# Alleviating Political Violence through Reducing Collective Tension: Impact Assessment Analyses of the Lebanon War

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This longitudinal social experiment replicates and extends an earlier study (Orme-Johnson, Alexander et al., 1988; 1990) in testing the proposal that political violence can be alleviated through reducing stress in the collective consciousness of a large population. It was predicted that group practice of meditation techniques in a series of seven assemblies held within a 2.25-year period would reduce collective tension and violence and enhance cooperative behavior among antagonistic parties in the Lebanon War. Daily event-data were derived from nine international and regional news sources. Levels of conflict, cooperation and casualties were scored by an experienced Lebanese coder blind to the hypotheses and techniques employed, using Rasler's (1981) 16-point scales. Box-Jenkins impact assessment analyses indicated that the assemblies had a highly significant impact in the predicted direction on all dependent variables, with an estimated mean 66% increase in cooperation and estimated reductions of 48% in conflict, 71% in war fatalities, and 68% in war injuries during the assemblies ($p < .00001$ for each variable). Analysis of an index combining the dependent variables indicated that each of the seven assemblies also had a separate positive impact on the war ($p < .01$). These results were robust across alternative models of the dependent series, and improvements could not be accounted for in terms of changes in temperature, holidays, weekends, or other forms of seasonality or trends in the dependent series, which were explicitly controlled for. Nor were results explicable in terms of "reverse causality" (assemblies being held in reaction to prior events in Lebanon), as experimental periods (assembly dates) were set months in advance and were statistically independent from prior levels of conflict.

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With the end of the Cold War and the breaking up of Soviet political and military power, there emerged a broad hope and consensus for establishing a peaceful "new world order." However, many nationalist, ethnic, religious and cultural conflicts across all major regions continue to defy easy resolution (e.g., Azar, Davies, Pickering, & Shahbazi, 1990; Gurr, 2000; Gurr & Davies , 2002), and the threats to the hoped-for peaceful world order remain daunting, as exemplified currently in Iraq and Sudan.

Threat of war has been defined (e.g., Singer, 1958) as the product of two basic factors: capability (objective military capacity) and intent (subjective hostility). Hence a threat can be reduced through countering or reducing either the objective military capacity (as was done with Iraq), or the subjective hostility which motivates its use. In the absence of an adequate understanding of subjective, motivational factors, the dominant debate has been between those who emphasize increasing relative military capacity and deterrence (peace through strength), on the basis that one can only assume the worst (hostile) intent; and those who advocate mutual disarmament agreements (peace through cooperation), on the basis that hostility is not a threat in the absence of means for destructive aggression. Subjective factors remain which limit the effectiveness of both approaches.

**Subjective Aspects of Conflict**

The peace-through-strength approach tends to exacerbate fear, mistrust and hostility in actual and potential opponents (domestic as well as international). As continued nonuse of nuclear weapons erodes the credibility of nuclear deterrence, such hostility may find expression in localized wars (as in the Gulf), terrorism and other forms of protracted, low-intensity conflict (see also Fischer, 1984; Jervis, Lebow, & Stein, 1985; Weede, 1982, 1984). Greater military capacity (and especially growing military capacity) is the national attribute to emerge as the most consistent predictor of increased war-proneness from Singer's (1980, 1986) research on the correlates of war (see also Gochman, 1990). The main difficulty with the second approach is also subjective—significant disarmament cannot be expected when levels of tension (and consequent mistrust and misperceptions) remain high, as is apparent from the still dismal record of the history of disarmament negotiations. Even the marginal reductions agreed to in the as yet unratified START treaty, and the more extensive reductions subsequently planned, could only be achieved *after* U.S.-Russian tensions had already been greatly reduced, following the collapse of the Soviet economy and political order.

Theorists are beginning to recognize the need to include the subjective issues in international relations (e.g., Ferguson & Mansbach, 1991)



and in approaches to peace. White (1984), for example, argues that traditional approaches to peace, including deterrence and arms reduction agreements, cannot be effective in the absence of concurrent measures to drastically reduce tension. High levels of tension or stress directly motivate violence aimed at removing perceived injustices, threats, or blocks to progress. They also may indirectly trigger unwanted outbreaks of violence through breeding misperception, fear, and dysfunctional cognitive and decision-making processes (see also Janis, 1982; Tetlock, 1983). High levels of societal stress thus modify or constrain rational, utilitarian decision-making, and so have been associated with increased risk, not only of external aggression (e.g., Wright, 1942), but also of domestic violence and sociocultural disintegration (Feierabend & Feierabend, 1971; Linsky & Straus, 1986). This, in turn, renders the society more vulnerable to external aggression (George & Smoke, 1974; Haas, 1968; Russett, 1990).

Societal stress and tension may be seen as resulting in large part from frustration of progress toward satisfaction of needs or goals (Feierabend & Feierabend, 1971; Gurr, 1972; Laborit, 1978). Azar (1979, 2002; Azar et al., 1990) further distinguishes between ontological "needs," such as those for security, identity, and effective participation—which appear to be inherent to human development, with satisfaction largely dependent on collective achievement—and nonessential "interests," such as role preferences or commercial interests. Only the latter (interests) appear amenable to long-term denial through processes of negotiation, socialization, or political control. Whereas when the former (ontological needs) are frustrated, they continue to be pursued in one way or another, providing the driving force for peaceful social development, or, where this appears to be blocked, for violent and often protracted attempts to force political and social change.

When stress has become chronic and widespread, then the associated fears, misperceptions, mistrust and lack of social integration inevitably further inhibit creativity and development, thus creating a vicious cycle in which growing frustration and violence may appear as inevitable. An effective approach to peace should thus address the need for effective alleviation of the tension which hampers sustainable societal development, integration and peaceful resolution of conflict.

**A New Approach**

A factor hindering the development of such an approach that includes the alleviation of tension has been a strong emphasis in the social sciences during the behaviorist period on correlational analysis of objective variables and simple, non-dynamic models of overt behavior. Over

the last two decades, however, there has been a renewal of interest in the experimental analysis of the cognitive, perceptual and affective factors which are experienced as motivating individual and collective behavior (e.g., Bruner, 1986; Sperry, 1993), particularly in situations of social conflict (e.g., Stroebe, Kruglanski, Bar-Tal, & Hewstone, 1988). Concurrently, there has been a growing appreciation of the dynamic complexity and intricate delicacy of social and ecological systems, and of the significance of many subtle and diverse inputs in changing systemic behavior (e.g., Bevan, 1991; Gleick, 1987; Ruloff & Frei, 1985; Toulmin, 1990).

The still fragmentary nature of the findings from several decades of research aimed at understanding the critical factors underlying war and peace (Banks, 1986; Singer, 1986; Vasquez, 1987) has been attributed in part to this emphasis on simple positivistic, "deductive-nomological" analysis (Dessler, 1991). A more integrative and policy-relevant understanding of these complex factors would seem to require that attention also be paid to (inductively) building and testing causal theories (Dessler, 1991). In our view, such causal theories of social behavior must in turn address (inter alia) subjective and social-systemic motivational dynamics such as those discussed above if they are to help policy makers move beyond a costly and risky preoccupation with developing and destroying objective technologies for defense. The challenge is to formulate and operationalize such dynamic theoretical propositions.

One systematic attempt to operationalize a proposed causal link between subjective factors and war or social violence has emerged from a tradition that has long focused on the study of consciousness and subjective processes—the Vedic tradition of India (Maharishi Mahesh Yogi, 1978, 1986). Specifically, a "subjective technology" for alleviating violence and promoting societal integration (through reduction of collective stress) has been developed in a format which allows prospective experimental or quasi-experimental testing of its efficacy. This has led to a series of studies (e.g., see reviews by Orme-Johnson, 1994; 2003) which allow us to confront once again conceptual and theoretical issues left in abeyance during the behaviorist decades.

The purpose of this paper is to address some methodological and theoretical issues still outstanding in this novel line of research by undertaking a longitudinal assessment of the predicted efficacy of Maharishi's Vedic technology in reducing collective tension.

The Lebanon War, which continued unabated for over a decade (mid-1970s through late-1980s), was characterized by persistent tension and arrested development in a local population fractionated over socio-economic, religious, ethnic and political issues. The internal conflict was exacerbated by Cold War tensions played out through a complex web of



protracted regional and international rivalries (Azar, 1984; Rasler, 1983). The reassertion of government authority has been far from complete; it is still subject to Syrian tutelage, the continued presence of massive Palestinian refugee camps, and until recently, occupation of the south by the Israeli army and allied Christian militias who have been fighting Iranian-supported Shiite Hezbollah militias. Thus at the time of the study (early to mid-1980s), it provided a critical test for the effectiveness of any strategy for peace through tension reduction.

## AN APPROACH TO REDUCING STRESS IN A SOCIAL SYSTEM

Maharishi (1979) has proposed that all occurrences of violent conflict arise from the accumulation of collective stress. This collective stress can be substantially reduced through practice of meditative techniques by even a small portion of a large population. In order to present the conceptual ground on which this key proposition is based, we briefly describe these techniques and review the associated research and theoretical framework.[1]

Maharishi describes individual consciousness and successive levels of "collective consciousness"—the consciousness of the members of a family, community, city, nation, or world, taken as a whole—as dynamically interconnected fields underlying individual and collective behavior at each level of social organization. Specific techniques for experiencing the abstract, field nature of consciousness underlying experience and behavior at all these levels are provided as the basis for a practical program to improve the quality of individual and social life (Chandler, 1987).

According to this view, quality of life in any biological or social system is said to be determined by the degree of order or "coherence" with which consciousness is functioning in that system, as reflected, for example, in the degree of functional integration among the various components of an individual mind and nervous system, or in the degree of spontaneous coordination and complementarity among the diverse goals and activities of the individuals and groups comprising a society. Higher coherence thus allows better use of resources for balanced development, satisfaction of needs, and a dynamic and diverse, but stable and peaceful society; greater incoherence (equated with stress), if persistent, is reflected in narrower perspectives, greater conflict, frustrated development, and susceptibility to violence, disease and social disintegration (Maharishi Mahesh Yogi, 1986).

[1] A complete exposition is beyond the scope of this paper. The reader is referred to the works cited.

The most fundamental of a series of techniques offered for enhancing coherence (and hence reducing stress) is the Transcendental Meditation (TM) technique, described as a simple mental procedure for allowing the mind to settle down to a state of "pure consciousness" (Maharishi Mahesh Yogi, 1969). This state is experienced as a silent, peaceful state of heightened alertness without any thought or mental agitation (hence "pure") and has been closely correlated with increased neurological integration (higher EEG coherence) and deep rest (virtual suspension of breath: e.g., Badawi, Wallace, Orme-Johnson, & Rouzere, 1984). An exhaustive meta-analysis of the experimental literature indicates the overall drop in somatic arousal during TM practice is twice that for resting with eyes closed (Dillbeck & Orme-Johnson, 1987).

A substantial research literature also indicates that regular practice of the TM program is consistently associated, on the individual level, with reduced anxiety, tension, hostility, drug use and related problems in health and behavior; and with enhanced neurophysiological integration, creativity, intellectual performance, self-development, and social relationships (e.g., see reviews in Alexander, Cranson, Boyer & Orme-Johnson, 1987; Alexander et al., 1990). Further, extensive quantitative meta-analyses indicate that the TM technique appears to be two or three times as effective in reducing trait anxiety and other forms of psychological distress, and in promoting self-actualization and psychological health, as compared to other meditation or relaxation programs with equivalent expectations and time spent sitting (Eppley, Abrams, & Shear, 1989; Ferguson, 1981; Alexander, Rainforth, & Gelderloos, 1991; Alexander, Robinson, & Rainforth, 1994).

The TM-Sidhi techniques are more advanced procedures for further stabilizing the experience of pure consciousness, and thus maximizing coherence, through culturing the ability to consciously initiate thought, perception and action from this level of awareness (Maharishi Mahesh Yogi, 1978). These techniques have been associated with additional improvements compared to the TM technique, including enhanced neurological (EEG) coherence across a broad range of frequencies during, and continuing outside, the practice, and with further gains in cognitive, behavioral, and physiological functioning (e.g., Orme-Johnson & Haynes, 1981; Orme-Johnson & Gelderloos, 1988; Dillbeck, Orme-Johnson, & Wallace, 1981).

Several studies of the TM program have addressed a social problem as recalcitrant as that of political violence: the prevention of criminal violence through rehabilitation of maximum security prisoners. These longitudinal experiments have indicated substantial advances in self-development and decreases in aggression and subsequent recidivism (return to prison) rates among inmates practicing the TM technique, compared to other treatment groups (e.g., Alexander, 1982; Bleick & Abrams, 1987; Dillbeck & Abrams, 1987).



These studies provide evidence of enhanced coherence and reduced stress and dysfunction in body, mind and social behavior resulting from systematic changes in mode of consciousness during silent meditation. However, a more critical test of the theoretical and practical significance of consciousness as a variable relevant to social issues but not reducible to observable behavior is available from Maharishi's proposed link between individual and collective consciousness and behavior.

Maharishi (1978, 1986) describes individual consciousness and the various levels of collective consciousness as reciprocally interrelated, the quality (degree of coherence) in one contributing to the quality of the others. Each individual mind is seen as a dynamic local expression of an essentially nonlocal field of consciousness at its base, just as particles of matter or energy are now accepted in the physical sciences as being local expressions of one or more underlying nonlocal quantum fields. When the individual mind settles down to experience this abstract field of consciousness at its basis, it is proposed that coherence is enhanced, not only as reflected in the individual neurophysiology and behavior, but also in field effects reflected in the surrounding population or social system.

Given the principle that more coherent elements in any system have a greater impact relative to their number than the incoherent elements, Maharishi predicted that for large populations, even one person in 100 practicing the TM technique should result in gains in coherence (reductions in stress) in collective consciousness. These gains should be measurable as behavioral changes in the population as a whole.

Prior to the modernist period, several leading social scientists had proposed field theories of collective consciousness (e.g., Fechner's "unity of general consciousness," James' "infinite continuum" of consciousness—both in James, 1898/1977—Jung's, 1968, "collective unconscious" and Durkheim's, 1912/1951, "conscience collective"). Indeed, contemporary social identity (SI) theory (e.g., Tajfel & Turner, 1979)—which has succeeded in accounting for a range of empirical findings not explicable through simple "realist" conflict theory (Condor & Brown, 1988)—was originally framed in terms of the concept of collective consciousness (McDougall, 1919). However, as McDougall (1920/1973, p. 103) concluded after reviewing the early theories: "the conception of a 'collective consciousness' as a hypothesis [must] be held in reserve until the study of group life reveals phenomena that cannot be explained without its aid."

Maharishi's prediction of a consistent and immediate relationship between the silent meditations of relatively few individuals and measurable improvements in the behavior of entire populations would seem to provide an opportunity for such a test of the validity and relevance of the collective consciousness concept. The prediction has been operationalized in hypotheses which are specific and falsifiable. Consistent findings of improvement are predicted in unambiguous indices of societal (in)coherence, such as number of violent deaths, during periods of regular practice of the TM program by at least one percent of the population of a large social system.[2]

A series of sociological studies, focusing on changes in such indices as violent crime, fatal accidents, and suicides as the one percent threshold has been exceeded on the city or national level, have confirmed this prediction (e.g., Dillbeck, Landrith, & Orme-Johnson, 1981; Dillbeck, Banus, Polanzi, Landrith, 1988). For example, in a study of 160 randomly selected U.S. cities over a seven-year period, significant decreases in crime were found following increases in the proportion of the population practicing this technique to the one percent level, after controlling for demographic variables associated with crime rate (such as levels of education, unemployment, income, age distribution, police coverage, and size, density and stability of population: Dillbeck et al., 1988, study 1). Further, cross-lagged panel analysis indicated that in each case decreases in crime followed rather than led increased participation in the TM program, consistent with the proposed causal link between TM practice and reduced crime.

More recently, Maharishi (1978) proposed that these broad societal effects would be further amplified through collective practice of the TM-Sidhi program. Whereas one percent of a population practicing the TM technique was found to be sufficient for a beneficial societal impact, it was predicted that similar effects would be achieved through group practice of the more advanced program by as few as the square root of that number (in both cases assuming a substantial number of participants: $n > 100$). This formula was based on the proposal that at a fundamental level, collective consciousness behaves as a "Bose" field, which amplifies the influence of adjacent coherent elements of a system in proportion to their number squared (as with laser light sources), whereas the influence of incoherent elements is merely proportional to their number (as with ordinary light sources: Hagelin, 1987).[3]

[2] Because the one percent formula is presented as an approximation, and as a sufficient, rather than a necessary, condition, some sub-threshold influence is not excluded.



The lower numbers thus required for a predicted large-scale societal impact has allowed testing via experimental or quasi-experimental intervention studies on the city, national, and international levels, across a variety of quality of life indices. Again, findings have been generally consistent with predictions, with positive changes in indices of political cooperation and economic strength, as well as decreases in violent crime, armed conflict, accidents, suicides, infectious diseases, and other symptoms of collective stress during and/or immediately following each intervention (e.g., Assimakis & Dillbeck, 1995; Cavanaugh, 1987; Cavanaugh & King, 1988; Cavanaugh, King, & Ertuna, 1989; Dillbeck et al., 1988, study 3; Dillbeck, Cavanaugh, Glenn, Orme-Johnson, & Mittlefehldt, 1987; Dillbeck, 1990; Gelderloos, Cavanaugh, & Davies, 1990; Gelderloos & Dillbeck, 1990; Gelderloos, Frid, Goddard, Xue, & Loliger, 1988; Goodman, Orme-Johnson, Rainforth, & Goodman, 1997; Hagelin et al., 1999; Hatchard, Deans, Cavanaugh, & Orme-Johnson, 1996; Orme-Johnson, Alexander, Davies, Chandler, & Larimore, 1988; Orme-Johnson, Alexander, & Davies, 1990; Orme-Johnson & Dillbeck, 1987; Orme-Johnson, Gelderloos, & Dillbeck, 1988; Orme-Johnson, Alexander et al., 1988). The use of dynamic time-series analytic techniques in these studies has allowed further controls for systematic influences from other variables which may be influencing the dependent series and repeated confirmation of the predicted leading relationship between the experimental and dependent series.[4]

These latter studies, linking the meditative activity of groups removed from the general population with immediate social changes across extensive areas, also make it clear that the observed improvements cannot have been mediated through simple behavioral interactions. This raises the issue of whether all connections between individuals that significantly influence experience and behavior are isolated from the field character of nature at more fundamental levels, as described in quantum physics (Dillbeck et al., 1987). Addressing this issue does not imply any challenge to the general validity of current knowledge in the

[3] Thus if one percent of light-emitting elements at the same frequency is enough to determine the color of the whole array, the square root of this number would achieve the same effect if they were adjacent and in phase (coherent) as with laser light.

[4] Not all dependent variable changes in all populations studied were significant, as might be expected since meditation (or even stress) is not the only factor influencing crime and violence. However, when the impact of meditation is evaluated across several variables and/or populations, signal-to-noise ratio should be enhanced, yielding more consistently positive findings, such as have been reported in the studies cited.

social sciences developed during the behaviorist period. Rather, it questions whether there may be another useful level of analysis complementary to more conventional analyses of social interaction on the individual, community, national, and international levels (cf., Waltz's, 1959, three "images" of man). New methodologies and circumstances frequently open up new levels of inquiry previously inaccessible to researchers and/or overlooked by theorists (Kegley, 1993).

Increasingly strong evidence from well-designed experiments indicates that there is action at a distance in the social sciences (Jahn, Dunne, Nelson, Dobyns, & Bradish, 1997; Schlitz, 1996). Action-at-a-distance or field effects are now well accepted in the natural sciences. Gravity and the reception of television signals are familiar examples. Physicists explain such phenomena as mediated by abstract quantum fields. In fact, all structures and all processes in nature are now understood as localized expressions or fluctuations of a few underlying, universal quantum fields, through which they are fundamentally interconnected. While the classical concept of material objects as separate except insofar as they behaviorally interact (the "billiard ball" view of the universe) still serves us well in many social science applications, recent discoveries of coherent systems explicable only in terms of quantum mechanical processes and operating at familiar scales and temperatures (such as superconductors and laser light) are making inescapable the potential relevance of such quantum field processes to the realm of everyday experience.

Further, the development of heterotic superstring theory, providing for the first time a consistent quantum theory of gravity and matter fields, and a fully unified framework for understanding all forces and structures in nature, has demonstrated the likelihood that a single, unified field underlies all the various quantum fields (e.g., Antoniadis, Ellis, Hagelin, & Nanopoulos, 1987, 1988). The precise description of this field is at the forefront of research in quantum field theory (e.g., Green, 1986; Kaku & Trainer, 1987), but two general characteristics are relevant here. First, the nature of space-time at the Planck scale of superunification is described as intrinsically nonlocal, allowing the mediation of significant nonlocal effects, which do not necessarily fall off as a function of the inverse square of the distance from the source (Hawking, 1984). Second, the necessary non-separation of observer and observed at the level of superunification implies a unified field which is as much a field of subjectivity (consciousness) as objectivity (Hagelin, 1987, 1989).

In like terms, the French physicist Bernard D'Espagnat (1979/1983) claims: "The doctrine that the world is made up of objects whose existence is independent of human consciousness turns out to be in conflict with quantum mechanics and the facts established by experiment." Max Planck similarly concluded: "I regard consciousness as fundamental. I regard matter as derivative from consciousness" (quoted in Klein, 1984). A number of the other founders of quantum physics were also pushed by the implications of the new theory into what might be described as a field theory of consciousness, as seen in Erwin Schrodinger's "one mind," Sir James Jeans' "great thought," Sir Arthur Eddington's "mind-stuff," and Wolfgang Pauli's "unity of all being" (see also Davies, 1984; Llewellyn-Smith, 1981; Pagels, 1982).



Such concepts, while still unfamiliar in the contemporary social sciences, are consonant not only with the traditional Vedic understanding of consciousness, but also with the oldest continuing tradition of philosophical thought in the West—the idealist tradition. The nominalist tradition (in which the positivist or behaviorist worldview has its roots) has its emphasis on reality as made up of separate objects. The idealists—like their successors among theorists in contemporary quantum physics—have maintained the fundamental unity of reality and the interconnectedness of human beings on the level of consciousness. Plato (see Handelton & Cairns, 1963), for example, speaks of "an eternal oneness" (*Symposium,* paragraph 210E), a "changeless, simple state of consciousness [as]...the primary source of all things" (*Laws,* paragraph 899C). More recently, Carpenter (1904/1916, p. 68) argues in similar terms that "consciousness is [all] existence," and Hegel (1910/1949, p. 279) that "consciousness...[is] all reality...both itself and its object."

The limiting assumptions of modernist thought are being challenged across several disciplines in favor of a broader paradigm in which nominalist (classical, structural, particulate) and idealist (field-theoretic, dynamic, integrative) views are seen as complementary perspectives on the nature of reality. Empirical research evidence suggesting that a coherent influence on collective consciousness and behavior may be mediated via field dynamics should not be ignored. A willingness to evaluate novel research findings on their scientific merits—especially in the current era of "theoretical pluralism" (Ferguson & Mansbach, 1991)—is essential to the continued healthy development of social science theory.

In assessing the validity of a new theoretical construct, it is customary to look not only at the issue of relationship to existing theoretical perspectives, but also at whether there is a convergence of findings when the construct is tested across different domains of empirical research. Thus it is interesting that four recent studies have tested this proposed field mechanism neurophysiologically under controlled laboratory conditions. In the first three, periods of group practice of the TM-Sidhi program were found to correspond to simultaneous increases in inter-

subject EEG coherence (Orme-Johnson, Dillbeck, Wallace & Landrith, 1982), and in serotonin turnover (Pugh, Walton, & Cavanaugh, 1988; Walton, Cavanaugh, & Pugh, 2005), among subjects outside the group and unaware of whether or when it was assembled. In the fourth, Travis and Orme-Johnson (1989) used transfer function analysis to identify the dynamic relationship between the EEG coherence of individuals practicing the TM-Sidhi program and that of non-meditators sitting in an adjacent room. It was found that increases in EEG coherence in each pair of study participants were correlated, with increases in meditating participants always leading those in the non-meditators, consistent with the proposed causal mechanism.

## REDUCING CIVIL VIOLENCE: PEACE PROJECT IN THE MIDDLE EAST

A prospective experimental study to test the impact of these procedures in the context of political violence was first conducted in Israel in 1983, where a group was brought together in Jerusalem to practice the TM-Sidhi program over a two-month period (Orme-Johnson, Alexander et al., 1988). Box-Jenkins impact assessment, cross-correlation, and transfer function analyses indicated that increases in the size of the coherence creating group, which frequently exceeded the threshold for a predicted impact on the populations of Israel and of neighboring Lebanon (where Israeli troops still occupied almost half the country), closely predicted same-day and lagged reductions in number of reported war deaths (all parties) and overall war intensity in Lebanon. Also as predicted publicly and in advance, reductions in crime and accidents, and improvements in economic and other available social indicators were observed both in Jerusalem and in Israel as a whole as group size exceeded the respective thresholds for these smaller populations.

Holidays, temperature and other seasonal variables were explicitly controlled for. Subsequent research on violent crime in Washington, DC has also shown that the apparent impact of the meditating groups is independent of temperature (Hagelin et al., 1999). Moreover, transfer function analysis in the studies in both Lebanon and in Washington, DC revealed that improvements followed, but did not lead, the daily size of the coherence creating group, thus supporting the hypothesis that collective practice of the TM-Sidhi program was the causal factor.

This study was accepted for publication in the *Journal of Conflict Resolution* after alternative (transfer function) analyses undertaken to satisfy reviewers' concerns (Duval, 1988) were found to confirm the results of the initial impact assessment analyses. Further analyses were



reported by Orme-Johnson et al. (1990) to answer concerns raised by Schrodt (1990) focusing on the apparent impact of the group in Lebanon. Specifically, it was found that the reported results for Lebanon were robust across fourteen alternative transfer function models and also when using a different statistical approach (Liu's linear transfer function approach) to the Box-Jenkins transfer function method used initially. Other robustness checks substituting "pseudo" independent or dependent variables did not yield spurious results, confirming the significance of the consistent leading relationship between the actual independent and dependent variables.

Given these robust findings for the "Israel study," it is important to further assess the reliability of this procedure as an approach to domestic and international peace, and its generalizability across time and place. Although the related theory is novel, the findings should not be rejected on this ground, as the criteria for plausibility in the social sciences are themselves under debate. Particularly where the plausibility of new findings is hard to assess by current conceptual criteria, their replicability becomes central (Duval, 1988; Neuliep, 1993; Russett, 1988).

The Israel study assessed the influence of only one group on the Lebanon War. Since the time of that study (1983), there have been six other occasions in which groups practicing the TM-Sidhi program (convened as "World Peace Assemblies") have been sufficiently large and close to Lebanon for a predicted impact on the war, based on the square root of one percent formula—ranging from a small group in the focal area of conflict within Lebanon, to groups of about 7,000 based in the United States. The persistently violent nature of the Lebanon conflict, and the ample press coverage it was accorded, provide a unique opportunity for a rigorous longitudinal evaluation of these social experiments. It was considered essential to evaluate the entire sequence of interventions for impact in Lebanon (though most involved large groups with a predicted influence beyond Lebanon) in order to avoid any issue of selectivity in testing or reporting results.

The Israel study focused more on quality of life indices for Israel and accessed only a small proportion of the information potentially available for analysis of the predicted impact on political violence and progress toward peace in Lebanon. In particular, daily war intensity was rated on a five-point scale, thus restricting the amount of day-to-day variance that could be registered in what was a very complex and volatile conflict; a single news source was relied on for the conflict measures; and cooperative political events indicative of progress toward peace were not evaluated at all.

In addition, the varied size and location of the assemblies in relation to Lebanon allow a test of the prediction that stress and violence can be reduced via enhanced coherence at any level of collective consciousness—community, national, international, or even global—given groups of the required size. For assemblies large enough for a predicted international or even global impact, those involved in the Lebanon War can be taken as a sample of the broader population affected; this sampling strategy allows more precise measurement of dependent variables and evaluation of whether the intensity of the predicted impact is equivalent across groups/populations of different sizes.

**Proposed Study**

The general hypothesis to be tested in the present study is that on days when there is collective practice of the TM-Sidhi program by a group of size n, there will be greater coherence (reduced tension) in collective consciousness and behavior in the surrounding population equivalent to $100n^2$. Greater coherence and reduced tension in the Lebanese context is operationally defined in terms of progress toward peace and reduced political violence. Where the number (n′) practicing the TM program individually in the population affected is also known, the size of the total population included within the predicted area of influence is increased by 100n′ (see Orme-Johnson, Alexander et al., 1988, 1990). More specifically, it was predicted that during experimental periods of collective practice of this technique by groups of such size (n) and location that the surrounding population equivalent to $100n^2$ + 100n′ extends to include Lebanon or at least the primary region of concurrent violent conflict within Lebanon,[5] there would be an attenuation of political violence and greater progress toward peace, in comparison to adjacent non-experimental periods.[6] These changes would be indicated by:

(1) a higher level of cooperation among non-allied internal and external (international) participants in the Lebanon War;

(2) a reduced level of conflict among these groups;

[5] Maharishi (1979, 1986) defines the surrounding population in terms of collective consciousness, which in turn is localized within community (national, etc.) boundaries. Geographic distance from the group is only used comparatively, in determining the order in which communities (nations, or villages, etc. within a nation) will be influenced by a group of given location as it increases in size. See more detailed discussion below on independent variables.

[6] Experimental periods are defined in days, as the impact of the usual twice-daily practice is said to persist for the entire day (Maharishi Mahesh Yogi, 1969), and data for the dependent variables are not available for shorter periods.



(3) fewer casualties resulting from such conflict, as measured by total number of (a) fatalities, and (b) non-fatal injuries; and

(4) more positive scores on a general index combining the above indices.

## METHOD

**Generation of a Data Base for the Lebanon War**

There is no current quantitative data base suitable for study of the Lebanon conflict (e.g., Davies & McDaniel, 1994). Rasler (1981, 1983) has developed a set of scales specifically for measuring degree of conflict and cooperation in the context of this war from available media sources. A 16-point cooperation/conflict scale is provided in six parallel forms to allow separate assessment of both verbal and physical events initiated by either the Lebanese government, other domestic political groups, or international actors. As with Azar's (1982) Conflict and Peace Data Bank (COPDAB) scales, degree of social injustice as well as violence is relevant in defining the value of each event on Rasler's scales (COPDAB data between 1979 and 1989 are as yet unavailable: Davies & McDaniel, 1993; Davies, 1998). Hence operationalization of the foregoing hypotheses was achieved through application of these scales, while at the same time recording the casualties reported for each event by the same sources.

*Cooperation/conflict scales.* Each scale (government, domestic and international) includes 16 categories or levels of political events ranging from a high degree of cooperation, support, or facilitation to extreme conflict, demand, or repression. Reliability for the rank ordering of categories within each scale by experts in international politics was very high, with Spearman rho correlation coefficients between .90 and .98 (see Rasler, 1981, Tables 1–6). These ordinal scales were transformed into ratio scales (0–100 for cooperation, and the same for conflict) through expert evaluation of the intensity of cooperation or conflict represented by each category (Rasler, 1981).

Total values for cooperation and conflict are generated for each day on each scale by multiplying the frequency of events reported in each category by the intensity rating for that category (see Rasler, 1981) and adding the products separately for categories 1 to 8 (cooperation) and 9 to 16 (conflict). Intensity ratings for Lebanon are considered roughly equivalent across scales 1, 3, and 5 (verbal) or across scales 2, 4, and 6 (physical), so that it is possible to generate overall daily values for cooperation and conflict, as required for this study, by combining totals from the different scales. It is recommended that physical and verbal values be combined by weighting the physical values by a factor of two

(Rasler, 1981). In the present study this was achieved by dividing the intensity ratings for physical events by 10 (each event is thus weighted between 0 and 10), and that for verbal events by 20 (each event is thus weighted between 0 and 5), and then adding the total values (for cooperation and conflict separately) across the six scales.

*Data sources*. For analysis of event data, the reliability of journalistic sources—including the international "elite" as well as regional newspapers—is limited by problems such as selection in response to changing political or editorial pressures, regional bias, and preoccupation with the more spectacular or violent events. Nevertheless, it is widely recognized that there is nothing else available with the same consistency, coverage, and utility (Doran, Pendley, & Antunes, 1973; Rosenblum, 1979; Taylor & Jodice, 1983). Journalistic sources thus continue to be heavily relied on by the major data banks for research on international and domestic events (Davies & McDaniel, 1994).

A fundamental rule for selection of such sources from the research to date is that reliance should be placed on a combination of multiple sources, particularly for studies focusing on events in a specific region or involving an international crisis, where a combination of international and regional sources is recommended (Azar, 1975; Burrowes & Spector, 1973; Taylor & Jodice, 1983). Rasler (1981) points out that the use of a broad range of different sources to ensure maximum coverage of events is especially critical in studies designed to examine political behavior at small time intervals or using measurement scales with a large number of event categories—both of which apply in the present study.

Throughout the period of the Lebanon War, the Lebanese Information and Research Center in Washington, DC maintained a cumulative daily file consisting of all articles relating to Lebanon from the major international news sources, including the *New York Times, Christian Science Monitor, Washington Post, Wall Street Journal, Time, Newsweek, US News and World Report,* and daily *British Information Service* news summaries from the major British newspapers. Regional news sources were covered through the *Foreign Broadcast Information Service* (FBIS), based in Washington, DC, which includes daily extracts from radio and television news broadcasts in Lebanon and neighboring countries, translated into English. These include the Beirut, Damascus, Jerusalem, and Tehran Domestic Services, Voice of Lebanon, Voice of Arab Lebanon, Voice of the PLO, Radio Free Lebanon, Voice of the Mountain, Voice of Palestine, Marj 'Uyun Lebanon Voice of Hope, Ihdin Radio of Free and Unified Lebanon, and Israel Defense Forces Radio.

Edward Azar (personal communication, June 11, 1987), who supervised the establishment of the Center's file, noted that all articles on Lebanon from the above sources are included without regard to content or political views expressed; and that the addition of further Lebanese domestic news sources would have negligible benefit, for two reasons. Firstly, FBIS provides translations of daily news reports and commentary from both official and clandestine radio stations representing all the major parties within Lebanon, as well as other nations in the region. Secondly, because of the high level of international interest in Lebanon throughout the period of this study, the journalists with the leading Lebanese newspapers were concurrently retained by the international news agencies, and thus were submitting essentially the same stories to them as to the domestic press. Hence the news sources cataloged above were relied on for the study.



*Coding procedures*. Events were identified from these sources and coded using Scales 1–6 (Rasler, 1981) by a Lebanese national with extensive prior experience in events coding under the supervision of Edward Azar, then Director of the Center for International Development and Conflict Management, University of Maryland and of the Conflict and Peace Data Bank (COPDAB). The coder, who was substantially responsible for the establishment of the file of news sources relied on for this study, was blind as to the purpose of the study and unfamiliar with the theory or techniques on which the hypotheses were based. On the other hand, he was highly familiar with the political and religious factions and geography of Lebanon and also with the file of news sources. He was trained in the application of the specific scales for this study by the first author, following detailed consultation with Karen Rasler, who developed the scales, and with Edward Azar.

Each event was coded for date of occurrence; actor and target (by group membership or nationality); location; brief summary; scale number and category; number of reported fatalities and injuries; and source(s). Training was conducted using reports from the above sources for a two-month period prior to that of the experimental interventions, until there was 90% inter-coder reliability with the experimenter in assignment of scale category and number of casualties.

In order to focus specifically on cooperative actions that reflect progress toward peaceful resolution of conflict rather than maintenance of current alliances, cooperative interactions within a single faction, or between currently allied internal or external participants, were not coded. Similarly, even mild negative events within a faction were excluded; i.e., unless they involved a breakup of the faction or physical violence.

To minimize risk of double coding of events reported in different sources or in more than usual detail, events on the same day and in the

same scale category (e.g., repeated instances of shelling), which involved the same parties in the same or adjacent locations (suburbs or villages), were coded as a single event. Further, because a consistent impact across all experimental periods was predicted only for people within Lebanon,[7] only interactions inside Lebanon between individuals, groups, or external forces currently based in Lebanon or in Lebanese coastal waters, were coded. Cross-border raids (e.g., between Israelis and the PLO) were thus excluded, as were related political developments outside Lebanon, unless they involved direct consultation among the leaders of antagonistic domestic or foreign groups or nations with armed forces independently based in Lebanon.

When there were conflicting reports of the same event, the most recent report or non-partisan source was preferred. If both reports weighed equally on these criteria, number of fatalities or injuries (by far the most frequent point of difference between sources) was calculated as an average from the two reports. Where a total number of fatalities or injuries was given for a period of a few days without more specific details, there were assumed to be equal numbers for each day. Similarly, where only total "casualties" were reported, they were assumed to include fatalities and injuries in the same proportion as reported for other incidents in the same period.

After completion of coding, any apparent discrepancies were referred back to the coder for checking with reference to original sources, and revised by him if and as he considered necessary.

**Experimental Design and Analysis**

This data set provided the basis for a dynamic statistical analysis of the predicted impact of collective practice of the TM-Sidhi program on events in Lebanon. The study employed an interrupted time-series design with multiple replications, which is regarded as a "very powerful" basis for making causal inferences regarding the relationship between the independent (exogenous) and dependent (endogenous) variables (Cook & Campbell, 1979, p. 222).

*Dependent variables*. Five dependent variables were derived from the data set:

(a) level of cooperation among non-allied internal and external participants in the Lebanon War (hypothesis 1). This variable was operationalized as the daily sum of intensity weights for all events coded in cooperation categories 1 to 8 on any of the six scales;

(b) level of conflict among internal and external participants in the war in Lebanon (hypothesis 2). This variable was defined as the daily sum of intensity weights for all events coded in conflict categories 9 to 16 on any of the six scales;

(c) total number of fatalities per day (including civilians and combatants from all parties) resulting from the conflict (hypothesis 3);

(d) total number of non-fatal injuries per day (including civilians and combatants from all parties) resulting from the conflict (hypothesis 3);

(e) a composite daily Peace/War Index, constituting a general indicator of progress (or otherwise) toward peaceful resolution of the Lebanon conflict (hypothesis 4). This Index was constructed by combining the measures of level of cooperation, level of conflict, and number of fatalities. The second measure of casualties (non-fatal injuries) was excluded because it was highly correlated with the first (fatalities: r = .77), in contrast to lower correlations among the other three variables (r's from .06 to .44). The three variables used were first log transformed where necessary to achieve stationarity of variance (see Results section). They were then standardized (z-transformed), and inverted where necessary so that positive values always indicated an improvement, then summed. The four initial variables were correlated with the Index as follows: r = .45 (cooperation); -.71 (conflict); -.73 (fatalities); and -.58 (injuries).

*Independent variable*. This is a binary variable reflecting whether or not on a given day there was collective practice of the TM-Sidhi program by a group of such size (n) and location that the surrounding population equivalent to $100n^2$ includes most of the population of Lebanon, or the primary area of concurrent violent conflict within Lebanon. (As noted above, for local groups in Lebanon or neighboring Israel, where records of the approximate number (n′) of people practicing the TM technique individually are maintained, it was possible also to take that number into account in calculating the minimum group size required at a given location, so that 100n′ could be added to the size of the population predicted to be influenced by the group.) A binary model of the intervention was adopted, in the absence of any clear theoretical basis for predicting a more intense impact in Lebanon with increasing group size over the threshold for a given assembly location, rather than only a more

[7] Although for larger groups, some impact on international violence might also be expected, the specific areas affected would vary according to size and location of each group, and the group within Lebanon was too small for any such impact at all.

widespread impact of uniform intensity across a larger population outside Lebanon.[8]

The 27-month period covered by the analysis, from June 1, 1983 to August 30, 1985, was selected to include all seven "World Peace Assemblies" held during the war, with participants collectively practicing the TM-Sidhi program in sufficient numbers and proximity to Lebanon for a predicted impact on the war for all or part of the assembly period;[9] as well as a 10-week baseline period before, and 6 weeks after, the assemblies.[10] The assemblies included a total of 93 above-threshold days, or 11.33% of the period covered, with the remaining 728 days constituting a control or comparison period.

Each of these assemblies was organized and publicized as a prospective social experiment to test the prediction of improved quality of life and progress toward peace in the surrounding population. Except in the case of an assembly held in Lebanon, the dates for the assemblies were selected well in advance and without reference to events in Lebanon. With the further exception of an assembly in neighboring Israel, predictions were not any more specific to Lebanon than to other trouble spots within the area of the projected impact of each assembly. This is consistent with the prediction that improvements during each assembly spontaneously result from the practice of techniques for personal growth, without any focus by participants on specific outside people or events. Thus, while strict, laboratory-style random assignment of assembly dates or locations was not possible for practical reasons common to all

[8] The possibility that there may be a greater impact on communities closer to the group than on those further away or spread over a larger area (but still within the population area defined by the $100n^2 + 100n'$ formula) is not excluded. This study, however, is designed to address the prior issue of whether there is any impact within the area so defined, for groups and populations of varying sizes. (Two recent and as yet unpublished studies available from the authors do report evidence that communities closer to the group are more strongly affected than those further away.)

[9] One other assembly was held in 1978/1979, which was too much in advance of the rest for its inclusion in this time-series to be justifiable either on statistical or economic grounds. See Orme-Johnson, Alexander, Dillbeck, & Bousquet (1991) for an independent analysis of its positive impact in Lebanon. Other international assemblies held since the completion of data collection for the current study in 1988 may have been sufficiently large for a predicted impact to include Lebanon, but may be better evaluated without primary reference to the Lebanon War, given the reduced levels of violence there in recent years.

[10] The longer baseline period before the first assembly was set prior to data collection and analysis in order to provide enough days to allow modeling of long and complexly autocorrelated dependent series without limiting our ability to evaluate the impact of the first assembly.



such large-scale social experiments,[11] nevertheless the assemblies were held essentially randomly in relation to day-to-day changes in Lebanon.

For each assembly except those in Lebanon and Israel, these predictions were announced in advance to local and international press, and in some cases (the Israel, "Utopia" and Washington assemblies) to independent scientists. However, in no case did any of the Lebanese news media carry the story before or during the assembly. In addition, prior to commencement of coding and analysis of data for the present study, a research proposal setting out the specific details of hypotheses, design, assembly dates, and dependent variables, was lodged with internal and external faculty members of the doctoral committee of the first author (Davies, 1988).

The seven assemblies are briefly described in the following paragraphs.

### *The Israel assembly*

The Israel assembly was held in two separate stages—from August 1 to October 1, 1983, in Jerusalem; and with a smaller group from October 2 to 16 in Natanya. The maximum number involved in group practice each day varied between 65 and 241, as part-time participation was encouraged, and a special advanced course was held from 15 to 27 August to attract additional participants. The population of Israel in 1983 was approximately 4,014,000, plus an additional 1,250,000 in the occupied Palestinian territories; while that for Lebanon was an estimated 3,300,000 (principal source for all population statistics was Paxton, 1987). At the time of the assembly, the southern part of Lebanon, up to the Chouf mountains outside Beirut, was occupied by the Israeli army. The primary area of violent conflict was in the Chouf. For an influence of coherence from a group in Israel to include at least the Chouf (and the population of the southern half of Lebanon occupied by Israel) would therefore require, in addition to approximately 38,000 Israelis and 2,000 Lebanese practicing the TM technique individually ($n' = 40{,}000$), a minimum group size of $n = 171$. This was calculated as the square root of one percent of $(4{,}014{,}000 + 1{,}250{,}000 + 3{,}300{,}000/2 - 100 \times 40{,}000)$. Although parts of other countries neighboring Israel might have been physically closer to the assembly than parts of Israel or southern Leba-

[11] Specific assembly dates and locations were set based largely on the availability and cost of facilities and on convenience and accessibility for potential participants. Following a formally randomized schedule would have prohibitively increased expenses and reduced attendance levels, and thus was not attempted. Nor was it considered acceptable to achieve formal randomization through withholding collective meditation on a random schedule once an assembly was successfully convened, given evidence as above that such a step could result in more human deaths.

TABLE 1 Periods of Predicted Impact in Lebanon

| *Experimental Periods* | *Location of Assembly* |
|---|---|
| **1983** | |
| 1. Aug. 12–27, Sept. 2–3, 9–10, 21–24 & 28–29 | Jerusalem, Israel |
| Oct. 14–15 | Natanya, Israel |
| **1984** | |
| 2. Dec. 28, 1983 to Jan. 7, 1984 | Fairfield, IA, USA ("Utopia" assembly) |
| 3. Mar. 1–9 & 14–17 | Broumana, Lebanon |
| 4. Apr. 16–23 | Porec, Yugoslavia |
| 5. July 2–14 & 16 | Fairfield, IA, USA |
| **1985** | |
| 6. Dec. 29, 1984 to Jan. 7, 1985 | The Hague, Netherlands |
| 7. July 10–18 | Washington, DC, USA |

non, Maharishi's (1979, 1986) theory, which formed the basis for the intervention and its predicted impact, emphasizes that such an impact is mediated via collective consciousness, which is localized more in terms of community boundaries rather than simple geographic distance. Hence it was assumed that those in the area governed or occupied by Israel would be impacted more immediately than those in (other) neighboring states (see more detailed discussion of this point by Orme-Johnson et al., 1990).

Numbers of individual practitioners were provided by the national offices of the International Meditation Society in Israel and Lebanon. Numbers practicing collectively in the Jerusalem assembly each day were sent monthly, in advance of any analysis of the impact of the assembly, to review boards of independent scientists in Israel and North America with whom predictions as to specific social changes expected to result from the assembly had already been lodged (see Orme-Johnson, Alexander et al., 1988). The consequent pattern of above-threshold experimental intervention days is detailed in Table 1.

### *The "Taste of Utopia" assembly*

The "Taste of Utopia" assembly was held at Maharishi University of Management (MUM), (formerly Maharishi International University, 1971–1995) in Fairfield, Iowa, from December 18, 1983 to January 6, 1984. The approximate size threshold for this assembly, 4,180, was calculated as the square root of one percent of the population at that time of the total area at least as close to the assembly as Lebanon: 1.75 billion. On this scale, it was not possible to take into account number of individuals practicing the TM technique outside the assembly (even approximate figures were not available), or unevenness in the pattern of "spread" in predicted coherent effects due, for example, to national, geographic, or ethnic population boundaries defining local communities or units of collective consciousness (see above). It was assumed that for assemblies large enough for a projected impact across the populations of many countries, these factors would to some extent counter-balance each other, so that taken together, they would not systematically increase or reduce the required size threshold for each assembly in relation to Lebanon. According to assembly records maintained independently of this study at MUM, this threshold was consistently exceeded (up to a maximum group size of 7,830) for the period December 27, 1983 to January 6, 1984. Number of participants was lower during the early part of the assembly, as there were two alternative dates for joining the assembly—December 18 or 27. Given an eight-hour time difference between the assembly and Lebanon, this led to a predicted impact for the period from December 28 to January 7 in Lebanon.



### *The Lebanon national assembly*

The Lebanon national assembly was held in Broumana from March 1 to 17, 1984. Broumana is in the mountains just east of Beirut, in the central region of the conflict at that time. According to the International Meditation Society in Lebanon, there were approximately 70 participants in collective practice each day, except for a four-day period (March 10 to 13) when numbers dropped to between 25 and 30. In this case, the assembly had been initiated in response to a worsening situation in Lebanon. The combined impact of 2,000 Lebanese practicing the TM technique individually (almost all were in Beirut and the surrounding region) and of 70 practicing the TM-Sidhi techniques collectively was predicted to cover a population of 690,000 ($100n' + 100n^2 = 200{,}000 + 490{,}000$), which includes all the surrounding mountain region where the fighting was most intense, and much of Beirut itself (population estimated then at 700,000). Again, where the predicted impact of the assembly extends across many communities (in this case towns and suburbs—there was no question of a possible impact reaching across national borders) geographical distance is taken as the best guide to the population affected. Intervention days were thus taken to be March 1 to 9, and 14 to 17.

### *The Yugoslavia assembly*

The Yugoslavia assembly was held in Porec from April 13 to 23, 1984. According to assembly organizers, there were at least 2,000 participants (up to 2,500) throughout this assembly, but adequate facilities were not available until April 16 for all to practice collectively at one

time, rather than in two shifts of about 1,100 each (not big enough for a predicted impact in Lebanon). April 16 to 23, when the assembly was expected to impact on a surrounding population of at least 400 million (which includes Lebanon) was thus taken as the experimental period.

*The Fairfield assembly*

The Fairfield assembly was located (like the Utopia assembly) at Maharishi University of Management, Fairfield, Iowa, and held from July 1 to 15, 1984. According to records kept at MUM, the threshold of 4,180 was exceeded (up to a maximum group size of 5,132) on all days except July 14, so that after allowing for the time difference from Lebanon, experimental days were taken to be July 2 to 14, and 16.

*The Netherlands assembly*

The Netherlands assembly was held in The Hague from December 21, 1984, to January 12, 1985. Because there was a choice of dates for joining or leaving the assembly, group size jumped sharply from 1,200 to 6,100 on the evening of December 28, and remained at or slightly above that level until January 7, when it dropped again to a subthreshold level of 2,700. Given the late collective practice by the larger group on December 28, and a one-hour time difference from Lebanon (so that any impact from the group would not be felt in Lebanon before nightfall), the experimental period for this assembly was taken to be December 29 to January 7.

*The Washington, DC assembly*

The Washington, DC assembly was held from July 9 to 17, 1985. According to assembly organizers, number of participants remained at or slightly above 5,000 throughout this assembly, well above the threshold for a projected impact in Lebanon. Given the time difference from Lebanon, the experimental period was taken to be July 10 to 18.

*Control variables*. Two independent variables (other than the experimental variable), which were measurable and might systematically influence the dependent variables (Anderson, 1987, 1989; Singer & Small, 1972) were included as control variables in the analysis: temperature and holidays.[12]

Temperature in Beirut at 2 pm local time was recorded from daily reports in the *Washington Post*. To adequately control for holidays, however, it was necessary to distinguish among several different categories. Any impact from regular weekend holidays would automatically be controlled for statistically through time-series analytic procedures (see next section). However, national holidays, and Moslem, Christian, and Jewish religious holidays occurred irregularly, and thus had to be included as separate binary variables. One variable was required for each category, since the impact of Jewish holidays, for example, may be quite different from that of Lebanese national holidays (Israelis occupied most of southern Lebanon throughout the study period).

[12] Changes in the political situation in Lebanon could not be controlled for in this way, as they are considered an integral part of the dependent variables. Nevertheless, it will be necessary to assess whether there is any evidence that the dependent variables lead the independent variable (see discussion below of reverse causality).



**Data Analysis**

Analysis was based on the time-series impact assessment methodology derived by Box and Tiao (1975), as a special case of Box-Jenkins transfer function analysis of the dynamic relationship between two or more time-series (Box & Jenkins, 1976; Vandaele, 1983). This is a more rigorous approach for testing interventions than can be provided by the usual parametric statistical tests, which depend on the assumption that observations are independent (not autocorrelated). This assumption is usually not met in the case of time-dependent observations of a system. Although most parametric tests are robust with respect to departures from normality, the presence of autocorrelations (correlation of a series with itself at different time lags) generally leads to spuriously high test statistics (Box & Jenkins, 1976; Box & Tiao, 1975). The more rigorous Box-Jenkins approach controls for this serial dependence of the data by first modeling it as "noise", and then using this noise model as the null case for comparison in assessing the impact of the independent or exogenous variable.

The intervention model used as the basis for assessment was a "zero order" transfer function model of the form:

$$Y_t = C + W_o I_t + N_t,$$

where $Y_t$ is the dependent or endogenous series, C is a constant, $W_o$ is the intervention parameter to be estimated, $I_t$ is an intervention step function which is one during each experimental period and zero elsewhere, and $N_t$ is the separately modeled stochastic noise component.

Impact assessment analysis thus determines whether a binary independent variable provides any additional information for forecasting the dependent series beyond that provided by trends and periodicities in the series' own prior history, as captured in the null or noise model. Prior history, which Cook and Campbell (1979) regard as the main threat to the internal validity of a time-series experiment, is thus controlled for statistically in this type of analysis through modeling the noise component as the basis for assessing the further impact of the intervention

component. Assessment of daily temperature and holidays allowed additional control for prior history, and, whenever warranted, these were included separately in the model for each dependent series (following Liu & Hanssens, 1982).

Finally, the fact that the experimental assembly periods were selected well in advance and (with the exception of the assembly within Lebanon) without reference to the current situation in Lebanon provided a quasi-randomization of intervention dates as further protection for the study's internal validity.

In identifying the noise model for each dependent series, minimization of Akaike's information criterion (AIC: Akaike, 1972) was adopted as an objective criterion for model selection, thus minimizing the need for any subjective judgment by the experimenter. The AIC provides a useful comparative measure of prediction error, such that the inclusion of each additional parameter is justified on the basis that the AIC is thereby significantly reduced (Larimore, 1983, 1986). Although minimization of the AIC was found to lead to complex noise models, it has been shown to provide the best balance between the competing goals of parsimony and precision of model fit (Larimore & Mehra, 1985). The more complex models reflect more detailed statistical control for preexisting cycles in the dependent series and thus a more rigorous test of the predicted impact of the independent variable (the assemblies).

## RESULTS

### Control Variables

The behavior of the two control variables—temperature and holidays—is first reviewed, before considering the results of the main analyses.

*Temperature*. The temperature series was highly autocorrelated, reflecting the stable day-to-day weather patterns of a Mediterranean climate. Thus, first order differencing would have been required to model the series for dynamic analysis. However, this was not acceptable, as it would have left only information on day-to-day differences—which were too small for any significant impact on level of conflict to be anticipated—and would in effect eliminate all information on annual temperature cycles. These annual cycles reflected substantial seasonal differences which may have been too long to be reliably modeled by ARMA parameters for this 2.25 year series. A further obstacle to dynamic analysis was a substantial proportion of missing data points—no temperature was reported for 134 out of 821 days.

Although non-independence of data points also prevented non-dynamic statistical analysis, simple inspection of means indicated that



TABLE 2 Coolest and Hottest Quartiles: Mean Levels of Dependent (Lebanon War) Variables and Proportion of Experimental Intervention Days

| | *Coolest quartile ( < 66 degrees)* | *Hottest quartile ( > 81 degrees)* |
|---|---|---|
| Cooperation (mean scale value per day) | 1.47 | 1.48 |
| Conflict (mean scale value per day) | 36.55 | 43.44 |
| War fatalities (mean per day) | 6.96 | 8.33 |
| War injuries (mean per day) | 16.29 | 18.22 |
| Proportion of intervention days | 12.94% | 18.03% |

experimental days were, on average, at least as hot as the remaining (control) days: 74.18 degrees as compared to 73.15 degrees. This appears to reflect a higher proportion of experimental days during the summer months (see Tables 1 and 2). Comparison of means during the hottest and coldest quartiles suggested no change in level of cooperative actions, but a worsening of the conflict and increased casualties when temperatures were higher, consistent with earlier studies (Anderson, 1989; Singer & Small, 1972): see Table 2. Thus higher temperatures during the experimental periods suggest that seasonal (temperature) cycles were not responsible for results in the predicted direction of higher cooperation and reduced conflict; if anything, temperature should bias results against the hypotheses.

A further protection against bias from annual seasonal cycles is that assemblies were held during all seasons of the year: the Lebanon and Yugoslavia assemblies in the spring; part of the Jerusalem assembly, and the Fairfield and Washington assemblies in the summer; part of the Jerusalem assembly, and the Natanya assembly in the fall; and the Utopia and Netherlands assemblies in the winter. Moreover, with one exception, dates which fell within the experimental period in one year were in the nonexperimental period in another year of the study. The exception was the period from December 29 through January 7, which was an experimental period for both years of the study (see Table 1). However, Orme-Johnson, Dillbeck et al. (1989) report that a global control analysis of Azar's (1982) COPDAB data on international and domestic conflict for the five-year period to 1978 (the last year for which data were available) indicated no amelioration in conflict during this 11-day period compared to prior and subsequent weeks: rather, there was a nonsignificant increase. Further, inspection of news sources for this

period in the year 1982–1983, just prior to the experimental period for the present study, similarly indicated a slight worsening of the conflict in Lebanon in comparison to prior and subsequent weeks.

*Holidays*. National, Moslem, Christian and Jewish holidays were separately modeled as binary independent variables in relation to each dependent variable and their impact assessed simultaneously with that of the experimental intervention variable. Alternative analyses were also conducted with the three categories of holiday within Lebanon (i.e., excluding Jewish) combined into a single binary variable. In only 1 case out of a possible 25 (5 holiday variables across 5 dependent variables)—no more than would be expected by chance—was there a significant impact from holidays: on Moslem holidays, level of cooperation was higher ($t = 2.13$, $p < .05$, 2-tailed). There was also a trend toward more positive Peace/War Index values on Moslem holidays ($t = 1.71$, $p < .10$, 2-tailed). In all other cases, the holiday variables did not significantly improve the AIC for the impact assessment models and were therefore excluded.

**Dependent Variables**

The raw series for each of the five dependent variables appeared stationary as to mean, but, with the exception of the Conflict Scale and Peace/War Index series, not as to variance. In each of the other three series, a natural log transformation was necessary to achieve stationarity. A zero order transfer function model was then constructed for each series, with that noise component which best minimized the AIC criterion being preferred. In each case the value of the intervention parameter (a zero order numerator parameter) was robust to alternative plausible specifications of the noise component, and all components of the model were well within the bounds of stationarity and invertibility. Diagnostic tests of the residuals for each model were satisfactory, with a Ljung-Box Q (LBQ) statistic indicating the joint nonsignificance of autocorrelations at lags 1 through 36 (Ljung & Box, 1978) at the .05 level. For each model, the LBQ statistic is reported only for lags 1 through 36, as is customary for daily time series, but in checking for longer cycles (including annual) the LBQ was also examined up to lag 400, and found to remain nonsignificant for all lags.

This suggests that each model adequately described the systematic structure of the series, leaving residuals which appeared to be generated by an uncorrelated white noise process. This was confirmed by the extended autocorrelation function for each set of residuals, which indicated an ARMA (0,0) structure. Moreover, inspection of the histogram, time-series plot and normal probability plot of the residuals for each model revealed no evidence of outliers, nonstationarity, gross nonnormality, or other evidence of model inadequacy.



*Cooperation scale*. The model for the noise component included both autoregressive (AR) and moving average (MA) parameters of the first order (AR 1 and MA 1), indicating the data were highly autocorrelated on successive days (one day's cooperation level was a good predictor of the next day's level). Several higher order MA parameters also indicated approximate weekly (MA 6 and 8), two-weekly (MA 14), and four-weekly (MA 26, 27 and 28) seasonality. Retention of the nonsignificant MA 6 parameter was indicated by the AIC. Also retained in the complete model is a parameter representing the impact of Moslem holidays, as discussed earlier. The parameter estimates and their corresponding t-statistics are listed in Table 3.

TABLE 3 Impact Assessment Analysis Parameters for Daily Cooperation Scale

| | *Factor* | *Estimate (log metric)* | *% Decrease (raw metric)* | *t* | *p** |
|---|---|---|---|---|---|
| Noise component | | | | | |
| Constant (mean) | | .49 | | 9.24 | <.0001 |
| AR 1 | 1 | .72 | | 6.55 | <.0001 |
| MA 1 | 1 | .59 | | 4.59 | <.0001 |
| MA 6 | 2 | -.06 | | -1.71 | <.10 |
| MA 8 | 3 | -.09 | | -2.40 | <.025 |
| MA 14 | 4 | -.08 | | -2.37 | <.025 |
| MA 26 | 5 | -.09 | | -2.51 | <.025 |
| MA 27 | 5 | .08 | | 2.26 | <.025 |
| MA 28 | 5 | -.08 | | -2.29 | <.025 |
| Control variable: | | | | | |
| Moslem holidays | | .38 | 46.90% | 2.13 | <.05 |
| **Intervention component** | | | | | |
| All assemblies | | .51 | 66.05% | 4.96 | <.0001 |
| Individual assemblies | | | | | |
| Israel | | .05 | n.s. | .27 | >.10 |
| Utopia (Iowa, USA) | | .71 | 104.05% | 2.54 | <.01 |
| Lebanon | | .81 | 123.85% | 3.20 | <.001 |
| Yugoslavia | | .88 | 141.67% | 2.19 | <.025 |
| Fairfield (Iowa, USA) | | 1.07 | 190.69% | 4.19 | <.0001 |
| Netherlands | | .19 | n.s. | .66 | >.10 |
| Washington, DC (USA) | | .62 | 85.39% | 2.10 | <.025 |

** 1-tailed for intervention parameters, otherwise 2-tailed.*

*Note: LBQ(36) = 18.0; AIC = 1818.50.*

The experimental intervention parameter covering all experimental (above threshold) days across all assemblies) was .51, t = 4.96, p < .00001. This is a very large t-statistic, corresponding to an exact p value of $4\times10^{-7}$, 1-tailed. This means that level of cooperation among antagonists increased by an average of .51 log units during the experimental periods, representing a 66.05% increase from the mean scale value of 1.22 during the nonexperimental periods to 2.03 (see McCleary & Hay, 1980, pp. 171–185, for conversion of log units to percentage change for intervention parameters). A scale value of 1 would correspond, for example, to a single expression of goodwill (category 7 in Scales 1, 3, and 5) or establishment of a committee to study a problem (category 7 in Scales 2 and 4); a scale value of 2 would correspond to a proposal for reform in response to demands, or for a specific solution to the conflict (category 5 in Scales 1 and 3).

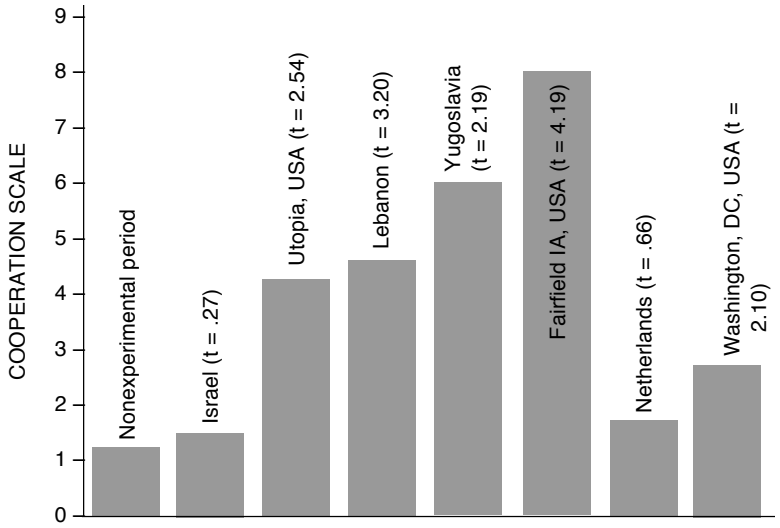
The actual daily mean level of cooperation during experimental periods was 3.82 (see Figure 1), corresponding, for example, to formation of a coalition between opposing groups (category 3, Scale 2). However, the more conservative estimated mean should be relied on for statistical purposes, as it was generated from dynamic analysis taking into account preexisting cycles or periodicities in the cooperation scale series.

When each of the seven assemblies was modeled as a separate intervention, parameter values for the noise model and Moslem holidays remained virtually unchanged. Estimated increases in cooperation were significant for 5 of the 7 assemblies (see Table 3). The actual mean scale values per day for each assembly and for the nonexperimental period are also presented in Figure 1.[13]

Given the high degree of day-to-day variation in level of cooperation, simply translating the mean in terms of examples from the scales does not give an adequate picture of what was happening during the assemblies. Closer examination of the data suggests major breakthroughs

[13] Apparent discrepancies between tables and figures as to the relative size of mean scale values during the experimental and nonexperimental periods result from the fact that, in estimating degree of impact, dynamic statistical analysis takes into account constant fluctuations in the level of the nonexperimental baseline, which cannot be represented in a simple figure. However, while these estimates of change are therefore relied on for dynamic statistical evaluation of the assemblies' impact, actual values are more appropriate for non-dynamic illustration of levels during each assembly, at least for those variables where actual values have a specific empirical interpretation (i.e., figures 1–3). Another apparent discrepancy in the tables is that often a higher t-statistic is given for an assembly with a lower percentage improvement (e.g., the Lebanon vs. Yugoslavia assembly on the cooperation scale). This is the result of a relatively low standard error for that assembly: although overall percentage improvement is not as high, it is more consistent, and hence more significant.






*Note: Impact assessment analysis indicates significant improvement during five of the experimental periods, and during all seven combined (p < .0001).*

FIGURE 1 Mean Daily Level of Cooperation among Antagonists in the Lebanon War during the Nonexperimental and Experimental Periods, June 1983 to August 1985

were made toward resolving the overall conflict during most assemblies (consistent with our predictions), which translated into high mean cooperation scores.

For example, the coder's event summaries indicate that during the Utopia assembly, the Lebanese government finally agreed on a security plan for all of Lebanon and was able to obtain the support of all the main domestic parties to the conflict and of the Syrian and Israeli governments. During the Lebanon assembly, Syria agreed to a gradual withdrawal of its forces from Lebanon; the Lebanese government and all domestic parties agreed at a reconciliation conference to the abrogation of a controversial agreement with Israel; and opposition leaders agreed to a comprehensive cease-fire and to drop their demand for the President to resign. During the Yugoslavia assembly, a productive meeting was held with Syria, following which all major parties agreed to form a national unity government, agreed on its structure and related reforms, and allowed some deployment of Lebanese army disengagement forces. The new government was formed, but it was not until during the Fairfield

assembly that substantial progress was finally made in implementing the security plan for Beirut.

Typically, however, as the quantitative analyses suggest, the momentum from each breakthrough was not sustained once the assembly ended or dropped below threshold size, and events fell back into the same low-cooperation pattern as prevailed before the assembly. For example, after the Utopia assembly, parties began to place substantial preconditions on their acceptance of the security plan; a few days after the Lebanon assembly the national reconciliation conference collapsed without a solution to the conflict; and after the Fairfield assembly no further progress was made in the disengagement of forces in Beirut during the period of the study.

*Conflict scale*. The model for the noise component included both AR and MA parameters of the first order, and higher order AR parameters indicating approximate weekly, two-weekly, three-weekly, and monthly seasonality. Retention of the nonsignificant AR 13 parameter was dictated by the AIC. Parameter estimates and their corresponding t-statistics are listed in Table 4.

Although the conflict series was uncorrelated with the cooperation series (r = .10), the intervention parameter was again highly significant, at -20.88, t = -5.81, p < .00001 (exact value: $p = 3\times10^{-9}$, 1-tailed). This means that level of conflict decreased by an average of 20.88 scale points from a mean scale value per day during the nonexperimental period of 43.48, to a mean value of 22.60 during the experimental period, a reduction of 48.02%. A conflict scale value of 43, for example, would correspond to one full-scale military engagement and four separate armed clashes in one day; a value of 22 would correspond to two armed clashes and one less violent incident, such as a kidnapping (examples taken from Scale 2, categories 15, 16 and 13, respectively). For the conflict scale series, the estimated daily mean during the experimental periods was close to the actual mean of 25.56 (see Figure 2) and the examples given above depict more accurately what was typically happening daily in each period.

When the seven assemblies were modeled as separate interventions, the parameter estimates for the noise model remained virtually unchanged. Estimated decreases in conflict were significant for 6 of the 7 assemblies (see Table 4). The actual mean scale value per day for each assembly is also illustrated in Figure 2.

*War fatalities*. The model for the noise component again included both AR and MA parameters of the first order and higher order AR parameters indicating three-weekly and 25 day seasonality. Both seasonal parameters were nonsignificant, but their inclusion was indicated



TABLE 4 Impact Assessment Analysis Parameters for Daily Conflict Scale

| | *Factor* | *Estimate (log metric)* | *% Decrease (raw metric)* | *t* | *p** |
|---|---|---|---|---|---|
| **Noise component** | | | | | |
| Constant (mean) | | 43.48 | | 21.26 | <.0001 |
| MA 1 | 1 | .27 | | 2.42 | <.025 |
| AR 1 | 1 | .54 | | 5.48 | <.0001 |
| AR 6 | 2 | .12 | | 3.33 | <.0025 |
| AR 7 | 3 | .08 | | 2.27 | <.05 |
| AR 13 | 4 | .07 | | 1.87 | <.10 |
| AR 14 | 4 | .12 | | 3.44 | <.001 |
| AR 21 | 4 | .07 | | 2.00 | <.05 |
| AR 31 | 4 | -.08 | | -2.42 | <.025 |
| **Intervention component** | | | | | |
| All assemblies | | -20.88 | 48.02% | -5.81 | <.0001 |
| Individual assemblies | | | | | |
| Israel | | -23.91 | 54.99% | -3.78 | <.0001 |
| Utopia (Iowa, USA) | | -24.33 | 55.96% | -2.33 | <.01 |
| Lebanon | | -17.73 | 40.78% | -1.89 | <.05 |
| Yugoslavia | | -19.84 | 45.63% | -1.72 | <.05 |
| Fairfield (Iowa, USA) | | -22.08 | 50.78% | -2.34 | <.01 |
| Netherlands | | -23.19 | 53.33% | -2.11 | <.025 |
| Washington, DC (USA) | | -9.68 | n.s | -.87 | >.10 |

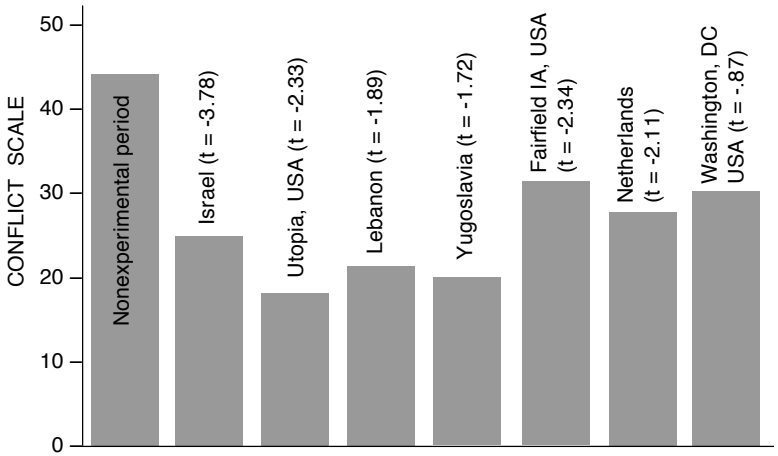
** 1-tailed for intervention parameters, otherwise 2-tailed.*

*Note: LBQ(36) = 19.0; AIC = 7120.19.*

empirically by the AIC. Parameter estimates and corresponding t-statistics are listed in Table 5.

The intervention parameter was -1.24, t = -6.45, p < .00001 (exact value: $p = 1\times10^{-10}$, 1-tailed). This means that total war fatalities decreased by an average of 1.24 log units, corresponding to a 70.93% drop from a mean during the nonexperimental periods of 12.05 fatalities per day to 3.50 per day during the experimental periods. The actual mean number of fatalities for the experimental periods was 2.78 per day (see Figure 3), but as with the cooperation scale, the more conservative estimate should be relied upon for statistical comparison.

This measure was not as highly correlated with the conflict scale as might be anticipated (r = .44), reflecting the fact that high casualty rates would commonly result from single incidents such as car-bombs, massacres, or attempts to take a position by force. On the other hand, many




*Note: Impact assessment analysis indicates significant alleviation of conflict during six of the experimental periods, and during all seven combined (p < .0001).*

FIGURE 2 Mean Daily Level of Conflict in the Lebanon War during the Nonexperimental and Experimental Periods, June 1983 to August 1985

separate clashes were regularly reported between armed militias, or between PLO or Lebanese "resistance fighters" and Israeli army patrols, which resulted in very few casualties but relatively high conflict scale scores. The two measures thus provide relatively independent assessments of different components of war severity.

When each assembly was modeled as a separate intervention, the parameter estimates for the noise model remained essentially unchanged. Estimated decreases in war fatalities were significant for 6 of the 7 assemblies (see Table 5). Actual mean fatalities per day during each assembly and the nonexperimental period are represented in Figure 3.

*War injuries*. For injuries, the intervention parameter was -1.15, t = -4.91, p < .00001 (exact value: $p = 5\times10^{-7}$, 1- tailed). This means that total non-fatal war injuries decreased by an average of 1.15 log units, corresponding to a drop of 68.42% from a mean during the nonexperimental period of 25.28 injuries per day to 7.99 per day during the experimental periods. This estimate agrees very closely with the



TABLE 5 Impact Assessment Analysis Parameters for Daily War Fatalities

| | *Factor* | *Estimate (log metric)* | *% Decrease (raw metric)* | *t* | *p** |
|---|---|---|---|---|---|
| **Noise component** | | | | | |
| Constant (mean) | | 1.65 | | 14.07 | <.0001 |
| MA 1 | 1 | .49 | | 7.90 | <.0001 |
| AR 1 | 1 | .79 | | 18.19 | <.0001 |
| AR 22 | 2 | .06 | | 1.83 | <.10 |
| AR 25 | 2 | .06 | | 1.71 | <.10 |
| **Intervention component** | | | | | |
| All assemblies | | -1.24 | 70.93% | -6.45 | <.0001 |
| Individual assemblies | | | | | |
| Israel | | -1.90 | 85.01% | -6.11 | <.0001 |
| Utopia (Iowa, USA) | | -1.34 | 73.70% | -2.25 | <.025 |
| Lebanon | | -.97 | 62.18% | -2.03 | <.025 |
| Yugoslavia | | -1.13 | 67.79% | -1.78 | <.05 |
| Fairfield (Iowa, USA) | | .35 | n.s. | .67 | >.10 |
| Netherlands | | -1.31 | 72.93% | -2.15 | <.025 |
| Washington, DC (USA) | | -1.12 | 67.42% | -1.81 | <.05 |

** 1-tailed for intervention parameters, otherwise 2-tailed.*

Note: LBQ(36) = 19.3; AIC = 2486.54.

actual mean for the experimental periods of 7.98. Estimated reductions in war injuries were significant for 4 of 7 assemblies and near significant (trend) for another one.

This measure was highly correlated with number of fatalities (r = .77)—fatalities and injuries tended to result from the same events—hence more detailed results are not included (available from the first author). However, this variable is still of some interest in showing that the observed impact of the different assemblies was consistent across different indices of reduction in violent behavior.

*Peace/War Index*. The model for the combined Peace/War Index included both AR and MA parameters of the first order, with higher order AR parameters indicating approximate weekly, two-weekly, and three-weekly seasonality. The retention of one nonsignificant parameter (AR 13) was indicated by the AIC. Parameter estimates and corresponding t-statistics are listed in Table 6.

The intervention parameter was 2.30, t = 9.03, p < .00001 (exact value: $p = 9\times10^{-20}$, 1-tailed). This means that interactions among antagonists changed in a positive direction (less violence, more cooperation) by

TABLE 6 Impact Assessment Analysis Parameters for Daily Peace/War Index

| *Parameter* | *Factor* | *Estimate* | *Improvement* (std units)* | *t* | *p*** |
|---|---|---|---|---|---|
| **Noise component** | | -.26 | | -1.96 | .05 |
| Constant (mean) | | | | | |
| MA 1 | 1 | .58 | | 6.85 | <.0001 |
| AR 1 | 1 | .78 | | 11.65 | <.0001 |
| AR 6 | 2 | .08 | | 2.02 | <.05 |
| AR 13 | 3 | .05 | | 1.51 | >.10 |
| AR 15 | 3 | -.09 | | -2.65 | <.01 |
| AR 22 | 3 | .09 | | 2.60 | <.01 |
| Control variable: | | | | | |
| Moslem holidays | | .73 | .39 | 1.71 | <.10 |
| **Intervention component** | | | | | |
| All assemblies: | | 2.30 | 1.22 | 9.03 | <.0001 |
| Individual assemblies: | | | | | |
| Israel | | 2.27 | 1.20 | 5.27 | <.0001 |
| Utopia (Iowa, USA) | | 2.89 | 1.53 | 3.78 | <.0001 |
| Lebanon | | 2.16 | 1.15 | 3.38 | <.0005 |
| Yugoslavia | | 2.83 | 1.50 | 3.45 | <.0005 |
| Fairfield (Iowa, USA) | | 1.71 | .91 | 2.46 | <.01 |
| Netherlands | | 2.35 | 1.25 | 2.98 | <.002 |
| Washington, DC (USA) | | 2.20 | 1.17 | 2.75 | <.005 |

** Improvement estimates converted to standard scores (SD = 1.89).*

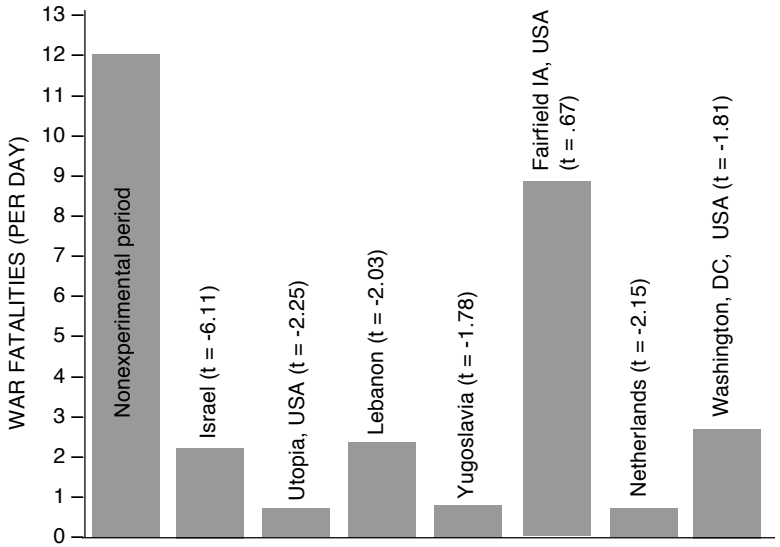
*** 1-tailed for intervention parameters, otherwise 2-tailed.*

*Note: LBQ(36) = 23.2; AIC = 3067.51.*

an estimated 2.30 index units, from a mean index value of -.26 units per day during the nonexperimental period to a mean of 2.04 during the experimental periods. Given a standard deviation for the index series of 1.89, this change corresponds to an improvement of a full 1.22 standard units, as shown in Table 6 (the mean of the series, including experimental and nonexperimental periods, was by definition 0.00).

When each of the assemblies was modeled as a separate intervention, parameter values for the noise model again remained essentially unchanged. Estimated improvements on the Peace/War Index were significant for all seven assemblies (see Table 6). Corresponding estimates for the standardized mean index values during each of the assemblies and the nonexperimental period are illustrated in Figure 4.

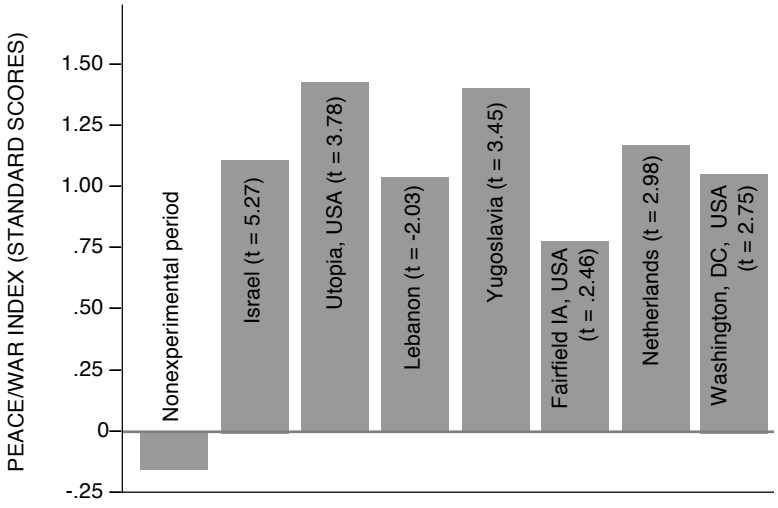





*Note: Impact assessment analysis indicates significant reductions during six of the experimental periods, and during all seven combined (p < .0001).*

FIGURE 3 Mean Daily Number of Fatalities in the Lebanon War during the Nonexperimental and Experimental Periods, June 1983 to August 1985

Each of the preceding dependent measures only partially operationalized the phenomenon being investigated—progress toward amelioration of the conflict. Hence, the value of the Index is in providing a holistic indicator of this phenomenon. If, as predicted, collective practice of the TM-Sidhi program in each assembly generated a general influence of coherence (reduced tension) in collective consciousness and behavior, it should be apparent to some extent in an improvement in any variable reflecting coherence (complementarity or constructive interaction) in behavior. However, each such variable is also subject to many other more or less unique influences, which will partially mask any common influence of coherence. In adding together several dependent variables, to some degree independent from each other but each sensitive to the hypothesized common factor of increased collective coherence, the impact of influences unique to each variable ("noise") will tend to be canceled out, so that the impact of the common factor ("signal") is less




*Note: Impact assessment analysis indicates significant improvement during each experimental period, and for all seven combined ($p < .0001$).*

FIGURE 4 Estimated Mean Daily Level on a Peace/War Index for the Lebanon War for the Nonexperimental and Experimental Periods between June 1983 and August 1985

masked: hence, signal-to-noise ratio will be improved (cf. Orme-Johnson, Alexander et al., 1988).

In fact, it was found that the apparent joint impact of the assemblies on the index ($p = 9\times10^{-20}$) was far more significant than on any of the other dependent variables ($p = 5\times10^{-7}$ through $1\times10^{-10}$). Also, the index was the only measure that significantly improved for each assembly taken separately and was more significant than other measures in almost all cases (26 of 28). These index findings strengthen the inference that the assemblies were responsible for a general positive change concurrently observed across all dependent variables.

A similar principle is involved in assessing the joint impact of several different assemblies on each dependent variable. Signal-to-noise ratio is improved in that the influence of the unique circumstances associated with each assembly (noise) is not repeated across different assemblies, so that the predicted influence of coherence common to all assemblies (signal) is more apparent when their impact is jointly assessed. Thus, the finding that for every dependent variable, the level of significance was higher for all assemblies jointly than for any assembly considered separately, further supports the proposed causal role of the assemblies.



**Adequacy of the Abrupt, Permanent Impact Model**

Further analyses were conducted to test the assumption that the impact assessment parameters were appropriately represented by zero order numerator parameters, corresponding to (a) an abrupt impact (zero delay) which is (b) permanent for the duration of each intervention (i.e., does not decay). For the index series (the behavior of which was typical of all the dependent series), the decay rate, or denominator parameter for the independent variable covering all assemblies, was .98. As decay rates (denominators) vary between 0 and 1, and 1 means no decay, this finding indicates the appropriateness of a simple numerator parameter, which assumes a denominator of 1.

In order to test the other assumption, that the numerator parameters should be of zero order (indicating abrupt impact, or zero delay), the data were reanalyzed to assess whether the AIC could be further reduced by the inclusion of higher order parameters (representing lagged impact) in the intervention component of the model. Higher order impact parameters were modeled using a second independent variable in addition to that for the zero order parameter, so that lagged impacts could be assessed without distortion from the pattern of above and below-threshold periods within assemblies. The new variable was binary, with a value of one on the day following the last above-threshold day in each assembly. There was a clear 14-day gap between the last above-threshold day in the first stage of the Israel assembly (in Jerusalem) and the first such day in the second stage (in Natanya), so they were treated as separate assemblies for this purpose.

Analysis employing both the original and new independent variables indicated no significant higher order intervention parameters: i.e., no model incorporating lagged impacts over any period from 1 to 14 days could be found which improved on the original abrupt impact model. This finding indicates the appropriateness of a single, zero order impact assessment parameter.

However, a related possibility, that changes in the index series led rather than followed the assemblies, should also be tested. In principle, it could be argued as an alternative to our hypotheses that worsening of the conflict may in some way have motivated or triggered the assemblies, and then after the assemblies began, conflict returned to a lower level following a simple process of regression to the mean. (Duval, 1988,

suggested this possibility in relation to the earlier Israel study, but further testing by Orme-Johnson, Alexander et al., 1988, 1990, demonstrated that it was clearly not consistent with the data.) To test this possibility over the longer period covered by the present study, a third independent variable was constructed following the same reasoning as for the second variable, with a value of one on the fourteenth day *before* the first above-threshold day of each assembly. This allowed a test of whether the index series led the intervention series by any period from 1 to 14 days, the minimum gap between different assemblies.

Analysis employing the original and this third independent variable indicated that the intervention component of the model could be improved (the AIC lowered) by the addition of a fifth order parameter, estimated at 1.24, $t = 2.19$, $p < .05$ (2-tailed). All other parameters in the model remained essentially unchanged (the zero order parameter improved slightly, to 2.32), and diagnostic tests of the residuals were satisfactory, applying the same tests as before. Instead of a worsening, however, this model suggests an additional improvement of 1.24 units in the index series (about half that associated with the beginning of the experimental periods) 9 days (i.e., 14 minus 5 days) prior to the first experimental day in each assembly.

It is not at all apparent how or why an amelioration in the war in Lebanon would spur the initiation, or enhance the size, of an assembly (at least outside Lebanon) after 9 days. In all cases except the Lebanon assembly, assemblies were scheduled and announced many weeks in advance; and the Lebanon assembly was called in response to a worsening of the conflict, not an improvement. However, it is interesting that 3 of the 7 assemblies commenced at below-threshold levels of participation about 9 days prior to the first above-threshold day (see Method), which could mean that this initial coming together of the groups had some impact (this possibility was not excluded in deriving our hypotheses, and if anything, adds to the evidence supporting them). It should be noted, however, that at least one higher order parameter out of a possible 28 (1 for each of 14 days before and 14 days after the intervention periods) should be expected to be significant at the .05 level purely by chance. Thus, the more conservative explanation is that the single significant higher order parameter represents only a random fluctuation, and the commencement of each experimental period was statistically independent from the immediately prior history of the index series.[14]

[14] The mean index value for the 48 "sub-threshold" days during the seven assemblies was 0.62. This is better than the overall mean for the control period, but well short of that for the 93 experimental days. (See footnote 2 concerning possible sub-threshold effects.)



## DISCUSSION

### Evidence for Causality

By employing an interrupted time-series design with multiple replications, this study provides a "very powerful" basis for addressing the issue of causality (Cook & Campbell, 1979, p. 222). The possibility that observed improvements during the experimental periods simply reflect pre-existing trends or periodicities in the dependent series is precluded by explicitly removing all such patterns of change as part of the noise or null model. In thus controlling for prior history, the noise model implicitly controls for systematic influences from any (even unknown) exogenous variables reflected in the behavior of the dependent series and not specified in the intervention model (Box & Jenkins, 1976; Vandaele, 1983). Thus, for example, removing weekly and multi-weekly cycles as part of the noise model statistically controlled for a tendency for the reported levels of fighting to settle down a little on weekends.

The impact of temperature changes and of national and religious holidays, which could not be included in the noise model because they occurred either irregularly or in a yearly cycle too long to be adequately modeled for this series, was separately controlled for and could not account for any of the observed improvements during the assemblies.

Another possible explanation for observed improvements during each assembly might be that assemblies were initiated in response to worsening conditions in the war, and so took place at times when the conflict might be improving anyway, due to regression toward the mean. This possibility may be discounted for several reasons. First, all assemblies, with the single exception of that held in Lebanon, were announced weeks or months in advance, and dates were set without reference to the current or predicted situation in Lebanon, which was generally no more a focus for concern or predicted improvements than other trouble spots within the range of predicted impact of each assembly. Even where Lebanon was a specific concern (as for the Israel assembly), the time lag between planning and initiation of each assembly was too long for an explanation of improvements in terms of regression to the mean, particularly in light of the marked volatility of the conflict during that time.

Further, the statistical independence of the occurrence of the assemblies (independent series) from the pattern of behavior (the combined dependent series) over the 14 days immediately preceding and succeeding each assembly was explicitly tested and confirmed. This contradicts the possibility that regression toward the mean, or any other reactive pattern, was regularly occurring with the onset of each assembly. Finally, it is clear from the results (see Figures 1 to 5) that the level of cooperation during the experimental periods was consistently above, and

the level of conflict and numbers of fatalities and injuries consistently below, the mean for the rest of the period of the study. The observed impact on each variable from each assembly thus represents improvement substantially away from the mean, not regression toward it.

The design of the experiment also precluded any satisfactory explanation of the findings in terms of coincidence, post-hoc selection of data, or measurement artifact. Coincidence may be ruled out on the basis of extremely low probability values ($9\times10^{-20}$ for all assemblies on the composite index) and the high level of consistency of observed improvements across all indices and all seven replications (assemblies). Post hoc selection of variables or data sources was precluded through announcement to the media and/or independent review boards of dates and predicted general effects prior to each assembly (except that held within Lebanon); and by specification of hypotheses, variables, methods of analysis, basis for calculating thresholds, data sources, and coding procedures in advance of the present study (see Method).

The possibilities for measurement artifact or biased data were also severely constrained through a number of design strategies. Cooperation and conflict were separately assessed using a set of independently developed and validated scales designed specifically for discrimination of the full range of relevant political events involving all parties in the context of the conflict in Lebanon. A broad array of international and regional media sources were relied on, including sources representing all the major parties, to minimize any possibility of uneven or biased coverage of events. Identification and coding of events, including assessment of number of casualties associated with each event, was carried out by a highly experienced coder, familiar with the cultural, political and geographic context of the war, but blind as to the nature of the hypotheses, the independent variable, and the theory and technology on which the hypotheses were based. Whatever margin of measurement error remained should thus have been randomly distributed, functioning to mask rather than exaggerate the predicted impact of the assemblies.

Another possibility for measurement artifact or experimenter bias in time-series experiments is in the selection of particular noise models for the dependent series which in effect create an apparent statistical impact for the independent variable out of random noise—the "Slutsky-Yule effect" (e.g., Schrodt, 1990). This possibility was excluded through first modeling the dependent variable separately (i.e., without including the experimental series), selecting the best model using an objective, mathematical criterion (the AIC), and only then adding the experimental intervention series into the model. In each case, the addition of the intervention series changed the estimates of the noise parameters only marginally; and more importantly, the significance of the impact of the intervention parameter(s) was highly robust across multiple alternative plausible specifications of the noise model. Similarly, when the noise models were ignored altogether, by taking a simple, non-dynamic t-test comparison of the dependent variables during the experimental and control periods (as suggested by Schrodt), the levels of significance remained at least as high as for the dynamic analyses reported.



Explanation of the observed improvements as a consequence of publicity or other behavioral interactions between assembly organizers or participants and the people of Lebanon can also be excluded. In only one case out of seven (the Lebanon assembly) was there any possibility of direct personal interaction, and even that was minimized in that participants and organizers remained isolated in their facility in a small village except for such activities as purchase of food, and travel when first joining or when leaving the assembly. (This was necessary not only to protect the integrity of the experiment, but more immediately to protect the safety of participants from those who regarded such meetings of people from opposing Muslim or Christian communities at this time as a betrayal, deserving of punishment.) In no case did the media within Lebanon carry any prior or concurrent news items concerning any of the assemblies, nor was there any attempt during any of the assemblies to create any expectation of change, or otherwise influence the behavior of parties to the Lebanon conflict other than through practice of the Transcendental Meditation and TM-Sidhi programs.

**A Different Paradigm**

Given the current context of shifting theoretical and research perspectives in the social sciences, away from reliance on simpler behavioral models to include more complex systemic and cognitive processes, it is not a simple task to evaluate the significance of findings such as those reported here. In this study, we have attempted a contribution to this process by addressing the primary concerns expressed by reviewers such as Russett (1988), Duval (1988), and Schrodt (1990) in their comments on the earlier study of the Israel (Jerusalem) assembly by Orme-Johnson, Alexander et al. (1988, 1990).

The key requirement in social science research where "the criteria for plausibility are unclear" (Russett, 1988, p. 774) is that findings be replicable under varying conditions. This has been satisfied not only by reevaluating the impact of the Jerusalem assembly (Orme-Johnson, Alexander et al., 1988) on the Lebanon War using independent data sources, additional variables, and a distinct method of analysis; but also by including in the analysis the follow-up assembly held in Natanya,

Israel, and by both separate and combined evaluations of all six subsequent and differently located assemblies, for which similar predictions had been made in advance.

We have also explicitly controlled for and evaluated the plausibility of all alternative hypotheses that have occurred to us or been suggested by skeptical colleagues whom we have engaged in the design, conduct or evaluation of the study.[15] Multiple safeguards against possible personal bias have been incorporated, including reliance on a wide array of publicly available and independently selected news sources; use of independently developed scales; employment of a highly experienced events coder blind to the techniques and theory involved; public announcement of general hypotheses in advance of each assembly; and precise specification of variables, hypotheses and methods in advance of the analysis.

The observed improvements in Lebanon during the assemblies do not appear to be explicable as design artifacts, or as resulting from behavioral interaction or other factors external to the assemblies. The improvements were predicted in detail and then observed from independent data sources to be consistently significant across all dependent variables (for the combined assemblies), across all seven assemblies (for the composite index). This occurred at distances up to 6,000 miles with no behavioral interaction, no time delay, and no evidence for, or apparent possibility of, reverse causality. The stronger effects seen for the composite index (and also when all assemblies were combined) support the interpretation of an underlying general influence of coherence being produced in, and adding constructively across, diverse systems simultaneously.

Such apparent action at a distance would seem to require mediation by an underlying field which is not isolated from either cognitive or behavioral processes at the individual and collective levels and which is characterized by non-local dynamics. Though such a field is unfamiliar in contemporary social science, it is consistent with concepts of collective consciousness which are present in traditional Western thought, as well as Eastern and Vedic thought, and with recent formulations of unified quantum field theory (see earlier discussion). According to Hagelin (1989), a leading quantum field theorist (e.g., see Antoniadis et al., 1987, 1988), the proposed non-local dynamics of a unified quantum field (in contrast to those of non-unified quantum fields) could, in

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principle, allow the systematic amplification of coherent activity in adjacent individuals through constructive interference, so as to impact directly on the coherence of collective behavior in the surrounding population. The plausibility of this proposed mechanism is supported by the studies discussed earlier (e.g., Travis & Orme-Johnson, 1989) indicating a leading relationship between enhanced EEG coherence in TM-Sidhi practitioners and that in nearby non-meditators.

These studies on the collective impact of the TM and TM-Sidhi techniques suggest the direct relevance of a proposed unified quantum field (and of the classical concept of collective consciousness) to social processes. (The relevance of the quantum electromagnetic field to interactive and orienting processes in several species is already widely accepted: Orme-Johnson, Alexander et al., 1988, p. 784.) Thus, apart from their potential relevance in the search for peace, these studies may also be of value in providing social scientists with a means of returning their attention to the study of collective consciousness at a more fundamental level of analysis, complementary to the more conveniently measurable levels of analysis to which we have restricted ourselves during the behaviorist period. Interestingly, McDougall (1920/1973, p. 55) anticipated that such a return to the scientific study of collective consciousness would most likely become possible only in the context of movement of society toward greater harmony and integration. Social integration or coherence is in itself measurable and appears from these studies to be a key variable deserving attention in any attempt to understand the underlying dynamics of collective life.

A more specific question which arises from the present study is whether the proposed international impact of the larger assemblies was observable other than within Lebanon (see footnote 6). Separate studies, undertaken since completion of this one, have directly examined the impact of the three largest of the seven assemblies on a global scale, showing a significant global impact of the largest assemblies on three different independent data bases: (a) global terrorism (data base from the Rand corporation) (Orme-Johnson, Dillbeck, & Alexander, 2003); (b) improved US/Soviet relations (data base from the Zurich Project on East-West Relations) (Gelderloos, Cavanaugh, & Davies, 1990), and (c) increased cooperation of US with other countries (data base World Event Interaction Survey or WEIS) (Goodman, Orme-Johnson, Rainforth, & Goodman, 1997). It was found that during or immediately following those assemblies approaching the size for a predicted global influence (i.e., over 5,000), there were significant decreases in international conflict (by about 30%) and terrorist incidents (by 72%). These findings, along with an increasing number of studies reporting similar results (e.g.,

Assimakis & Dillbeck, 1995; Cavanaugh, 1987; Cavanaugh & King, 1988; Cavanaugh, King, & Ertuna, 1989; Dillbeck et al., 1987, 1988, 1990; Gelderloos et al., 1990; Goodman et al., 1997; Hagelin et al., 1999; Hatchard et al., 1996; Orme-Johnson, Alexander et al., 1988, 1990; Orme-Johnson & Dillbeck, 1987; Orme-Johnson, Gelderloos et al., 1988; Orme-Johnson et al., 2003) accentuate the broad implications of the present study in the search for a stable peace.

Galtung's (1969, p. 186) requirement for "richer concepts and...forms of social action" allowing attainment of a holistic peace, satisfying normative goals across diverse cultures would seem to be met by this approach. Galtung suggests that peace requires elimination of that whereby "human beings are being influenced so that their actual somatic and mental realizations are below their potential realizations" (1969, p. 168). If accumulated stress (or incoherence) is the most basic block inhibiting human development—thus giving rise to continued instances of violence and social injustice—then a systematic technique for alleviating individual and collective stress and promoting coherence should provide a key element in the search for sustained development and peace.

Through minimizing "social entropy" (Boulding, 1977), such an approach should allow diverse communities, cultures, and institutions within the larger society to function in a more integrated and mutually beneficial manner. Such internal coherence (negentropy) implies increasing satisfaction of collective developmental needs. This reduces the motivation for social violence (Azar & Burton, 1986) and appears also to act as a deterrent to potential external aggressors (White, 1984; George & Smoke, 1974), thus alleviating a further source of fear, and reducing the problems associated with excessive dependence on high levels of military expenditure.

Although the associated theoretical premises are novel, the techniques evaluated are simple, relatively inexpensive, non-coercive and accessible to application and empirical testing in the field. This study adds to the evidence for the replicability of findings as to their value in alleviating tension and violence on local, national and international levels, and in reducing the enormous associated costs to human life. In this time of rapid political and social change in the wake of the Cold War, the risks of proliferating conflict are high. An immediate priority should be to investigate the large-scale application of this technology in resolving and preventing violent international and intercommunal conflicts on a continuing basis.



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