be classified as separate dyadic wars.

²⁶ The main difference, and perhaps a significant one, is the longer temporal span of their infectious process.

dyadic level of analysis and over the sixteenth–eighteenth as well as the nineteenth and twentieth centuries.

More generally, these findings are consistent with a long line of empirical research going back to Sorokin (1937). These earlier studies have repeatedly demonstrated the absence of contagion or periodicity in the outbreak of war. It is the similarity of empirical generalizations in conjunction with the distinctiveness of our approach that makes this an important contribution to the contagion literature. The demonstration of the absence of contagion in the outbreak of war over this spatial-temporal domain establishes the generality and comprehensiveness of earlier findings and greatly enhances confidence in their validity.

Particularly interesting are the implications of these findings for the popular war-weariness hypothesis. Not only are most of the relevant test statistics relatively weak and statistically insignificant, but they tend to run in a direction contrary to that implied by the hypothesis. In this study, neither war nor series of wars retarded subsequent war (or Great Power war). The severity of war had the smallest (rather than the largest) impact, and periods of most destructive war (as measured by severity) tended to be followed by more (not fewer) Great Power wars. If anything, it was the duration of war that appeared to have the greatest impact; but the longer wars tended to be followed by the *shortest* elapsed time until the next war or Great Power war. Finally, Great Power wars followed even more quickly after the very destructive general wars than after other wars. These tendencies run counter to the implications of the war-weariness hypothesis, but they are too weak to provide support for hypotheses of positive war contagion.

These findings of the absence of contagion do not necessarily mean, however, that none of the separate contagion hypotheses summarized earlier is valid. They mean only that there are *no net systemic contagion effects* of all of these separate processes operating simultaneously. Although it may be true that there are no individual contagion effects whatsoever, there are several other possibilities: (1) Some or all of these distinct contagion linkages may operate but simply cancel out; (2) Under some conditions war begets war, while under other conditions war retards war; and (3) War is positively contagious for some states but negatively contagious for others. Each of these possibilities, or some combination of them, could generate the observed results of no net contagion at the systemic level. The contagion process, in other words, may be considerably more complex than indicated by present theory and empirical research. The discovery of the absence of any net contagion effects is important in itself. Subsequent research ought to be directed towards the construction and testing of more complex causal models of the contagion

process, with attention to the question of spuriousness and antecedent variables.

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APPENDIX

A. Composition of the Modern Great Power System

France	1495-1975
England/Great Britain	1495-1975
Austrian Hapsburgs/Austria/Austria-Hungary	1495-1519, 1556-1918
Spain	1495-1519, 1556-1808
Ottoman Empire	1495-1699
United Hapsburgs	1519-1556
The Netherlands	1609-1713
Sweden	1617-1721
Russia/Soviet Union	1721-1975
Prussia/Germany/West Germany	1740-1975
Italy	1861-1943
United States	1898-1975
Japan	1905-1945
China	1949-1975

B. Interstate Wars Involving the Great Powers, 1495-1975

(Asterisks denote wars involving at least one Power on each side.)

1. *War of the League of Venice	1495-1497
2. Polish-Turkish War	1497-1498
3. Venetian-Turkish War	1499-1503
4. First Milanese War	1499-1500
5. *Neapolitan War	1501-1504
6. War of the Cambrian League	1508-1509
7. *War of the Holy League	1511-1514
8. *Austro-Turkish War	1512-1519
9. Scottish War	1513-1515
10. *Second Milanese War	1515*
11. *First War of Charles V	1521-1526
12. *Ottoman War	1521-1531
13. Scottish War	1522-1523
14. *Second War of Charles V	1526-1529
15. *Ottoman War	1532-1535
16. Scottish War	1532-1534
17. *Third War of Charles V	1536-1538
18. *Ottoman War	1537-1547
19. Scottish War	1542-1550
20. *Fourth War of Charles V	1542-1544
21. *Siege of Boulogne	1544-1546
22. *Arundel's Rebellion	1549-1550
23. *Ottoman War	1551-1556

24. *Fifth War of Charles V	1552-1556
25. *Austro-Turkish War	1556-1562
26. *Franco-Spanish War	1556-1559
27. *Scottish War	1559-1560
28. *Spanish-Turkish War	1559-1564
29. *First Huguenot War	1562-1564
30. *Austro-Turkish War	1565-1568
31. *Spanish-Turkish War	1569-1580
32. *Austro-Turkish War	1576-1583
33. Spanish-Portuguese War	1579-1581
34. Polish-Turkish War	1583-1590
35. *War of the Armada	1585-1604
36. Austro-Polish War	1587-1588
37. *War of the Three Henries	1589-1598
38. *Austro-Turkish War	1593-1606
39. Franco-Savoian War	1600-1601
40. *Spanish-Turkish War	1610-1614
41. Austro-Venetian War	1615-1618
42. Spanish-Savoian War	1615-1617
43. Spanish-Venetian War	1617-1621
44. *Spanish-Turkish War	1618-1619
45. Polish-Turkish War	1618-1621
46. *Thirty Years War—Bohemian Period	1618-1625
47. *Thirty Years War—Danish Period	1625-1630
48. *Thirty Years War—Swedish Period	1630-1635
49. *Thirty Years War—Swedish-French Period	1635-1648
50. Spanish-Portuguese War	1642-1668
51. Turkish-Venetian War	1645-1664
52. *Franco-Spanish War	1648-1659
53. Scottish War	1650-1651
54. *Anglo-Dutch Naval War	1652-1654
55. *Great Northern War	1654-1660
56. *English-Spanish War	1656-1659
57. Dutch-Portuguese War	1657-1661
58. *Ottoman War	1657-1664
59. Sweden-Bremen War	1665-1666
60. *Anglo-Dutch Naval War	1665-1667
61. *Devolutionary War	1667-1668
62. Turkish-Polish War	1672-1676
63. *Dutch War of Louis XIV	1672-1678
64. Russo-Turkish War	1677-1681
65. *Ottoman War	1682-1699
66. *Franco-Spanish War	1683-1684
67. *War of the League of Augsburg	1688-1697
68. *Second Northern War	1700-1721
69. *War of the Spanish Succession	1701-1713
70. Ottoman War	1716-1718
71. *War of the Quadruple Alliance	1718-1720
72. *British-Spanish War	1726-1729
73. *War of the Polish Succession	1733-1738

74. Ottoman War	1736-1739
75. *War of the Austrian Succession	1739-1748
76. Russo-Swedish War	1741-1743
77. *Seven Years War	1755-1763
78. Russo-Turkish War	1768-1774
79. Confederation of Bar	1768-1772
80. *War of the Bavarian Succession	1778-1779
81. *War of the American Revolution	1778-1784
82. Ottoman War	1787-1792
83. Russo-Swedish War	1788-1790
84. *French Revolutionary Wars	1792-1802
85. *Napoleonic Wars	1803-1815
86. Russo-Turkish War	1806-1812
87. Russo-Swedish War	1808-1809
88. War of 1812	1812-1814
89. Neapolitan War	1815 ^a
90. Franco-Spanish War	1823 ^a
91. War of Navarino Bay	1827 ^a
92. Russo-Turkish War	1828-1829
93. Austro-Sardinian War	1848-1849
94. First Schleswig-Holstein War	1849 ^a
95. Roman Republic War	1849 ^a
96. *Crimean War	1853-1856
97. Anglo-Persian War	1856-1857
98. *War of Italian Unification	1859 ^a
99. Franco-Mexican War	1862-1867
100. Second Schleswig-Holstein War	1864 ^a
101. *Austro-Prussian War	1866 ^a
102. *Franco-Prussian War	1870-1871
103. Russo-Turkish War	1877-1878
104. Sino-French War	1884-1885
105. Russo-Japanese War	1904-1905
106. Italo-Turkish War	1911-1912
107. *World War I	1914-1918
108. *Russian Civil War	1918-1921
109. Manchurian War	1931-1933
110. Italo-Ethiopian War	1935-1936
111. Sino-Japanese War	1937-1941
112. *Russo-Japanese War	1939 ^a
113. *World War II	1939-1945
114. Russo-Finish War	1939-1940
115. *Korean War	1950-1953
116. Russo-Hungarian War	1956 ^a
117. Sinai War	1956 ^a
118. Sino-Indian War	1962 ^a
119. Vietnam War	1965-1973

^a War beginning and ending in same year.

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