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OPPORTUNITY, WILLINGNESS, AND THE DIFFUSION OF WAR

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Using borders and alliances as indicators of opportunity and willingness, respectively, we test the relationship between these and the diffusion of war during the 1816–1965 period. The impact of borders and alliances, individually and in combination, on the growth of ongoing war through “infectious” diffusion is shown through the comparison of baseline cases to cases where states at peace were exposed to various “treatments” comprised of warring border nations or warring alliance partners. The findings indicate that the probability of war diffusion is substantially increased as opportunities and willingness increase, particularly when such geographic and political factors are combined. The applicability of the opportunity and willingness framework to the study of war and diffusion is expanded and confirmed.

A considerable amount of the early empirical research on war attempted to explain its onset by looking at the effects of one or several independent variables on a dependent indicator variable, such as, for example, the nation-months of war (Singer, Bremer, and Stucky 1972; Singer and Small 1968) or the number of nations at war (Singer and Small 1974). The initially unrecognized problem with this procedure is the conflation of the onset of war (a dichotomous variable) with the size of a war (a continuous variable). The problem, however, has consequences significantly beyond what type of measurement is appropriate, since by using the *size* of a war while the theory under investigation specifies that *onset* is being measured, the distinct possibility of diffusion is overlooked. This means that the process by which the first two nations in a war *begin* fighting may be considerably different than the process by which subsequent

participants *join* the war. This blurred distinction neglects what is usually referred to as Galton’s problem (Ross and Homer 1976). Under circumstances where diffusion is present but unrecognized, the resulting models are necessarily misspecified and most probably investigated with inappropriate methods.

Because of the recognition of this problem, more recent research has moved in two new directions. One of these focuses on the behavior of the initial participants in wars and attempts to explain only their behavior. To a considerable extent this is accomplished by considering the onset of war as the end product of a dispute between nations (Bueno de Mesquita 1981; Bueno de Mesquita and Lalman 1986; Leng and Gochman 1982; Maoz 1982).

A second line of research is based on the recognition that wars might diffuse, or be “contagious.”¹ In general, research on the diffusion of war began with determining the extent to which wars were “infectious.”

tious" (Davis, Duncan, and Siverson 1978; Faber, Houweling, and Siccama 1984; Most and Starr 1981) and, after establishing that they were, seeking to uncover the factors responsible for *variation* in the diffusion processes. In general, two lines of investigation have been followed on the diffusion of war. The first of these is based upon borders as interaction opportunities (Most and Starr 1980; O'Loughlin 1984; Ward and Kirby 1987). The second centers on alliances as *indicators* of groups of states that share roughly the same international policies and may be willing to fight together for them (Altfeld and Bueno de Mesquita 1979; Siverson and King 1980).

These two lines of research on the diffusion of war—borders and alliances—have only recently been connected in preliminary empirical analysis (Most et al. 1987; Siverson and Starr 1988). In the present research the data set has been expanded significantly over previous collections, new analytic tools have been added and greater attention is given to interaction of method, theory, and empirical findings. In particular, the research we present brings borders and alliances together within a theoretical framework based on the ideas of opportunity and willingness. The use of this framework permits us to examine ongoing wars as events that alter the incentive-constraint structures perceived by foreign policy decision makers, thus increasing the chances that nations will become involved in an ongoing war. The analyses presented here will be conceived in terms of a research design in which particular conditions or sets of conditions are "treatments," which may or may not produce effects.²

Opportunity and Willingness in the Diffusion of War

Following the work of Most and Starr, the diffusion analyses presented here will

be developed within the general framework provided by the concepts of opportunity and willingness (Most and Starr 1989, chap. 2; Starr 1978a). As ordering concepts, they form the basis for linking environmental and systemic factors to the behavior of decision makers and governments that represent states.

By *opportunity* we mean the possibilities that are available to any entity within any environment, representing the total set of environmental constraints and possibilities. While opportunity thus represents macro level (environmental and structural) factors, willingness represents the choice processes that occur on the micro level, that is, the selection of some behavioral option from a range of alternatives. This framework is derived from Sprout and Sprout's (1969) "ecological triad" of the relationship among entity, environment, and entity-environment. In it their concepts of environmental possibilism, environmental probabilism, and cognitive behaviorism require the combination of both structure-environment and choice-decision process, captured in opportunity and willingness, respectively. Thus, opportunity and willingness are concerned with the relationships that nest decision makers within their surrounding environments.

The central use of *opportunity* is as the degree of interaction. This conception of opportunity has been the primary impetus in Most and Starr's work on the effects of borders as interaction opportunities in the diffusion of violent conflict. As in Sprout and Sprout's environmental possibilism, this simply means that some activity must at base be physically, technologically or intellectually possible. Once the obstacle of possibility is crossed, however, opportunity is, in fact, a continuous phenomenon in which some nations have more or less of it with respect to other nations.

The dual nature of opportunity-possibility (especially as it relates to capabilities) must be recognized. Initially, some

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capability (technology, ideology or religion, form of government, manner of organizing people to some task, etc.) must be created so as to be part of the range of possibilities available to at least some members of the international system. However, there is then an important second dimension in the effects of opportunity-possibility—the distribution of such capabilities in the international system. At one level all international actors share the same menu of possibilities—for example, no nation could have had nuclear weapons to fight World War I; the United Nations could not have been used to separate the United States and Mexican forces in 1846; and any nation may avail itself of the International Court of Justice. At another level international actors may have very different menus of possibilities—for example, the wealth, technological talent, and resources needed to take advantage of the nuclear possibility are not evenly distributed across nations today.

The concept of *willingness* is more familiar, being central to the study of decision making and choice. The dynamics of choice are embedded in a decision maker's image of the world, or definition of the situation. Willingness is related to a decision maker's calculations of advantage and disadvantage, cost and benefit, considered on both conscious and unconscious levels. It is through willingness that decision makers recognize opportunities and then translate those opportunities into alternatives that are weighed in some manner.

As is implied above, opportunity and willingness are linked in a number of ways. They do not create mutually exclusive categories. Anything that affects the structural possibilities of the environment or environments within which decision makers must act also affects the incentive structures for those decision makers. Opportunity and willingness thus become more than organizing concepts. They take

on theoretical characteristics when we understand that they describe the conditions that are necessary for the occurrence of events. They are necessary but not sufficient for the occurrence of international outcomes such as war.

Opportunity, conceived of as interaction opportunity, has been central to the geopolitical study of positive spatial diffusion. This has been most explicitly and extensively developed by Most and Starr, who use borders as the interaction opportunity through which violent conflict would spread. Borders are investigated and conceptualized as "constraints on the interaction opportunities of nations" (Starr and Most 1976). Simple geographic proximity, as indicated by borders of various kinds, is related to both the amount of interaction and the probability of various types of interaction, such as war (see Starr and Most 1978). To some extent, borders represent a proximity between states that increases both the salience of the neighboring territories and (in general) the ease of interaction. Thus, because states are probably more likely to be more attuned to, and involved in, political situations on their borders, there is a tendency for opportunity to shape the range of willingness—although power certainly affords some nations the possibility of very wide openings for defining their borders. Briefly, the various works of Most and Starr argue that opportunity for interaction is a necessary condition for the positive spatial diffusion of violent conflict, that borders are one factor providing such an opportunity, and that the empirical evidence for the 1946–65 period indicates that positive spatial diffusion of violent conflict occurred along the easements provided by borders.

It needs to be emphasized that within such a warring border nation framework it is not reasoned that borders *cause* wars but rather that they contribute to the potential outbreak of violence because the more borders a nation has, the greater (1)

the number of risks and opportunities confronting the nation, (2) the likelihood that the nation or its territories will be "conditionally viable" (Boulding 1962), and (3) the level of that nation's uncertainty. Under these conditions, it is asserted, nations have a greater probability of going to war (see also Diehl and Goertz 1988).

Additionally, Most and Starr argue that once a war starts on a nation's border, that nation may find its environment changed in such a way that it either participates in a war it did not intend to join or forgoes fighting a war that it had intended to join. The warring border nation model thus analyzes whether states that experience the treatment of having a warring nation on their borders have their environment and decision calculus altered so as to alter the probability of their own subsequent war involvement, or not. (See Starr and Most 1985 for a full elaboration of the warring border nation model.)

While borders can in general be conceptualized as an "agent" of diffusion representing the effects of opportunity, another such agent, alliances, represents willingness.³ Numerous observers of alliances in international relations have commented on their entangling nature. Following this general line of argument, a second approach to the problem of war diffusion has thus focused on the extent to which alliance commitments could be responsible for the diffusion of wars.

Siverson and King (1979, 1980) explore the extent to which the independent effect of alliance memberships and the attributes of different types of alliances account for the extent and character of war diffusion. Recognizing the work of Most and Starr on diffusion and borders, Siverson and King argue that alliances, unlike geography, result from a deliberate process of policy choice. States clearly have much greater latitude in their choice of allies than the states on their borders.⁴ It is thus important to recognize alliances as

manipulable interaction opportunities.

More importantly, it is reasonable to look at alliances as a conscious choice among foreign policy behaviors or policy positions. The willingness to form alliances—and with specific partners—may be seen as an indicator of shared policy preference. Put simply, two (or n) nations forming an alliance are indicating, to some degree, that they share policy preferences.⁵ This conception of alliances, implicit in the work of Siverson and King, is explicitly developed in Bueno de Mesquita's (1981) model of expected utility, an approach centered on the calculations that lead to willingness.⁶

The research we report here seeks to investigate the effects of both opportunity and willingness on the diffusion of war. This will be done by looking at the individual and combined effects of borders and alliances on the diffusion of war among members of the international system over the period 1816–1965.

Research Design and Data Generation

While several studies of conflict diffusion have relied on varieties of autocorrelation (Hill and Rothchild 1986; O'Loughlin 1984), the method we chose is considerably simpler. It has much in common with various epidemiological models in that it examines the magnitude of the effects of being exposed to various conditions as treatments. More specifically, it allows us to explore various changes in the probability that nations will enter an ongoing war if they have a warring border nation (WBN) or a warring alliance partner (WAP).

In order to evaluate the impact of WBNs and WAPs on the diffusion of war we constructed a data set containing several types of information on national borders, national alliance commitments, and national war participation. Data were

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collected and coded in order to test both a WBN hypothesis and a WAP hypothesis. Thus, the WBN hypothesis and the WAP hypothesis may be tested separately, and the strength of the results compared. The data also permit us to look at the impact of a nation's bordering states that are *also* allies. This will enable us to test the combined treatment of a nation's being both a WBN and a WAP. Again, the results of these analyses may be compared to the results of the analyses of each factor singly.

In order to make the appropriate comparisons, however, it is necessary to do more than simply record the relevant border and alliance information for the instances in which nations entered a war. Doing so would tell us something about the process of diffusion, but such a procedure would deal only with "successful" cases in which diffusion took place. The cases in which a nation experienced some type of either a WBN or WAP but did not enter the war would be lost from view; hence, no estimate could be made of the effect of the variable on the larger population within which these nations exist (see Most and Starr 1989, esp. chaps. 3-5).

In order to pursue our purpose of assessing the joint and individual effects of borders and alliances on the war experiences of states, it was necessary to bring together data on war participation, alliances, and borders of each state in the international system for each year between 1815 and 1965. Information on the set of states in the system, war participation, and national alliance commitments was relatively easy to acquire. The set of states was taken from the lists provided in Small and Singer (1982). We also noted the power status of the various nations, using a simple division of nations into either major power or minor power status.⁷

There are, of course, several generally available data sets on international war, including, most notably, those of Kende

(1971, 1978), Richardson (1960), Small and Singer (1982), and Wright (1965). Most and Starr's initial diffusion analyses used a combination of all these sources, as those analyses, in actuality, investigated the diffusion of any organized violent conflict (whether it was civil war, internal conflict, or intervention or relatively small-scale violence) as well as large-scale organized interstate violence. We, however, focus on interstate war for the entire state system over the post-Napoleonic era.

We thus selected the larger-scale interstate war data set presented in Small and Singer 1982, which represents an updating and refinement of a well-established earlier effort by the same authors (Singer and Small 1972) to present the data of the Correlates of War Project. There were several other reasons to select this war data set. First, it incorporates a great deal of the information contained in the earlier studies by Wright (1965) and Richardson (1960). The data used here cover more contemporary events than the compilations by Wright and Richardson but also cover much earlier periods than the post-1945 data of others (e.g., Kende). Finally, utilizing Small and Singer's data will make our findings compatible with the growing body of empirical work that has derived from the Correlates of War Project (Gochman and Sabrosky 1990).

The alliance data also are a product of the Correlates of War Project. In this case we drew upon Sabrosky's (1975) extensive revision of an earlier work by Singer and Small (1968) that provided an initial listing of formal international alliances between states during the period 1815-1965. In the case of each alliance, we identified its class as coded by Singer and Small: defense, neutrality, or entente. These will be referred to as A1, A2, and A3, respectively.

We view these types of alliance commitments as forming an ordinal index of willingness. Using Sabrosky's discussion,

Garnham (1988, 15) outlines these three types of alliances as developed by the Correlates of War Project: "The strongest alliance commitment is a defense pact, . . . in which the signatories agree to intervene militarily in the event of an attack on one of their number. Next, insofar as the formal strength of the alliance is concerned, is the neutrality or nonaggression pact, . . . which obligates the signatories to remain militarily neutral should one of them become involved in a war. . . . Finally, the entente . . . merely required consultations or conversations if one of the signatories was attacked." Thus, we expect that WAPs involving defensive alliances (A1) will have a greater likelihood of producing diffusion than nonaggression pacts (A2) or finally the ententes (A3).

The most difficult data to gather were those indicating which states shared borders. However, through the use of several excellent historical atlases (Shepherd 1932 and *Hammond Historical Atlas of the World*), it was possible to ascertain the border network of states back to 1815. Specifically, in a modified version of the coding rules used by Starr and Most (1976), we recorded for each state the entities on its contiguous borders, those across less than two hundred miles of open water and those on the borders of its colonial possessions.⁸ We refer to these as B1, B2, and B3, respectively.

As noted, we regard the divisions of the border and alliance variables as having an ordinal value. In terms of the opportunity and willingness concepts discussed we hypothesize that the greatest opportunity is present with contiguous borders, then cross-water borders, and finally, colonial borders (Starr and Most 1976). At that point considerable variation is introduced. Similarly, the greatest willingness should be present with defense alliances, then neutrality agreements, and then ententes.

Using the nation-year as the basic unit of analysis, the completion of the data collection eventuated in a data set of 3,929 cases, representing a coding of the borders, alliances, and war participation of all nations in all years between 1816 and 1965 in which a war either started or was ongoing. However, to make our test as rigorous as possible we removed a number of cases. First, in order to test for diffusion as the growth of war it was necessary to remove the initial two participants in a war. Second, once a nation entered a war it was deleted from the data set until the war was concluded or the nation left the war. These reductions produced a final data set of 3,749 cases. Within this data set there were 94 cases of war diffusion whose existence we will attempt to explain on the basis of opportunity and willingness.⁹

In order to differentiate positive spatial diffusion from both reinforcement phenomena and negative spatial diffusion, a set of expectations was derived and tested. The procedure used here is derived from one used in an earlier study by Starr and Most (1983, pp. 110-11).¹⁰ In their design they began by "looking for all states at any given point in time which were at peace (to avoid complications with 'reinforcement' effects) and asked two questions: (1) at what point in time did they have any warring border nations? (2) Within the next five years did they have any new war participations?"

There is one major deviation in the present study from the design set out above. Instead of looking at a treatment at time t_0 and subsequent behavior only during the t_1 - t_5 period, we have looked at all years (t_0) in which the international system was experiencing war (some 83 years between 1816 and 1965) and examined the extent to which nations not at war in $t - 1$, either were or were not exposed to various combinations of WBNs or WAPs and either did or did not go to war in year t_0 . Recall that once a nation

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enters a war, it is removed from the data set until the war is ended or the nation leaves the war. Under this procedure it is possible then to aggregate the results of all war years for each of the treatments.

This procedure made it possible for us to estimate and compare the effects of various combinations of WBNs and WAPs. Moreover, by running identical tables for the conditions of any border or any alliance we were able to estimate the extent to which WBNs and WAPs made a difference over counterpart conditions where war as a condition or treatment was absent; that is, we could compare the effects of having a contiguous WBN to the effects of simply having contiguous border nations or compare the effects of having a defense pact WAP to the effects of simply having defense pact partners. Delineating the effects of the various types and combinations of borders and alliances *without* WBNs or WAPs thus gives us a set of baselines for comparing the war-joining rate of those states *with* WBNs or WAPs.

The logic of our investigation of diffusion centers on the notion of treatment, that is, the notion that the environment of the decision makers of states will have been changed by the existence of war in a bordering nation or in one of its alliance partners. As developed by Starr and Most in regard to borders (1976), and in terms of foreign policy decisions in general (Most and Starr 1989), such treatments may alter the opportunities facing decision makers as well as their willingness to pursue certain behavioral alternatives, such as going to war. The argument also follows our notions that states' interactions will tend to follow along the paths provided by interaction opportunities such as proximity (borders) and common policy interests—high value salience (alliances).

The theoretical basis of opportunity and willingness, as well as for interaction opportunity, has been developed at length

by Most and Starr (1980, 1989). The WBN model derives from the notion of interaction opportunity—the physical possibilities for interaction, factors that increase the probability that such interaction will take place, and the perception of both possibility and probability by decision makers. This idea is rooted in the ecological and geopolitical concepts and formulations of Sprout and Sprout (1969), as later modified by Starr's concepts of opportunity and willingness. It should be recognized that the concept of opportunity encompasses important components of the geographical theory of proximity and its effects (Boulding 1962; Gleditsch 1969; and Zipf 1949). For example, Boulding's loss-of-strength gradient links geographical components to threat perception and the role of uncertainty (Midlarsky 1975).

Our expectations on the effects of such treatments also may be seen within a "loose necessity" framework; that is, these treatments are to be seen as loosely necessary but not sufficient for influencing the war-joining behavior of states. We are not arguing that such treatments always lead to joining ongoing wars but that war behavior is much more likely to occur if such treatments have occurred. This is the "loose" aspect of the logically necessary relationship between treatment and consequence. The key to these expectations is cell d in Table 1, which sets out our basic treatment matrix. Cell d indicates that a state has joined a war subsequent to being exposed to the relevant treatment. The central expectation is that

Table 1. The Border-Alliance Treatment Matrix

War Participation	Treatment	
	Absent	Present
Absent	a	b
Present	c	d

there should be a clear and strong difference in cell d between matrices where there is a treatment and matrices where there is *no* treatment; that is, analyses presented will contrast the results found in a matrix where the columns simply note the presence or absence of *borders* or *alliances* to the results of a matrix that looks like the one presented in Table 1, where *warring* border nations or *warring* alliance partners comprise the treatment columns.

This is a simple idea: being exposed to a treatment will, using Alcock's (1972) phrase, increase the chances of "catching the war disease." We ask what the world should "look like" if a state has a bordering state at war or an alliance partner at war. Our expectation is that a WBN or WAP should substantially increase the probability of that state's joining the ongoing war of its WBN or WAP. A further expectation is that this probability should increase with the combination of border and alliance treatments. Thus, we have taken one of several possible approaches to diffusion—the growth of ongoing wars. We have identified two possible ("loosely necessary") agents by which those wars would grow. We have then posited a simple expectation of behavior given 'treatments' by those agents. The following section presents data that simply but directly test these expectations.

Findings

Initially, it may be noted that the overall rate of war diffusion is rather small. In the 3,746 nation-years in our data set there were only 94 cases of war diffusion. The overall rate of diffusion is thus 2.51%. War diffusion is, to be sure, a relatively rare event, but *rare* does not mean "unimportant." Many statistically rare events are of considerable interest to scientists, particularly when their consequences are either highly lethal or very costly. For example, both lung cancer and

earthquakes are both relatively rare, but are nonetheless the objects of attention for very large, nationally organized research efforts. War diffusion is both lethal and costly. Of the 240 cases of international war involvement in the Singer and Small data set, the 94 cases we studied represent 39% of the total. Additionally, a great deal of the severity of war (i.e., how many die) may be explained in terms of the expansion or growth of war. In fact, from the data in Small and Singer's (1982) consideration of lethality in warfare, it is clear that most of the war-related deaths take place because of war expansion.

Because war diffusion is a relatively rare event, it may be seen that under "loose necessity" a large number of treatments result in a much smaller number of cases of war diffusion. In this respect several points should be noted. First, we investigate here only one form of diffusion—infection, or the growth of an ongoing war. We do not deal with demonstration effects. Also if only the *opportunity* for interaction was of concern, we might expect ongoing wars to grow to include all those nations with opportunity. However, willingness is important in such decisions. Put differently, decision makers choose behavior within the constraints posed by the range of incentive structures within which they are imbedded. The effects of WBNs and WAPs are just one aspect of that structure. While other aspects of the structure may lead to the willingness to choose other foreign policy behaviors, it is impressive that the opportunity and willingness model of interaction opportunity is able to identify WBNs and WAPs as factors having a significant impact on war-joining behavior.

The data analysis will take place in two stages. First, we will explore the extent to which the variables measuring opportunity and willingness have anything to do with war expansion. Put differently, we will show that there is a significant relationship between the various measures of

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Table 2. No Treatment, Treatments, and War Involvement, 1816-1965

War Involvement	Border or Alliance (No Treatment)			Warring Border or Warring Alliance Partner (Treatment)		
	No	Yes	Total	No	Yes	Total
No	14	3,641	3,655	2,320	1,335	3,655
Yes	1	93	94	8	86	94

opportunity and willingness and proclivities to join a war. That done, the second part of our data analysis will be to examine how various individual and combined treatments affect war-joining behavior.

Do Opportunity and Willingness Influence War Diffusion?

From the previous discussion of opportunity and willingness it is obvious that we expect nations that have been exposed to either WBNs or WAPs will have a higher propensity to join a war than those that have not. We begin our analysis by examining the extent to which this expectation is borne out. Table 2 reports two initial parts of this analysis. The left half presents the cross tabulation of a nation's having any border or any alliance and being a war joiner. Except for the 15 cases in the first column, this baseline is the same as the overall baseline. It is readily apparent that the table contains no relationship.¹¹ Moving to the right half, it may be seen that when a nation is exposed to any of the treatments, the propensity to join a war increases substan-

tially. Put simply, in the baseline case 2.4% of the nations participate, but under the treatments 6.1% join.

While the left half of the table demonstrates that exposure to any treatment increases the likelihood of joining a war, we need to examine the effect of increasing numbers of treatments. Nations may at the same time have various types of warring borders, may be the members of several alliances of different types having members in the war or, more likely, have some combination of warring borders and alliances. Table 3 displays the cross tabulation of war involvement against the number of treatments to which a nation was exposed. It is clear from the data that as the amount of exposure increases, the rate of participation increases as well. The overall relationship (see Table 4) as measured by the correlation ratio (η), derived from a one-way analysis of variance, is .452.

The analysis has not thus far clarified which of the variables makes the greatest difference. There are, unfortunately, some difficulties in making such an assessment. Our dependent variable, war in-

Table 3. War Diffusion and Number of Treatments to Which a Nation Was Exposed

War Involvement	Number of Treatments							
	0	1	2	3	4	5	6	> 6
No	2,320	703	372	142	57	34	12	15
Yes	8	9	17	12	10	16	7	15
Percentage yes	.3	1.2	4.3	7.8	14.9	32.0	36.8	50.0

Table 4. Analysis of Variance for Treatments in Table 3

Source of Variation	Sum of Squares	df	Mean Squares
Treatments	18.737	13 ^a	1.441
Error	72.906	3,735	.20

Note: $F = 73.839$, $p < .001$, $\eta^2 = .452$.

^aThe degrees of freedom are from the uncollapsed table.

volvement, is dichotomous, which means that the usual techniques of regression and correlation are not appropriate. Normally, one could approach this type of a problem with log-linear analysis, but an analysis based upon dichotomies of the six possible independent variables and war involvement would produce a table of 128 cells. Given the large total number of observations we have, this would not ordinarily be a problem; but in this instance only 94 of the cases indicate war diffusion, and allocating these in a very large table would produce such a large number of empty cells that analysis would be questionable.

Fortunately, it is possible to gain estimates of the effects of the various inde-

pendent variables on war diffusion through probit, which, although sensitive to the highly skewed distribution of the data will allow us to make a preliminary comparison of the relative effect of the variables on war diffusion. Table 5 displays the results of the probit analysis when a nation's war involvement is analyzed in relation to its number of (1) contiguous WBNs (B1); (2) cross-water WBNs (B2); (3) colonial WBNs (B3); (4) defense WAPs (A1); (5) neutrality WAPs (A2); and (6) entente WAPs (A3). The estimates it gives for the independent variables are generally equivalent to the estimates of beta reported in regressions. The results given in Table 5 are generally consistent with the ideas of opportunity and willingness; that is, for the border variables B1 has greater weight in influencing war joining than B2, and B2 has more than B3. The alliance variables are slightly different. While A1 counts the most among these variables, A3 influences war joining much more than A2; in fact, from this analysis A2 seems to have little or no effect on war joining.¹²

Table 5. Probit Estimates of Treatment Variables on War Involvement, 1816-1965

Parameter	Estimate	t-Statistic
Constant	-2.62	-31.80
B1	.54*	9.97*
B2	.36**	3.47**
B3	.21*	3.77*
A1	.51*	5.68*
A2	.18****	1.36****
A3	.31***	3.14***

Note: B1 = contiguous borders, B2 = cross-water borders, B3 = colonial borders, A1 = defense alliances, A2 = neutrality agreements, and A3 = ententes.

* $p < .01$.

** $p < .02$.

*** $p > .05$.

**** $p > .10$.

How Much Do the Variables Contribute to War Diffusion?

Thus far, our analysis has indicated that any exposure to the treatment variables substantially increases the chances of a nation's joining a war (Table 2), that more exposure increases such chances (Table 3), and that the strength of the impact of the treatment variables is ordered

approximately as our rationale for opportunity and willingness suggested (Table 5). What the analysis has not revealed is the magnitude of the impact of the individual and combined indicators of opportunity and willingness.

Let us begin with a brief, but necessary, description of the relatively straightforward analysis that follows. Recall from Table 2 that we compared the rate of war joining among all nations to only those nations that had been exposed to at least one treatment variable. We may now, in effect, take Table 1 apart, examine the impact of each of the variables individually on war diffusion, and then combine each of the border variables with each of the alliance variables to observe their combined impacts on war diffusion.

The first 3 rows of Table 6 report the results, for all nations of the baseline, of being exposed to one of the three types of WBNs or WAPs and the percentage change associated with the treatment.¹³ Beginning with borders, two things are apparent. First, the presence of a WBN has a significant impact on war diffusion. In each case the presence of the treatment produces a marked increase in the propensity for diffusion, ranging from a 262% increase for the contiguous borders to slightly over 100% for the colonial borders.¹⁴ Second, the strength of the results is ordered as the opportunity hypothesis predicts, with the closest borders producing the strongest result and the most distant borders producing the weakest result.¹⁵

Turning to the alliance variables shown in Table 6, a similar pattern may be seen, but with considerably stronger results. Defense alliances produce the substantial increase of 439% over the baseline. While the results for neutrality agreements and ententes are weaker, 297% and 166%, respectively, they are still strong. Again, the strength of the relationships is ordered from the strongest to the weakest commitments. As agents of the opportunity for

interaction, both borders and alliances meet the expectation of increasing the probability of states' joining ongoing wars. In addition to the increased ease of interaction that borders provide (opportunity), borders and alliances both individually increase the salience of the WAPs and WBNs and thus also the willingness to become involved in their conflicts.

How do the border and alliance variables interact with each other? The three border and three alliance variables combine, of course, to produce nine possibilities. The first three columns of Table 7, report the results of these combinations for all nations. (Because the tables reporting the combination of the variables contain eight cells, the cell corresponding to d in Table 1 is h.) It may readily be seen that there is a considerable amount of interaction between the border and alliance variables in influencing the diffusion of war. The most potent effect is with the combination of the contiguous WBNs and defensive WAPs. This should not be surprising, given our previous results and our hierarchy of importance within opportunity and willingness. The latter derives clearly from the international relations literature. Most geopolitical studies focus on direct contiguous borders because of their immediate impact and because they provide the most important opportunity for interaction. In turn, the form of alliance that, scholars theorize, creates the strongest bond between states is the defensive pact. Defense pacts provide the most important indicator of salience, commitment, and shared policy preference. The magnitude of the joint effect is, to say the least, considerable, with the combination of these two variables producing an increase of 719% over the baseline cases in producing war diffusion.

While that result is the strongest, the other results on the several combined variables also generally reveal a considerable amount of interaction. Indeed, *all* contiguous border (B1) and all noncolony

Table 6. Effects of Individual Border and Alliance Treatments, 1816-1965

Condition	All Nations			Major Powers			Minor Powers		
	Cell d Percentage		Percentage Change	Cell d percentage		Percentage Change	Cell d percentage		Percentage Change
	No Treatment	Treatment		No Treatment	Treatment		No Treatment	Treatment	
B1	2.4 (3,300)	8.7 (772)	262*	7.2 (304)	17.5 (103)	143*	1.9 (2,996)	7.3 (669)	284*
B2	3.1 (1,696)	9.2 (295)	196*	7.7 (353)	24.4 (78)	216*	1.9 (1,343)	3.7 (217)	94
B3	2.6 (1,992)	5.6 (659)	115*	9.4 (256)	17.9 (123)	90*	1.6 (1,736)	2.8 (536)	75**
A1	5.3 (808)	28.6 (105)	439*	9.9 (191)	40.0 (40)	304*	3.9 (617)	21.5 (65)	451*
A2	4.4 (204)	17.5 (40)	297*	5.9 (67)	27.3 (11)	362††	3.6 (138)	13.8 (29)	283**
A3	4.2 (453)	11.2 (160)	166*	10.2 (137)	26.5 (49)	159*	1.6 (316)	4.5 (111)	181*

Note: Numbers of cases are in parentheses. B1 = contiguous borders, B2 = cross-water borders, B3 = colonial borders, A1 = defense alliances, A2 = neutrality agreements, and A3 = ententes.

* $p < .01$ (difference of proportions).

** $p < .05$ (difference of proportions).

† $p < .01$ (Fisher's exact test).

†† $p < .05$ (Fisher's exact test).

Table 7. Effects of Combined Border and Alliance Treatments, 1816-1965

Condition	All Nations			Major Powers			Minor Powers		
	Cell h Percentage		Percentage Change	Cell h percentage		Percentage Change	Cell h percentage		Percentage Change
	No	Treatment		No	Treatment		No	Treatment	
	Treatment			Treatment		Treatment		Treatment	
B1A1	5.1 (755)	41.8 (55)	719*	9.2 (152)	37.0 (27)	302*	3.9 (603)	46.4 (28)	1,089*
B1A2	4.4 (204)	22.2 (27)	404*	5.9 (67)	40.0 (5)	577††	3.6 (137)	18.2 (22)	405*
B1A3	3.6 (211)	18.5 (65)	413*	9.5 (105)	30.8 (26)	224	1.6 (306)	10.2 (39)	537*
B2A1	6.8 (355)	47.8 (23)	602*	10.6 (161)	61.1 (18)	476†	3.6 (194)	0 (5)	-100
B2A2	4.5 (112)	30.0 (10)	566††	6.7 (60)	75.0 (4)	1,019†	1.9 (52)	0 (6)	-100
B2A3	6.4 (250)	33.3 (27)	420*	10.9 (128)	64.3 (14)	489†	1.6 (122)	0 (13)	-100
B3A1	6.5 (352)	34.1 (44)	424*	15.1 (106)	70.0 (20)	363†	2.8 (246)	4.2 (24)	50
B3A2	4.8 (83)	14.2 (14)	195	7.3 (41)	66.7 (3)	813††	2.4 (42)	0 (11)	-100
B3A3	5.5 (253)	15.3 (72)	178*	11.8 (102)	40.0 (25)	238*	1.3 (151)	2.1 (47)	61

Note: Number of cases are in parentheses. B1 = contiguous borders, B2 = cross-water borders, B3 = colonial borders, A1 = defense alliances, A2 = neutrality agreements, and A3 = ententes.

* $p < .01$ (difference of proportions).

** $p < .05$ (difference of proportions).

† $p < .01$ (Fisher's exact test).

†† $p < .05$ (Fisher's exact test).

cross-water (B2) effects are improved when combined with alliance variables; and all defense and neutrality pact (A1 and A2) effects are improved when combined with B1 and B2. Cross-water WBNs and defense WAPs, for example, combine to produce an increase of 602% over the baseline cases, while cross-water WBNs and neutrality WAPs combine to increase war diffusion 566% over the baseline cases. Even colonial borders (B3) and ententes (A3), the weakest of the individual effects, produce significant increases on war joining when combined with the other variables—indeed, even when combined with each other (178%).

Given the various combinations of our variables it is, of course, difficult to produce an ordered prediction of their strength, as we did with the single variables. However, it is worth noting that when the class of the WBN is held constant and the WAP class varies, with one exception the magnitudes of the impact are ordered within the groups. The sole exception is that the combination of contiguous WBNs is stronger with entente WAPs (413%) than it is with neutrality WAPs (404%).

Thus far, our consideration of the problem of war diffusion has treated all nations as if they were the same except for their exposure to the various treatments. Much of international relations theory, however, relies on the knowledge that all nations are not the same. A distinction among nations that traditionally has been central to an overwhelming part of the field of international relations is that between major and minor powers. For our purposes, too, this is an important distinction, since there is ample reason to believe that major and minor powers will differ in their behavior with respect to opportunity and willingness in joining wars. Specifically, we should expect the major powers to respond to opportunities that are cross-water or colonial because, in the first instance, they have the greater

capabilities necessary to become involved and, in the second instance, they not only have the capabilities but are much more likely to have colonial borders. Moreover, while minor powers certainly had many alliances, major powers are over-represented among the nations with alliances, particularly defense agreements.

The neatness of the analysis begins to break down when we analyze the data separately for the major and minor powers in the international system. We begin with the major powers. The effects of the individual border and alliance conditions for the major powers are given in the middle three columns of Table 6. Here it is evident that while each of the variables had a discernable effect on war diffusion, the results depart from the magnitudes and orderings given in the first three columns of the same table. Cross-water WBNs are the strongest border effect for the major powers as are neutrality WAPs. As we expect from our ideas about the strength of various forms of opportunity, colonial WBNs have only a weak effect.

Note, however, that alliances are generally of more importance for major powers than are borders and that this relationship is stronger for major powers than for all states combined. By definition, major powers are the actors with global (or at least multiregional) interests and capabilities. They would be more likely to be able to dominate smaller neighbors. As such, the greater impact of alliances is not surprising.

The middle three columns of Table 7 present the combinations of variables for the major powers. Again, there is clear interaction involved in these combinations, some of them astonishingly large. Indeed, *every* individual condition improves with the combined effects of borders and alliances. The combination of colonial WBNs and neutrality WAPs, for example, produces an increase over the baseline of 813%. As might be suspected in the case

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of such a sharp increase, the number of cases is small ($N = 3$). Similarly, the cross-water WBNs and neutrality WAPs produce a gain of 1,019% for four cases.

More surprising, perhaps, than the size of some of the gains observed is the fact that the combination that previously demonstrated the largest gain, the combination of contiguous WBN and defense WAP, for the major powers, shows only a modest increase. Here the gain is only 302%; and while such an increase is not to be ignored, its modest size relative to some of the other combinations of variables is not in accord with what we would expect from our interpretation of opportunity and willingness or the findings presented above. The significant increase found in the effects of B3 (colonial borders) in combination with all alliance types may be related to Most and Starr's (1980) findings on colonial borders above. While the numbers of cases are rather small, it is clear that the combined effects of colonial borders *and* alliances—(far-flung) opportunity and willingness—now match the earlier findings and arguments about the interests and capabilities of major powers. These findings give us some anticipation of what will be found with the minor powers, to which we now turn.

The last three columns of Table 6 report the individual effects of WBNs and WAPs for the minor powers. First, it may be noted that with two glaring exceptions (B2 and B3, where the increases are very low) the treatment variables had clear effects. The strongest of these was the presence of defense WAPs, where the increase was 451%. In addition, the results are ordered as our discussion of the strength of the various indicators suggests. Comparing the results for major powers (the middle three columns) and minor powers, the latter are more strongly affected *both* by contiguous borders (B1) and defense pacts (A1). The first finding is expected. Minor powers, virtually by definition, are those with local

or regional concerns. Given the limited ability of minor powers to project power and thus their greater concern with viability in terms of immediate neighbors, direct borders should be of greatest importance.

The A1 results, however, are more intriguing. Previous work by Siverson and King (1979) has demonstrated that alliances are likely "agents" of diffusion. Such research results directly address the war-alliance relationship that is of concern to many scholars and the related assertion that alliances act as *conduits* for the spread of international conflict (e.g., see Starr 1978b). Alliances might bring great power conflict into the regional sub-systems of small allies. Conversely, alliances might drag major power allies into the local conflicts of their smaller alliance partners. Since the bulk of minor power defensive alliances are with major powers, the A1 results appear to indicate in which direction the alliance conflict conduit has tended to work—minor powers being pulled into the ongoing wars of their major power allies.

The last three columns of Table 7 report the results of the nine combinations of variables for the minor powers. Again, some of the increases are, to say the least, sharp. The situation where we expect the largest increase, contiguous WBNs and defense WAPs, does indeed show the strongest increase, with a magnitude of over 1,000%. Moreover, this time, the number of cases is *not* small. The first four variable combinations all show marked increases, then something interesting takes place.

Once the more distant forms of opportunity and willingness are encountered, the results drop substantially. In fact, for the last six combinations in the table the results are either meager or nonexistent. For all of these cases, the combined treatment results are *less* than the effects of the individual treatments; that is, the combined conditions make war diffusion less

likely. For the first time the results show negative interaction. One may initially suspect that this result is nothing more than the artifact of variable combinations producing numbers of cases so small that they disappear. But, as shown in the last three columns of Table 7, this is not the case. While the number of cases does go down because of the combination, they are certainly too big simply to attribute the absence of an effect to that artifact.

The more likely explanation is to be found in the fact that these combinations do indeed represent the more distant forms of opportunity and lesser types of willingness and that minor powers, because of their lesser capabilities, are either reluctant or unable to enter conflict. Wars, after all, do impose costs on participants; and minor powers may not occupy positions where the costs are tolerable.

A Problem?

Before drawing the results together there is a problem, or puzzle, that must be addressed. Throughout the data analysis it may be seen that there is a consistent pattern wherein the number of nations exposed to the various treatments is very large relative to the number of nations who actually join the war. Consider, for example, the data in the right half of Table 2, which offer the clearest display of this pattern. The data in that table show 1,421 cases of nations exposed to any of the treatments; but only 86 instances of the exposure result in the nations joining a war. To be sure, the proportion of those joining under the treatment is considerably larger than under the baseline, but it is nonetheless perplexing that only 6.44% of the cases exposed to any form of the treatment joined a war.

There are a number of possible approaches to evaluating the impact of these "error" cases to the validity of our find-

ings. First, recall that we explicitly stated that we are working within a framework of "loose necessity." Under this circumstance we expect that there will be many "error" cases but that such error is more apparent than real. The requirements of opportunity and willingness do not predict that a nation exposed to these conditions will join a war but only that its probability of joining will be substantially higher than where those conditions are not present. This situation is quite similar to that encountered by Bueno de Mesquita (1981) in his consideration of the initiation of war. In his analysis it may be seen that nations have positive expected utility for war far more than they actually go to war, while in this research there are far more WBN-WAP interaction opportunities than there are instances of diffusion.

In this research the importance of the idea of necessity may be seen in Table 1. The concern with overprediction is reflected in the number of cases in cell b. However, for necessary relationships the number of cases in b is irrelevant. The relevant cell to compare to cell d is c, which should be empty. Given our "loose necessity" formulation, we should expect only a few cases in c, especially as a percentage of the total number of cases in the no-treatment column (i.e., the a + c column). Returning to the right half of Table 2, it is clear that although there are a very large number of cases in the no-treatment column (2,320), there are only eight in cell c. Similar relationships occur in the matrices that provide most of our results. (In the example given in n. 13 reporting the results of contiguous WBNs there are only 27 cases in c out of a possible 2,977 cases.)

There is a second way to investigate the "error" cases. It is instructive to examine once again the data in the right half of Table 2. There it may be seen that most of the "error" is to be found in the cases in which a nation was exposed to only one of the treatments. The 703 "error" cases

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Table 8. Occurrence of Single Border and Alliance Treatments, All Nations, 1816-1965

Variable	Number of Single Treatments	Percentage of Total
B1	328	46
B2	75	10.5
B3	259	36.4
A1	10	1.4
A2	6	.8
A3	34	4.8

Note: B1 = contiguous borders, B2 = cross-water borders, B3 = colonial borders, A1 = defense alliances, A2 = neutrality agreements, and A3 = ententes.

under that condition represent 52.7% of the total "error." As exposure goes up, the rate of war joining goes up quite sharply. The question now is whether or not the 712 cases (i.e., the 703 cases of "error" and the 9 cases of war joining) that received only single treatments are distributed evenly across the opportunity and willingness variables. Table 8 summarizes this distribution. Clearly, exposure to a single B1 or B3 happened fairly frequently but did not have much of an effect.

There is at least one interesting implication that may be drawn from the above observations: decisions to join an ongoing war face considerable "friction." A single opportunity is rarely associated with war joining. It is only when the opportunities begin to accumulate, or, more importantly, are attached to the *political* affinity indicated by an alliance that the chances of joining an ongoing war begin to build significantly. The fact that wars are, in a sense, undersubscribed is not surprising. Theories of collective goods tell us that it is not rational for a nation to undertake a costly course of action if someone else will do it for them (Olson and Zeckhauser 1966) and wars can be among the most costly of all the courses of action a nation may choose.

Conclusion

This study began with the aim of investigating the diffusion of war—in terms of the expansion of ongoing conflict—between 1816 and 1965. This was done in the context of opportunity and willingness, as indicated by WBNs and WAPs. We have proposed a relatively simple expectation derived from the opportunity, willingness, and interaction opportunity concepts and investigated it through a set of comparisons between treatment and no-treatment groups of data. The data presented in the tables support the contention that war does expand among nations along the indicators that operationalize opportunity and willingness and that the strength of the relationship is ordered by the type of border or alliance, as hypothesized.

We have added to the understanding of war diffusion in several ways. While one body of previous research has indicated an important geographic basis for diffusion and other research has indicated that alliances are important in spreading conflict, the present work has the virtue of *combining* geographic and political variables so that the strong interaction of these two elements may be observed.

The scope of the present analysis is also more extensive than previous studies of war diffusion. The data used are global (not limited to any single geographic region) and cover all international wars from 1816 to 1965.¹⁶ We provide separate analyses of major and minor powers, revealing different patterns of diffusion and indicating how major and minor powers differentially relate to the elements of opportunity and willingness.

Perhaps most useful to the theoretical development of the study of war diffusion, we have presented more evidence as to the applicability of research based on opportunity, willingness, and their interaction. We have shown here that this theoretical approach is applicable to

large-scale war as delineated by the Correlates of War Project's data set. The previous applications of this approach by Most and Starr focused violent conflict on a smaller scale, whether internal or external.

We also have more confidence in the theoretical scope of this approach, since we now find that it can help explain two different conceptualizations of diffusion: (1) the linkage-penetration view taken in earlier research by Most and Starr (among others), where events elsewhere change a state's disposition to behave similarly; and (2) the infection-contagion approach taken here, where diffusion is conceived as the growth of ongoing wars.

The refinement of such analytic tools is vital in the design of future research. With multiple sources of evidence indicating that diffusion processes of various kinds do exist in international relations, we now require further work in the specification of the *processes* at work in various kinds of diffusion, including the conditions under which the diffusion of violent conflict takes place. The further specification of these processes might also help us understand the interaction between opportunity and willingness and various theories as to why wars are likely to be larger at particular times than at others.

Notes

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1. While *diffusion* has been given several meanings, and has a number of dimensions, we will be using it essentially to mean the growth of an ongoing conflict, the process by which states join an ongoing war and the scope of the conflict becomes enlarged. The concept of diffusion and its theoretical relevance to the study of international conflict is reviewed extensively in Most, Starr, and Siverson 1989. For other reviews of the diffusion concept, see Most and Starr 1981, O'Loughlin 1984 and Welsh 1984. For an over-

view of the renewed interest in geopolitical approaches (including diffusion) to war, see Diehl 1988. For a classic statement on the contagion of political conflict, see Schattschneider 1960.

2. We use the term *treatment* to emphasize the epidemiological nature of our research, not to suggest that we are performing an experiment in which we have the ability to randomize and control exposure. However, what we report is in many respects a historical experiment, similar in method to the procedures described by Singer (1974) and Holsti and North (1965).

3. Although research on this point is not clear (Garnham 1988), it is reasonable to suspect that under some circumstances geographical proximity to, or shared borders with, some other nation will in themselves influence a nation's willingness to become involved in conflict. If so, opportunity and willingness are not independent, as we noted. Indeed, borders themselves can be seen in terms of environmental possibilism by providing possibilities for interaction. The warring border nation model, however, can be seen in terms of cognitive behaviorism or willingness, as activities on a state's borders effect the perceptions of threat, uncertainty, and opportunity held by that state's decision makers. Clearly, most nations are likely to be sensitive to the security concerns of neighboring nations or, when the capabilities are present, are likely to see their neighbors as the greatest potential threats to their own security.

4. Of course, states may attempt to manipulate their immediate political geography by creating neighbors (e.g., Belgium in 1830) or eliminating them (e.g., Poland in 1939), but the costs of these activities are likely to be quite high.

5. Alliances, of course, are not a perfect indicator of willingness. For example, while there is general tendency for alliances to be reliable, it is clear that reliability is less than complete (Sabrosky 1980). In addition, some alliances are specific to certain issues or geographic areas (e.g., NATO), and their existence does not mean that one ally will join another no matter where the conflict. Also, alliances signed at one time may deteriorate while continuing to exist formally. In short, we do not construe alliances as indicating a general willingness to fight. However, alliances have long been recognized as the key means that nations have chosen to indicate their political position in the international system. Formal alliances are matters of serious concern to decision makers and in addition to their presumed rewards of enhanced security, they impose costs and risks both domestically and internationally (Sullivan 1974).

6. In fact, Altfeld and Bueno de Mesquita (1979) successfully apply expected utility theory to the problem of explaining which side nations will join in a war. While this is a problem similar to the one pursued here, it does not directly address the question of diffusion. For some other differences, see n. 16.

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7. Following Small and Singer (1982), the major powers and the years of their inclusion in that group are Austria-Hungary (1816–1918), Italy (1861–1943), the United Kingdom (1816–1965), Russia-USSR (1816–1965), Japan (1895–1945), Prussia-Germany (1816–1945), the United States (1989–1965), France (1816–1940, 1945–65) and China (1949–65).

8. This third category of data was the most difficult to obtain because of the number and almost unbelievable obscurity of some colonies. We were aided very considerably by Henige's (1970) comprehensive list of colonial governors. This list, which begins with the fifteenth century, identifies all political units that were the colonial possession of some other nation. Finding them in this list then permitted relatively easy location in one of the historical atlases.

9. Copies of the coding scheme employed in this study are available from Siverson. It should be noted that in general we followed the data given by Small and Singer (1982) with respect to war expansion. We did, however, depart from their delineation of what constituted war joining in a few cases. For example, they show Japan as joining World War II on 7 December 1941. While it is true that Japan began fighting the United States on that day, it is also true that the Japanese decision had relatively less to do with the European war that had been in progress since 1939 than it did Japan's war with China that had been ongoing since 1937. Hence, we do not treat Japan as joining the war. Also, we do not treat as war joiners the nations that left World War II (albeit briefly) and then changed sides (i.e., Italy, Romania, and Bulgaria) to reenter it. It makes sense to count the initial participation only. It should be noted that including these cases would have favored the opportunity and willingness hypotheses.

10. Recall that Most and Starr (1980) distinguished between reinforcement, or addiction (where a state's war behavior affects the probability of its own subsequent behavior) and diffusion (where a state's war behavior affects the probability of the subsequent war behavior of other states). They also recognized that either could have positive or negative effects (either increasing or decreasing the probability of war behavior). The reader must be alerted that the matrix employed in the present analyses follows that utilized in Most et al. 1987 and is *not the same* as the matrix used in Most and Starr 1981 or Starr and Most 1983, 110–11.

11. The single case of war involvement by a nation with no bordering nations of any kind and no alliance involvement is New Zealand's entry into World War II in 1939.

12. The weak results from A2 may be partly due to the fact that there were far fewer of this type of alliance in the data set than either of the other two types. When they are analyzed together, the more

numerous alliances may overwhelm A2. In the analysis that follows it may be seen that A2 does not apply to a large number of cases but that when it does, a clear effect is evident.

13. Recall the treatment matrix from Table 1. In the single treatment tables that follow, the numbers being reported are those from cell d of that figure. Reporting all the tables would be cumbersome, so only the effects of the treatments are given. As an example of what a table looks like, we offer a full table for the *treatment* involving B1. Note that the numbers of cases reported in the tables refer to the total of the b–d column and that the percentages reported are for d of that total.

War Participation	Contiguous Warring Bordering Nation	
	Absent	Present
Absent	2,950	705
Present	27	67
Total	2,977	772

14. What we mean by percentage increase is the magnitude by which involvement in a treatment situation is larger than the base. Thus, the first three columns of Table 6, while the B1 treatment percentage of 8.7 is more than three times the size of the baseline percentage of 2.4, the relevant measurement is the amount of increase from 2.4 to 8.7. Thus, the appropriate calculation is the treatment percentage minus the base percentage with the remainder divided by the base percentage.

15. The tests of significance used in Tables 6 and 7 require a brief comment. Because the percentage changes between the no-treatment and treatment columns are often based on relatively small numbers of cases, the skeptical reader may be curious as to (1) whether the observed changes are statistically significant and (2) whether there is any way that the method could fail to produce a change, i.e., whether the results are predetermined. With respect to the first question, we have tested the differences for statistical significance in two ways. First, when the number of cases in the treatment column is greater than 20, the *p*-value is derived from the *Z*-score in a test of a difference of proportions. When the number of cases is less than 20, we have determined the *p*-value from Fisher's exact test. (Recall that the cases in the treatment column are also present in the baseline no-treatment column. Because the two results are therefore not independent, before we could test for statistical significance between the no-treatment baseline and the treatment, it was necessary to remove the treatment cases from their respective baseline. A full set of the resulting tables is available from Siverson.) More important than each test of significance is the correspondence between our theoretical structure and the overall pattern of the

data. With respect to the second question (whether the results are predetermined), if one suspects that the method will always produce an increase in the observed cases of war diffusion under the treatment condition, see the last three columns of Table 7, where failure does occur.

16. Altfeld and Bueno de Mesquita (1979) are interested only in those cases of war expansion that took place within the first two months of a war. Hence, their main data set contains only 40 cases of war joining. In addition, they exclude from their data set the participation of the four Commonwealth nations (i.e., Canada, Australia, New Zealand and South Africa) that joined World War II in 1939, on the grounds of missing data (that is, they had no alliance memberships). Those cases are included here. We also include the cases from the Korean War, which were totally excluded by Altfeld and Bueno de Mesquita (p. 94, n. 7).

References

- Alcock, Norman Z. 1972. *The War Disease*. Oakville, Ontario: Canadian Peace Research Institute Press.
- Altfeld, Michael, and Bruce Bueno de Mesquita. 1979. "Choosing Sides in Wars." *International Studies Quarterly* 23:87-112.
- Boulding, Kenneth. 1962. *Conflict and Defense*. New York: Harper & Row.
- Bueno de Mesquita, Bruce. 1981. *The War Trap*. New Haven: Yale University Press.
- Bueno de Mesquita, Bruce, and David Lalman. 1986. "Reason and War." *American Political Science Review* 80:1113-29.
- Davis, William, George Duncan, and Randolph Siverson. 1978. "The Dynamics of Warfare, 1816-1965." *American Journal of Political Science* 22:772-92.
- Diehl, Paul. 1988. "Geography and War: A Review and Assessment of the Empirical Literature." Presented at the annual meeting of the International Studies Association, St. Louis.
- Diehl, Paul F., and Gary Goertz. 1988. "Territorial Changes and Militarized Conflict." *Journal of Conflict Resolution* 32:103-22.
- Faber, Jan, Henk Houweling, and Jan Siccama. 1984. "Diffusion of War: Some Theoretical Considerations and Empirical Evidence." *Journal of Peace Research* 21:277-88.
- Garnham, David. 1988. "Balancing or Bandwaggoning: Empirical Evidence from Nineteenth- and Twentieth-Century Europe." Presented at the International Studies Association, St. Louis.
- Gleditsch, Nils P. 1969. "The International Airline Network: A Test of the Zipf and Stouffer Hypotheses." *Peace Research Society Papers* 11:123-53.
- Gochman, Charles S. and Alan Ned Sabrosky, eds. 1990. *Prisoners of War? Nation-States in the Modern Era*. Lexington, MA: D.C. Heath.
- Henige, David P. 1970. *Colonial Governors from the Fifteenth Century to the Present*. Madison: University of Wisconsin Press.
- Hill, Stuart, and Donald Rothchild. 1986. "The Contagion of Political Conflict in Africa and the World." *Journal of Conflict Resolution* 30:716-35.
- Holsti, Ole R., and Robert C. North. 1965. "The History of Human Conflict." In *The Nature of Human Conflict*, ed. Elton McNeil. Englewood Cliffs, NJ: Prentice Hall.
- Kende, Istvan. 1971. "Twenty-five Years of Local Wars." *Journal of Peace Research* 8:5-27.
- Kende, Istvan. 1978. "Wars of Ten Years (1967-1976)." *Journal of Peace Research* 15:227-41.
- Leng, Russell J., and Charles S. Gochman. 1982. "Dangerous Disputes: A Study of Conflict Behavior and War." *American Journal of Political Science* 26:664-87.
- Maoz, Zeev. 1982. *Paths to Conflict*. Boulder: Westview.
- Midlarsky, Manus. 1975. *On War*. New York: Free Press.
- Most, Benjamin A., P. Schrodt, Randolph M. Siverson, and Harvey Starr. 1987. "Border and Alliance Effects in the Diffusion of Major Power Conflict, 1815-1965." Presented at the annual meeting of the International Studies Association, Washington.
- Most, Benjamin A., and Harvey Starr. 1980. "Diffusion, Reinforcement, Geo-politics and the Spread of War." *American Political Science Review* 74:932-46.
- Most, Benjamin A., and Harvey Starr. 1981. "Theoretical and Methodological Issues in the Study of Diffusion and Contagion: Examples from the Research on War." Presented at the annual meeting of the International Studies Association, Philadelphia.
- Most, Benjamin A., and Harvey Starr. 1989. *Inquiry, Logic, and International Politics*. Columbia: University of South Carolina Press.
- Most, Benjamin A., Harvey Starr, and Randolph Siverson. 1989. "The Logic and Study of the Diffusion of International Conflict." In *Handbook of War Studies*, ed. Manus Midlarsky. Boston: Allen & Unwin.
- O'Loughlin, John. 1984. "Geographic Models of International Conflicts." In *Political Geography: Recent Advances and Future Directions*, ed. Peter J. Taylor and John House. London: Croom Helm.
- Olson, Mancur, and Richard Zeckhauser. 1966. "An Economic Theory of Alliances." *Review of Economics and Statistics* 46:266-79.
- Richardson, Lewis F. 1960. *The Statistics of Deadly Quarrels*. Chicago: Quadrangle.

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- Ross, Marc, and Elizabeth Homer. 1976. "Galton's Problem in Cross-National Research." *World Politics* 29:1-28.
- Sabrosky, Alan N. 1975. "The Utility of Interstate Alliances." Presented at the annual meeting of the International Studies Association, Washington.
- Sabrosky, Alan N. 1980. "Interstate Alliances: Their Reliability and the Expansion of War." In *The Correlates of War*, vol. 2, ed. J. David Singer. New York: Free Press.
- Schattschneider, Elmer E. 1960. *The Semi-Sovereign People: A Realist's View of Democracy in America*. New York: Holt, Rinehart, and Winston.
- Shepherd, William R. 1932. *Atlas of Modern History*. New York: Henry Holt.
- Singer, J. David. 1974. "The Historical Experiment As a Research Strategy in the Study of World Politics." *Political Inquiry* 2:23-42.
- Singer, J. David, Stuart A. Bremer, and John Stuckey. 1972. "Capability Distribution, Uncertainty, and Major Power War, 1820-1965." In *Peace, War, and Numbers*, ed. Bruce M. Russett. Beverly Hills: Sage.
- Singer, J. David, and Melvin Small. 1968. "Alliance Aggregation and the Onset of War." In *Quantitative International Politics*, ed. J. David Singer. New York: Free Press.
- Singer, J. David, and Melvin Small. 1972. *The Wages of War, 1816-1965*. New York: Wiley.
- Singer, J. David, and Melvin Small. 1974. "Foreign Policy Indicators: Predictors of War in History and in the State of the World Message." *Policy Sciences* 5:271-96.
- Siverson, Randolph M., and Joel King. 1979. "Alliances and the Expansion of War." In *To Augur Well: Early Warning Indicators in World Politics*, ed. J. David Singer and M. D. Wallace. Beverly Hills: Sage.
- Siverson, Randolph M., and Joel King. 1980. "Attributes of National Alliance Membership and War Participation, 1815-1965." *American Journal of Political Science* 24:1-15.
- Siverson, Randolph, and Harvey Starr. 1988. "Alliance and Border Effects on the War Behavior of States: Refining the Interaction Opportunity Model of Diffusion." Presented to the Third World Congress of the International Peace Science Society, College Park, MD.
- Small, Melvin, and J. David Singer. 1982. *Resort to Arms: International and Civil Wars, 1816-1980*. Beverly Hills: Sage.
- Sprout, Harold, and Margaret Sprout. 1969. "Environmental Factors in the Study of International Politics." In *International Politics and Foreign Policy*, ed. James N. Rosenau. New York: Free Press.
- Starr, Harvey. 1978a. "'Opportunity' and 'Willingness' As Ordering Concepts in the Study of War." *International Interactions* 4:363-87.
- Starr, Harvey. 1978b. "Alliances: Tradition and Change in American Views on Foreign Military Entanglements." In *American Thinking About Peace and War*, ed. Ken Booth and Moorhead Wright. New York: Barnes & Noble.
- Starr, Harvey, and Benjamin A. Most. 1976. "The Substance and Study of Borders in International Relations Research." *International Studies Quarterly* 20:581-620.
- Starr, Harvey, and Benjamin A. Most. 1978. "A Return Journey: Richardson, 'Frontiers,' and Wars in the 1946-1965 Era." *Journal of Conflict Resolution* 22:441-67.
- Starr, Harvey, and Benjamin A. Most. 1983. "Contagion and Border Effects on Contemporary African Conflict." *Comparative Political Studies* 16:92-117.
- Starr, Harvey, and Benjamin A. Most. 1985. "The Forms and Processes of War Diffusion: Research Update on Contagion in African Conflict." *Comparative Political Studies* 18:206-27.
- Sullivan, John D. 1974. "International Alliances." In *International Systems*, ed. Michael Haas. New York: Chandler.
- Ward, Michael, and Andrew Kirby. 1987. "Reexamining Spatial Models of International Conflicts." *Annals of the Association of American Geographers* 77:279-83.
- Welsh, William A. 1984. "Inter-Nation Interaction and Political Diffusion: Notes Toward a Conceptual Framework." Presented at the annual meeting of the International Studies Association, Atlanta.
- Wright, Quincy. 1965. *A Study of War*. Rev. ed. Chicago: University of Chicago Press.
- Zipf, George K. 1949. *Human Behavior and the Principle of Least Effort*. Cambridge, MA: Addison-Wesley.

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