The "Coup Contagion" Hypothesis

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This paper attempts to examine the extent to which military coups in one country influence in some fashion the occurrence of coups in other countries. The examination is conducted primarily via the application of three stochastic models (the Poisson, the "contagious Poisson," and the Gaussian [Markovian]) to 1946-1970 data on successful and unsuccessful military coups, aggregated at the world and selected regional levels. Since the statistical evidence indicates that the occurrence of earlier coups does affect the subsequent probability of coups elsewhere, the paper concludes with a speculative interpretation of the "coup contagion" phenomenon which emphasizes the possibility of behavioral reinforcement processes operating within global and regional communication networks.

Each year gives additional testimony to the fact that the analysis of political behavior grows increasingly complex. A substantial part of the problem has been summarized by Rosenau (1969a: 2):

> Politics everywhere, it would seem are related to politics everywhere else. Where the functioning of any political unit was once sustained by structures

AUTHORS' NOTE: Part of the research on which this study is based was originally supported by a 1971-1972 dissertation fellowship (to the second named author) from the Committee on Arms Control and Disarmament Agency Support of Dissertation Research in the Social and Behavioral Sciences of the National Academy of Sciences. Earlier versions of this paper have benefited from a presentation to George Modelski's World Society Seminar (University of Washington) and from the suggestions of Peter Aranson, Manus Midlarsky, George Modelski, A. L. Pelowski, and this journal's anonymous referees.

JOURNAL OF CONFLICT RESOLUTION, Vol. 19 No. 1, March 1975

> within its boundaries, now the roots of its political life can be traced to remote corners of the globe.

Resource shortages, inflationary pressures, airplane hijackings, student demonstrations, terrorist kidnappings, and the ubiquitous multinational corporation–to name a few–are all dramatically working to undermine our more traditional outlooks and approaches. Nevertheless, recognition of interdependence remains only part of the problem of analytical complexity. For, once recognized, the scholarly challenge then becomes one of integrating the implications of interdependence into our frameworks, hypotheses, and theories of political behavior. This has proved to be easier said than done. Judging from past experience, integration will require time and cumulative empirical research focused on bits and pieces of the interdependence phenomena. This paper seeks to contribute by concentrating on one of the many possible bits, the "coup contagion" hypothesis. Essentially, the query is whether or not military coups in one country influence in some fashion the occurrence of military coups in other countries (where a military coup is defined as occurring whenever members of the regular armed forces remove or attempt to remove a state's chief executive through the use or threat of the use of force). To what extent, then, are these events interdependent? In pursuit of an answer, several types of evidence will be considered. Should the evidence warrant it, an attempt will also be made to explain why or how military coups might influence the occurrences of other coups.

THE QUESTION OF "COUP CONTAGION"

In 1952, a well-publicized military coup, ostensibly led by General Mohammed Nagiub, overthrew the Egyptian monarch, Farouk. A good many miles from Egypt, the post-Korean-conflict economic slump prompted Indonesian parliamentary debates on the subject of substantial military demobilization as a means to reduce expenditures. Some parliamentarians feared demobilization might provoke a military coup. According to Feith (1962: 257), the phrase *Nadjib-Nadjiban* (doing a Nagiub) quickly became a part of Djakarta's political vocabulary. Several years later it had become apparent that Nagiub had been only a figurehead for Gamal Abd al-Nasir's behind-the-scenes leadership. A Colonel Trinquier, a French parachutist commander in Algeria, is reported to have toasted DeGaulle's 1958 ascension to power via a compromise military coup with the phrase, "Neguib est au pouvoir, vive Nasser!" (Kelly, 1965: 216). That same year, Venezuela's Perez Jiminez was ousted by a military coup. When the news reached neighboring Colombia, crowds in Bogota were seen celebrating in the streets with as much enthusiasm as they had displayed the preceding year when their own military had ousted Rojas Pinilla (Hispanic American Report, 1958: 35). A similar but reverse phenomenon is claimed for East Africa where Mazrui (1969: 97) states that Ugandans feared a Kenyan military coup almost as much as a Ugandan one inasmuch as a neighboring successful coup might be sufficient to precipitate an attempt in Uganda. More recently, and returning nearly full circle to Indonesia, Chilean conservative groups covered the walls of Santiago with the not-so-cryptic inscription "Djakarta" (Witznitzer, 1972: 6). The message, a reference to the 1965 attack on leading Indonesian military officers and their retaliatory suppression of the P.K.I. and the eventual overthrow of Sukarno, was presumably (and only slightly prematurely) intended to recommend a similar course of action to the Chilean army.

Extended anecdotal observations as in the above paragraph illustrate that the search for an understanding of military coup behavior need not be conducted exclusively in terms of domestic factors. Such speculation is further buttressed by a visual inspection of military coup frequency plots which tend to reveal definite wave patterns characterized by gradual increases and subsequent sharp declines in activity (Thompson, 1972: 191-194). Huntington (1962: 45) has aptly suggested that in general such event-wave patterns reflect the "shrinking" of world politics, the similarity of political conditions and forces in different states, and the extent to which events in one country may affect those of another. If we may assume that the third possibility is primarily a consequence of the first, the problem can be reduced to distinguishing between situational similarity and event interdependence. This is certainly not a new problem for the social sciences. Anthropologists once quarreled over whether the spatial distribution of cultural innovations could be traced to common centers with subsequent diffusion or to independent developments with originality as the only common characteristic. Gradually, it was realized that some form of compromise in perspective was warranted. And even though the coup contagion question does not represent precisely the same problem, there is no reason why we cannot profit from the diffusionist/parallelist experience and avoid any mutually exclusive position. Military coup situations have been found to share some behavioral characteristics (Thompson, 1973), although evidently there has been a tendency to exaggerate the level of similarity and influence of background conditions thought to be associated with the military coup (Thompson, forthcoming). Consequently, it would seem that situational similarity, at best, could account only for some limited portion of the coup-wave pattern. Hence, an approach which focuses on the alternative possibility of event interdependence appears to be reasonably justified.

With a few exceptions, little systematic work has been conducted on this intriguing topic. Not uncommon, however, are brief references in coup-related studies usually to the effect that the leaders of one coup were somehow inspired by the model or example offered by earlier coup-makers. In fact, four types of influences can be extracted from this literature: model, disinhibitor, negative example, and reference group. The use of the model term signifies that a coup leader's actions during and/or after a coup served as emulatory examples for another country's coup leader(s). Disinhibitor usually refers to a coup which has demonstrated that a coup can be successful without high costs. Negative examples are situations to be avoided. Coup leaders may perceive their actions as "preventive medicine" for situations similar to, say, the 1965 Nigerian unrest or a Castro-style takeover. A coup may also serve as a negative example as in the cases where senior officers have acted to preempt the replication of another state's junior officer revolt. Finally, the reference group term has been restricted to regional groups of individuals in which the action of one group member creates new status aspirations for the other members. However, since reference groups also serve as evaluator check-points and aid in setting and enforcing behavioral norms (Shibutani, 1955; Kelley, 1952; Bourne, 1957), reference groups could presumably also function as a form of disinhibitor. For example, Afrifa (1966: 50) points to the coup-making activities of former Sandhurst colleagues as a factor decreasing his own reluctance to overthrow Nkrumah.

The various forms coup contagion might take and what functions it might perform make for an interesting topic of discussion. But so far, the evidence has not been all that solid. Analysts certainly have suspected the interdependence of some coups. Invariably, however, one has only a writer's opinion that such facilitating cross-national influences have taken place. To go beyond conjecture, it is necessary to develop objective evidence of coup contagion. One way in which this may be attempted is through the application of stochastic models to military coup data.[1] This

1. The military coup data were collected from 171 political histories and country/case studies of varying length, eight world and regional news digests, and the New York *Times* and *Times* (London). Data collection details may be found in Thompson (1973). A list of the coups by country and date is given in Appendix A.

paper will consider three such models; the Poisson, the "contagious Poisson," and the Gaussian.

THE POISSONS

The Poisson has been applied in various ways to the frequency distributions of wars (Richardson, 1960; Singer and Small, 1972), alliances (Job, 1973; Siverson and Duncan, 1973), racial disturbances (Lieberson and Silverman, 1965; Spilerman, 1970), events data methodology (Hayes, 1973), as well as to "military interventions" (Putnam, 1967) and to "successful insurrections and coups" (Midlarsky, 1970). In a rather limited application, Putnam concluded that Latin American data (1951-1965) failed to support the coup contagion hypothesis. Yet, Midlarsky's more extensive investigations found support for the hypothesis in terms of Latin America (1935-1949, 1935-1964) but not for Latin America (1950-1964) nor for Sub-Saharan Africa (1963-1967). Unfortunately, both analysts restrict themselves to an inspection of only successful events and their data universes are not restricted to military coups.[2] Currently available data permit a more exclusive focus on successful and unsuccessful military coups as well as on a more extensive geographic scope.

The specific approach to be taken in this examination consists of generating and comparing the expected distributions given by two stochastic models, the Poisson and the "contagious Poisson" with the observed distributions of military coups aggregated at the world and selected regional levels. The Poisson,

$$P_i = \frac{\alpha^i e^{-\alpha}}{i!}$$

where P_i = the probability of coup occurrences for i,

α = the mean of the distribution,

and e = the base of the natural logarithm,

basically assumes that events take place at a constant rate over time and that events in nonoverlapping time intervals are independent. The contagious Poisson,

2. Some of these problems, especially in reference to Midlarsky's data source, are examined in Thompson (1975).

$$P_i = \frac{e^{-(\alpha+\beta)}\alpha(\alpha+\beta)\ldots\alpha+(i-1)\beta\,(e^{\beta}-1)^i}{i!\,\beta^i}$$

where β = the natural logarithm of σ^2/μ

and $\alpha = \mu^2\beta/\sigma^2 - \mu$

is predicated on the alternative assumption that "when one person takes an action, then the probability of a second person's taking the action is changed" (Coleman, 1964: 299). Whereas the Poisson α, the transition rate of a year's variable number of coups "moving" into successive frequency intervals, is held constant, the contagious Poisson's transition rate is allowed to increase incrementally by i^{β}, which represents the influence of earlier coup events.

In brief, the Poisson model assumes that coups occur independently; the contagious Poisson assumes their occurrences are interdependent. The point of the comparison is to determine which of the models yields a better match with the actual frequency distributions. This, in turn, should indicate which of the independence/interdependence assumptions is supported best by the data. However, it is possible to arrive at the second probability distribution function by alternatively assuming coup-proneness heterogeneity.[3] Hence, if one should find that the contagious Poisson offers the superior match, it is still not clear whether this can be attributed to coup interdependence, variable coup proneness over time, or to some combination of both. While no entirely satisfactory solution for this problem of rival assumptions/interpretations has yet been proposed, it has been suggested (Feller, 1943; Midlarsky, 1970) that heterogeneity may be tested for by dividing the time periods under study into two adjacent periods and correlating. Low correlation coefficients would then support a heterogeneity or a combination of heterogeneity/interdependence interpretation.

Data Analysis

Table 1 reports the outcomes of the distribution comparison test for selected time periods and levels of aggregation.[4] Implicit to the selection

3. The two versions of the contagious Poisson are also known as the Polya model (interdependence assumption) and the Yule-Greenwood model (heterogeneity assumption). More expansive discussions of these models and the Poisson may be found in Coleman (1964: 288-314) and Midlarsky (1970).

4. Latin America includes Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras,

TABLE 1
A SUMMARIZED COMPARISON OF EXPECTED AND OBSERVED DISTRIBUTIONS
(number of years experiencing "i" number of coups)

				Contagious Poisson		Absolute Deviations by Percentage		
	n	σ	D	AD_1-AD_2	β	AD_1	AD_2	AD_1-AD_2
1946-1970								
Latin America	25	7.45	5.44	4.64	.31	52	45	7
Arab	25	2.92	1.96	1.60	.40	41	33	8
1955-1970								
Latin America	16	10.09	5.31	3.79	.64	92	83	9
Arab	16	3.00	2.56	2.38	.16	54	54	0
S.E. Asia	16	2.90	1.81	1.42	.47	40	26	4
1962-1970								
World	9	16.25	13.44	12.29	.19	87	92	–5
Latin America	9	10.22	3.67	2.10	1.03	63	61	2
Arab	9	2.25	3.44	4.24	–.43	71	68	3
S.E. Asia	9	3.73	1.78	1.20	.74	50	40	10
Sub-Saharan Africa	9	6.77	3.89	2.91	.55	99	91	8

NOTE: AD_1 = absolute deviation by percentage of Poisson from observed distribution.
AD_2 = absolute deviation by percentage of contagious Poisson from observed distribution.

of these levels is the assumption that interdependence is most likely to be discernible within regional subsystems and possibly at the world level. Due to different dates of independence, the time periods were chosen to maximize system/subsystem size homogeneity. Consequently, only one time period, 1962-1970, is fully comparable. In the absence of suitable goodness of fit indicators, one is forced to rely on β, a measure of the degree of "contagion," and $AD_1 - AD_2$, the percent difference between the two predicted distributions' absolute deviations from the actual coup frequency distributions.[5] Inspection of the β column reveals that some degree of positive "contagion" is indicated in nine of the ten cases. The sole exception (Arab, 1962-1970) is a case of moderate negative contagion. Similarily, the $AD_1 - AD_2$ column suggests that the contagious Poisson prediction is slightly superior to the Poisson prediction in eight of the ten cases. The two exceptions in this column (Arab, 1955-1970; world, 1962-1970) correspond to the two lowest β terms.

Still, the alternative explanation of coup-proneness heterogeneity remains to be investigated. Accordingly, each of the time periods was divided into adjacent subperiods and correlated for both the full country n's and for coup countries only, in case countries which did not experience coups might obscure the test. Table 2 suggests that the strongest support for proneness homogeneity is to be found in the Arab world (1962-1970), Latin America (1955-1970), and again, the Arab world (1955-1970). Heterogeneity is most strongly indicated at the world level (1962-1970), Latin America (1962-1970), and Sub-Saharan Africa (1962-1970), particularly in terms of the coup countries considered in isolation. The remaining cases are obviously more heterogeneous than homogeneous.

Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and Venezuela. The Arab world includes Algeria, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Saudi Arabia, Southern Yemen, Sudan, Syria, Tunisia, and Yemen. Southeast Asia includes Burma, Cambodia, Indonesia, Laos, Malaysia, Philippines, Thailand, North Vietnam, and South Vietnam. Sub-Saharan Africa includes Burundi, Central African Republic, Chad, Congo (Brazzaville), Dahomey, Ethiopia, Gabon, Ghana, Guinea, Ivory Coast, Kenya, Liberia, Malagasy Republic, Mali, Mauritania, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Somalia, Tanzania, Togo, Uganda, Upper Volta, and Zaire.

5. Two goodness-of-fit indicators have been used elseshere in conjunction with Poisson comparison tests: (1) the "g-statistic," the ratio of the variance to the mean of the observed data and (2) the better known χ^2. The former seems superfluous given the β indicator with which it is highly correlated. The usefulness of the χ^2 is severely weakened by the necessity to lump frequency categories. Consequently, neither one is employed in this paper.

TABLE 2
TEST FOR COUP-PRONENESS HETEROGENEITY
(Pearson's r)

	All Countries	*Coup Countries*
1946-1970		
Latin America	.40	.26
Arab	.35	.25
1955-1970		
Latin America	.68	.56
Arab	.59	.48
S.E. Asia	.54	.32
1962-1970		
World	.37	.02
Latin America	.16	–.09
Arab	.80	.70
S.E. Asia	–.20	–.66
Sub-Saharan Africa	.43	.03

In sum, the two Arab cases and the Latin American case appear to support the coup contagion hypothesis while the nature of the evidence does not support the application of the hypothesis to the world, African, and the third Latin American cases. The remaining four cases might be candidates for the mixed interdependence/heterogeneity interpretation. Yet, the tentativeness of these conclusions cannot be overemphasized. None of the distributions obtained with the contagious Poisson constituted excellent matches. Moreover, the alternative assumptions of interdependence and heterogeneity leave the investigator in something of a quandary when it comes time to interpret the applicability of the contagious Poisson. Given these problems, it should hardly seem unnatural for our search for empirical evidence to proceed with different tests. One such additional test is provided by the application of Gaussian (Markovian) models which attempt to estimate explicitly the degree of dependence of the probability of the occurrence of coups at time t on the probability of the occurrence of coups at time t–1. These more rigorous models are especially attractive since there is no need to assume homogeneity/heterogeneity.

THE GAUSSIAN MODEL

A "contagious" Gaussian model assumes (1) the state of a system is time dependent, (2) successive states in the system may be stochastically interdependent or independent, and (3) for any finite set of n time-dependent states (Z_t, Z_{t-1}, . . . , Z_{t-n}), their joint distribution is n-variate normal (Bhat, 1972: 15). When coups are influenced by "contagion" and by past random events, the appropriate Gaussian model–known as an AR–MA model of order (p,q)–may be expressed as:

$$Z_t = \sum_{j=1}^{p} \phi_j Z_{t-j} + N_t \qquad [1]$$

where Z_t and Z_{t-j} = successive coup states,

ϕ_j = transition rates,

and $N_t = X_t - \sum_{i=1}^{q} \theta_i X_{t-i}$ (the random white noise component of the process).

In the absence of any contagion affect (θ_j = o), the Gaussian model–known as a moving average (MA) model of order q–simply consists of the random white-noise component as:

$$Z_t = X_t - \sum_{i=1}^{q} \theta_i X_{t-i} \qquad [2]$$

where X_t, X_{t-1} = white-noise terms which incorporate the random and unexplained variation in Z_t

and θ_i = a measure of the relationship between Z_t and past random occurrences (e.g., economic depression, political threats to the military subsystem).

Finally, when coups can be explained in terms of past coups or when contagion does filter through successive coups and yet current coups are solely influenced by current random events (θ = 0), equation 1 is simplified to an autoregressive (AR) model of order p:

$$Z_t = \sum_{j=1}^{p} \phi_j Z_{t-j} + X_t.[6] \qquad [3]$$

6. If contagion diminishes over successive event states, the transition rates in the above models should decline in size such that $\phi_1 > \phi_2 > \ldots \phi_p$ and $\theta_1 > \theta_2 > \ldots >$

Empirical Estimation Methods

The autocorrelation (acf) and partial autocorrelation (pacf) functions are employed to detect the presence of an underlying process (see Box and Jenkins, 1970: ch. 2). According to statistical theory, every stationary p^{th} order autoregressive model (equation 3) has a theoretical acf characterized by exponential decay and a corresponding pacf with only p nonzero values. Every stationary q^{th} order moving average model (equation 2), alternatively has a theoretical acf with only q nonzero values but a corresponding pacf with values that decline exponentially. It follows then that a mixed (AR-MA) model (equation 1) must have both the theoretical acf and the theoretical pacf exhibiting exponential decline. However, if the given process is nonstationary, neither the acf nor the pacf will decline over time. Instead, the functions will maintain consistently high values that are close to equation 1 (Box and Jenkins, 1970: 174-175).

The values of the theoretical acf and pacf are generally unknown. But empirical estimates can be attempted by correlating recursively lagged series of time-dependent observations. The equation for correlating the estimated acf values is (Box and Jenkins, 1970: 28):

$$r_k = \frac{\Sigma(Z_t - Z_t)\,(Z_{t-k} - Z_t)}{\sqrt{\Sigma(Z_t - Z_t)^2\,(Z_{t-k} - Z_t)^2}} \qquad [4]$$

where Z represents the average Z value. The equation for obtaining the estimated pacf value is (Durbin, 1960: 233):

$$\beta_{kk} = \frac{r_k - \sum_{j=1}^{k-1} (\beta_{k-1,j})(r_{k-j})}{1 - \sum_{j=1}^{k-1} (\beta_{k-1,j})(r_{k-j})} \qquad [5]$$

where β_{kk} is the partial autocorrelation value.

θ_q. The model is then said to be stationary, satisfying the condition that $|\phi| < 1$ and $|\theta| < 1$. If, on the other hand, contagion leads to continuous increments in subsequent transition rates, such that $\phi_1 < \phi_2 < \ldots < \phi_p$ and $\theta_1 < \theta_2 < \ldots < \theta_q$, the model is said to be nonstationary with transition rates being $|\phi| \geqslant 1$ and $|\theta| \geqslant 1$, respectively. For detailed discussions of the (MA) and (AR) models, see Anderson (1971).

Equations 4 and 5 provide estimates of the lagged correlations and partial autocorrelation values, respectively. If the correlograms, the plots of these values, conform in shape to the theoretical acf and pacf and the correspondence is statistically significant, then the functional form of the desired Gaussian model can be directly deduced, leading to the construction of a tentative model. If the model provides an adequate fit, the variance left unexplained should contain no systematic trend; otherwise, the tentative model must be redefined. Testing for the goodness-of-fit (see appendix C) is accomplished by estimating the correlogram of the residuals and by assessing a Q statistic for evidence of nonrandomness in the series of residual terms (see Box and Jenkins, 1968: 71).[7]

Data Analysis

The acf estimated values and their corresponding standard errors are presented in Table 3. In addition, a Q statistic is reported for each area aggregation in order to indicate the statistical significance of each series of estimated values. The pacf estimated values are reported in Table 4. Inspection of the tables reveals that none of the estimated acf and pacf values for the Arab and Southeast Asian subsystems is statistically significant. That is, none of the estimated values produce t-ratios exceeding 1.5. The appropriate Q statistics further corroborate this finding and suggest acceptance of a null hypothesis that the Arab and Southeast Asian observed values merely constitute a series of "white noises," at the 10% significance level. However, since several Arab states attained independent status well after 1946, a separate estimate was derived for the Arab series (1955-1970). These separately estimated results, presented in Table 5 do not contradict the earlier finding. As before, no single correlated value exceeds its standard error more than 1.5 times and the Q statistic remains discouraging. On the other hand, the correlated values for Latin America and the world do reveal the possible presence of Markovian dependence or coup contagion. For example, the estimated (acf) values for Latin America (Table 3) show that the first autocorrelated value of .685 is statistically significant with a t-ratio exceeding 2. The Q statistic (21.46) also suggests that this series is not a purely random white-noise process. The pacf values (Table 4) provide corroboration for the acf result, demonstrating a significant first order value at .685.

Since the estimated values for Latin America exhibit exponential decline while Table 4 indicated a significant value only for the first

7. The correlograms were consturcted and examined but space considerations preclude their publication.

MILITARY COUP AUTOCORRELATED VALUES (1946-1970)

Lags (k)	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
World (Q = 28.88)												
Autocorrelated values	.51	.41	.36	.34	.18	–.01	–.10	–.25	–.22	–.37	–.27	–.35
Standard errors	.20	.25	.27	.29	.21	.31	.31	.31	.32	.33	.34	.35
Latin America (Q = 21.40)												
Autocorrelated values	.69	.33	.03	–.09	–.13	–.17	–.20	–.17	–.20	–.24	–.21	–.10
Standard errors	.20	.28	.29	.29	.30	.30	.30	.31	.31	.32	.32	.33
Arab (Q = 11.20)												
Autocorrelated values	.29	.11	.21	.38	.29	.03	.08	–.06	.01	–.06	–.15	–.22
Standard errors	.20	.22	.22	.23	.25	.26	.26	.26	.26	.26	.27	.27
Southeast Asia (Q = 5.80)												
Autocorrelated values	.23	.06	–.17	–.02	–.01	–.04	–.01	–.00	–.01	–.24	–.24	–.16
Standard errors	.20	.21	.21	.22	.22	.22	.22	.22	.22	.22	.23	.24

$Q = n \sum_{k=1}^{12} r_k^2$ and can be compared to a chi-square value with 12 degrees of freedom, testing the null hypothesis that the observed series is white noise.

TABLE 4
MILITARY COUP PARTIAL AUTOCORRELATED VALUES, 1946-1970

Lags (k)	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
World	.51	.21	.12	.11	–.12	–.24	–.16	–.26	.02	–.14	.15	–.07
Latin America	.69	–.26	–.15	.06	–.05	–.13	–.07	.05	–.21	–.14	.09	.03
Arab	.29	.03	.18	.31	.13	–.13	–.01	–.30	–.07	–.08	–.11	–.10
S.E. Asia	.23	.01	–.20	.07	.00	–.08	.03	.00	–.02	–.26	–.15	–.05

TABLE 5
ARAB MILITARY COUP AUTOCORRELATED VALUES (1955-1970)

Lags (k)	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Autocorrelated values (r)	.16	–.11	–.04	.24	.12	–.21	–.15	–.20	.02	–.07
Standard error	.25	.26	.26	.26	.27	.28	.29	.29	.30	.30

NOTE: Q = 3.53 and can be compared to a chi-square with 10 degrees of freedom, testing the null hypothesis that the observed series is white noise.

autocorrelation, it may be tentatively entertained that the underlying process fits a first-order AR(1) model:

$$Z_t = \phi_1 Z_{t-1} + X_t. \qquad [6]$$

Analysis of world-coup frequencies, in contrast, is less clear-cut. Because the Latin American data constitute approximately half of the world coup n, it could be assumed on intuitive grounds that a contagion effect is present. Tables 3 and 4 provide no contradicting evidence for this assumption and although the correlated values do exhibit some apparent cyclical trend, subsequent testing for seasonality in the observed data produced negative results.[8] The estimated acf for the world data has a significant first-order autocorrelated value but the second autocorrelated value falls slightly short of the criterion for the t-ratio to be greater than 2. When the possible spillover effects of the neighboring acf values have been partialled out in the pacf, the second partial autocorrelated value declines by a magnitude of .20 in comparison to its second acf counterpart. This decline of the second term indicates that it could better be omitted from the model, thereby leaving the following first-order AR(1) model for coups at the world level:

$$Z'_t = \phi_1 Z'_{t-1} + X'_t. \qquad [7]$$

Yet, unlike the Latin American case, neither the correlograms of the acf nor of the pacf for world coups shows anything resembling rapid decline. According to the previously discussed theoretical properties of the acf and the pacf, this is indicative of a dependent Markovian process filtering through both the observed coups and the white noise terms. Statistically, it implies an alternative first-order AR-MA(1,1) model for the world, altering equation 7 as follows:

$$Z'_t = \phi_1 Z'_{t-1} + X'_t - \theta_1 X'_{t-1}. \qquad [8]$$

8. A seasonal model of the following form (see Box and Jenkins, 1970: ch. 9) was tested:

$$(1 - \phi_1 B)(1 - \Phi_1 B^{10})\, Y_t = X_t$$

$$(1 - \phi_1 B - \Phi_1 B^{10} + \phi_1 \Phi_1 B^{11})\, Y_t = X_t$$

$$Y_t - \phi_1 Y_{t-1} - \Phi_1 Y_{t-10} - \phi_1 \Phi_1 Y_{t-11} = X_t$$

$$\text{or } Y_t = \phi_1 Y_{t-1} + \Phi_1 Y_{t-10} - \phi_1 \Phi_1 Y_{t-11} + X_t.$$

Estimation of equations 6, 7, and 8 gives the following:

Model 6: AR(1) $$Z_t = .697\ Z_{t-1} + X_t$$

Model 7: AR(1) $$Z'_t = .510\ Z'_{t-1} + X'_t$$

Model 8: AR-MA(1,1) $$Z_t = .708\ Z'_{t-1} + X_t - .273\ X'_{t-1}$$

Examination of the autocorrelation values of the residuals, as reported in Table 6, reveals no evidence of remaining systematic trend.

When the residual mean square (sums of squares of the residuals divided by the degrees of freedom) for equations 7 and 8 are compared, the former turns out to be better fitted. Equation 7 is more parsimonious, and its residual mean squares of .1302 is smaller than equation 8's residual mean squares of .1341. This immediately suggests that the added X_{t-1} term is superfluous and may be eliminated from the equation. Therefore, models 6 and 7 are the final contagion models selected for Latin America and the world, respectively. Not only do these adopted models suggests that a contagious process comparable to a first-order Markov operates but, more precisely, that the contagious effect filters from one coup-event state to the next one in time, but does not filter beyond that point (i.e., coups at time t−1 would affect those at time t but not those at time t + 1).

THE PROCESS OF COUP CONTAGION

Evidence has been sought from several sources for a single hypothesis; namely, that the occurrence of military coups in one country somehow affects the subsequent probability of military coups elsewhere. A comparison of expected Poisson and contagious Poisson distributions with observed coup frequency distributions indicated that the contagious Poisson provided a slightly superior prediction in most of the cases examined. Further testing on the potentially complicating influence of coup-proneness heterogeneity produced results which suggest that the coup contagion hypothesis is best supported in terms of data from Latin America (1955-1970) and the Arab world (1955-1970, 1962-1970) and least supported by 1962-1970 data from Latin America, Sub-Saharan Africa, and the world. Alternatively, applications of the Gaussian model, offering the advantage of avoiding the interdependence/heterogeneity problem, indicated first-order Markovian dependence processes were at

TABLE 6
RESIDUAL AUTOCORRELATIONS

Lags (k)	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
Latin American Model: AR (1) (Q = 3.93)[a]												
Autocorrelated values	.18	–.02	–.21	–.10	–.03	–.01	.07	.07	–.04	–.18	–.16	–.14
	.21	.22	.22	.23	.23	.23	.23	.23	.23	.23	.24	.24
World Model: AR (1) (Q = 6.24)[a]												
Autocorrelated values	–.08	.19	.03	.07	.07	–.19	.07	–.27	.07	–.28	–.01	–.18
Standard error	.21	.21	.22	.22	.22	.22	.23	.23	.25	.25	.26	.26
World Model: AR-MA (1, 1) (Q = 4.22)[b]												
Autocorrelated values	–.01	.07	–.05	.03	.02	–.20	.04	–.23	.06	–.25	–.01	–.16
Standard error	.21	.21	.21	.21	.22	.22	.22	.22	.23	.23	.25	.25

a. The Q statistic can be compared to a chi-square value with 10 degrees of freedom, testing the null hypothesis that the observed series is white noise.

b. The Q statistic can be compared to a chi-square value with 9 degrees of freedom, testing the null hypothesis that the observed series is white noise.

work in the 1946-1970 data for the world and Latin America. The data series of Southeast Asia (1946-1970) and of the Arab world (1946-1970, 1955-1970) failed to reveal the presence of Markovian dependence.

Clearly, the findings are not entirely mutually compatible. But perhaps this is to be expected given the diversity of assumptions and approaches. Considering the problems inherent in the utilization and interpretation of the Poissons, it seems advisable, at least at this stage, to express a greater amount of "faith" in the more rigorous and dynamically oriented Gaussian findings. In any event and regardless of the model given preference, some systematic if not overwhelming support for the coup contagion hypothesis has been found. It is now appropriate to turn to the "so what" and "how come" questions. Since the data examinations do not reveal specific answers to the whys and hows of coups affecting the likelihood of other coups in different political systems, it will be necessary to step back from the data and engage in what is hopefully educated speculation.

Relying heavily on sociopsychological theories of imitation, Midlarksy (1970: 74-77), apparently independently of the military coup literature, has developed a theory capable of encompassing the four effect types found in the literature. Midlarsky suggests that prototype individuals and groups exist which exhibit certain behavior patterns matched by an observer(s) with three possible outcomes: (1) a modeling effect in which the observer copies the prototype's behavior exactly; (2) an inhibitory effect caused by the observer's aversion to the prototype's behavior; and (3) a disinhibitory effect whereby observation of the prototype's behavior reduces certain inhibitions possessed by the observer. In terms of coups d'etat, Midlarsky prefers to deal only with the modeling effect which he regards as the most likely of the three.[9] Unfortunately, no concrete examples are cited to illustrate the alternative outcomes of the matching behavior. As it turns out, the military coup literature does provide several possible examples. Yet, it is highly questionable whether the literature's loose usage of the term "model" conforms to Midlarsky's more exacting specifications. For that matter, Kemal Ataturk, Abd al-Nasir, Peron, and DeGaulle may well near exhaust the pool of conceivable prototype individuals. Indeed, if it is necessary to stress any of the three alternative

9. The theory is then completed by the following deductions: (1) prototypes with higher status elicit a greater extent of diffusion than those with lower status; (2) prototypes which exhibit a higher degree of competence to the observer have elicited greater amounts of diffusion; (3) observers who are more likely to exhibit diffusion effects are those who are higher in measures of dependency, lower in self-esteem, and who perceive themselves as similar to the prototypes. Midlarsky found empirical support for the first two hypotheses in reference to Latin America (1935-1949).

outcomes as the most prevalent or most likely, the disinhibitory effect presents a much likelier candidate and a more general explanation.

It does not seem unreasonable to view the highly communicable military coup as a message in regional and global communication networks. Within this perspective, a strong argument can be made for viewing the process of coup contagion as primarily a process of reinforcement. In the first place, military coups are hardly innovations. The coup has been a well-known political procedure as long as there have been rulers to overthrow and the force with which to overthrow them. And while certainly not all military forces have had direct experience with coup tactics, the idea of the coup is readily available to all who are interested via what can be considered an increasingly globalized cultural inventory. Second, it is a reasonably well-documented fact of social science that: (a) people tend to see and hear communications that are favorable to their predispositions, and (b) people tend to respond to cues in line with their predispositions (see Berelson and Steiner, 1964: 529, 540-541; Neiburg, 1969: 31; Gurr, 1970: 224). In short, the individual tends to seek and to act on what he or she most wants to be told.

Along these lines, earlier students of behavioral contagion (Polansky et al., 1950) have argued that the influence of contagion is really the result of an active process on the part of the recipient; contagious recipiency then is determined almost wholly by the degree of readiness of the recipient to be influenced. The initiator of contagion need not establish the goals or the techniques of successive coups. It suffices merely to reinforce the aspiring coup-maker's desire to achieve his own ends. In most cases, the contagion initiator is not attempting to influence the recipient directly: he may even be unaware of his own influence. This general reinforcement process would also tend to subsume the previously noted disinhibitory effect (see Redl, 1949: 321). Successful examples reduce coup-maker inhibitions, if they have any, in the sense that their fears or calculations of failure are apt to be lowered. Observing no punishment directed toward successful coup-makers, coup conspirators are led to expect, other factors being equal, a similar lack of harmful consequences. Civilian opposition is infrequent and even less frequently effective. Overt international interference is just as rare.

An additional function linked to the reinforcement process is essentially one of legitimizing a world subculture. Gurr (1970: 169) has observed that the occurrence of a single coup in a state is not likely to create widespread expectations about its recurrence. However, as it becomes more commonplace the military coup achieves habit strength both within the single state and throughout the world. Through a conscious or otherwise participation in common communication channels, a world subculture has taken form in which some military elites view their full participation in authoritative decision-making as both correct and necessary. Hence, amplifying or positive feedback mechanisms, perhaps most intensively within regional subsystems but not restricted to their boundaries, transform the military coup into what Rosenau (1969: 49) has labeled a "Fused linkage." The consequences of this have been recognized by Zolberg (1968: 85-87) for Sub-Saharan Africa as constituting a lowering of the military's threshold of tolerance and a magnifying of the apparent weakness of political regimes. In several regions, coup-makers have become less satisfied with intermittent "intervention" and less hesitant to establish themselves as rulers (see Perlmutter, 1969).

The reinforcement process should not be likened to a series of ripples moving outward from the center of a pool into which a pebble has been dropped. As a process, it is probably less constant than intermittent. Mediating variables are definitely at work. Two obvious factors are the varying coefficients of coup-maker receptivity and domestic anticipation. It would be interesting, for example, to determine whether more coup plots are revealed during the peaks of coup activity than during the troughs. Another obvious variable is communication, in the absence of which reinforcement cannot occur. (Note that the best fit occurred for Latin America, an area marked by high linguistic homogeneity.) Barriers to reinforcement can be erected by regimes which are in a position to control extra-societal information. It is equally possible that such variables as distance and status[10] bias communication networks and hence the process of "coup contagion."[11] Not all of these questions can be answered in this paper, but hopefully we have taken another step toward responding to the criticism of a linkage theorist (Rosenau, 1969a: 6) who properly lamented

10. Fossum (1967: 238-240) has tested the hypothesis that if there is some form of coup interdependence, it should operate between neighbors (states with common borders) and to a greater extent than between nonneighbors. Examining successful Latin American coups (1907-1966), he found little confirmation for the hypothesis and concluded that "no neighborhood effect" was operating in Latin America, except possibly for neighbors of equally high status. Midlarsky (1970: 78) also found that the "extent of coup diffusion" was positively correlated with a state's diplomatic status in Latin America (1935-1949).

11. One final caveat deserves mentioning. Throughout this analysis, we have assumed that whatever evidence was found would relate to interstate contagion. But it is quite plausible that military coups are interdependent within each state as well. If this is the case, it is probably reflected in the data analyses of this paper. Unfortunately, it would be extremely difficult to attempt to control for these within-nation influences. Consequently, we have chosen to ignore this issue though we recognize its potential significance to the testing exercises.

"The absence of anything but the crudest tools to explain the rash of *coups d'etat* that have occurred."

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APPENDIX A

MILITARY COUPS 1946-1970[a]

Algeria	6/31/62(S); 9/29/63(C); 6/30/64(U); 6/19/65(S); 12/14/67(U).
Argentina	9/18/51(U); 6/16/55(U); 9/16/55(S); 11/13/55(S); 6/9/56(U); 6/20/59(U); 6/13/60(U); 11/30/60(U); 8/11/61(U); 3/28/62(S); 8/8/62(C); 9/19/62(S); 12/11/62(U); 4/2/62(U); 6/27/66(S); 6/8/70(S).
Bolivia	6/13/46(U); 7/18/46(S); 8/27/49(U); 7/22/50(U); 5/16/51(S); 4/9/52(S); 1/6/53(U); 6/20/53(U); 11/9/53(U); 10/4/57(U); 5/14/58(U); 10/21/58(U); 6/26/59(U); 3/19/60(U); 11/3/64(S); 9/26/69(S); 10/4/70(U); 10/6/70(S).
Brazil	8/22/54(S); 11/11/55(S); 11/21/55(S); 2/11/56(U); 12/3/59(U); 8/25/61(C); 9/12/63(U); 3/30/64(S); 8/31/69(S).
Burma	9/26/58(S); 3/2/62(S).
Burundi	10/18/65(U); 7/8/66(S); 11/29/66(S).
Cambodia	3/18/70(S).
Cen. Afr. Rep.	12/31/65(S); 4/10/69(U).
Colombia	6/13/53(S); 5/10/57(S); 5/2/58(U); 10/11/61(U).
Congo (B)	8/15/63(S); 6/27/66(C); 8/2/68(C); 8/30/68(S); 3/22/70(U).
Costa Rica	4/2/49(U).
Cuba	3/10/52(S); 4/29/56(U); 9/5/57(U).
Dahomey	10/28/63(S); 11/29/65(S); 12/22/65(S); 12/17/67(S); 12/10/69(S).
Dom. Rep.	5/30/61(U); 7/?/61(U); 1/16/62(U); 1/18/62(S); 9/25/63(S); 4/24/65(C).
Ecuador	3/14/47(U); 8/23/47(S); 8/30/47(S); 11/9/47(U); 7/26/49(U); 7/15/50(U); 3/3/52(U); 12/23/54(U); 8/7/56(U); 11/7/61(C); 7/11/63(S); 3/29/66(S).
Egypt	7/23/52(S); 2/24/54(C).
El Salvador	12/14/48(S); 1/5/49(S); 10/26/60(S); 1/24/61(S).
Eq. Guinea	3/4/69(U).
Ethiopia	12/14/60(U).
France	5/13/58(C); 4/21/61(U).
Gabon	2/17/64(U).
Ghana	2/24/66(S); 4/17/67(U).
Greece	4/21/67(S); 12/13/67(U).
Guatemala	7/18/49(U); 3/29/53(U); 6/27/54(U); 6/29/54(S); 1/20/55(U); 10/24/57(S); 11/13/60(U); 11/25/62(U); 3/30/63(S).
Haiti	1/11/46(S); 5/10/50(S); 12/12/56(S); 4/2/57(S); 5/21/57(C); 4/24/70(U).

Honduras	8/1/56(U); 10/21/56(S); 2/7/59(U); 7/12/59(U); 9/8/61(U); 10/3/63(S).
Indonesia	10/11/56(U); 11/16/56(U); 12/22/56(U); 2/10/58(U); 3/11/66(S).
Iran	8/13/53(S).
Iraq	7/14/58(S); 3/7/59(U); 2/8/63(S); 7/3/63(U); 11/13/63(U); 11/18/63(S); 9/16/65(U); 6/29/66(U); 7/17/68(S); 7/30/68(S); 1/20/70(U).
Jordan	4/13/57(U).
Laos	12/31/59(C); 8/9/60(S); 9/10/60(S); 12/8/60(U); 4/19/64(C); 1/31/65(U); 3/28/65(U); 4/16/65(U); 10/21/66(U).
Lebanon	12/30/61(U).
Libya	9/1/69(S).
Mali	11/19/68(S).
Nepal	12/15/60(S).
Nicaragua	5/25/47(S).
Nigeria	1/14/66(C); 7/28/66(C); 5/30/67(U); 8/9/67(U).
Oman	7/23/70(S).
Pakistan	10/7/58(S); 10/27/58(S); 3/25/69(S).
Panama	11/19/49(S); 5/9/51(S); 9/?/62(U); 10/11/68(S); 12/14/69(U).
Paraguay	6/9/46(U); 3/7/47(U); 6/3/48(S); 10/25/48(U); 1/30/49(S); 2/26/49(U); 5/4/54(S); 12/21/55(U).
Peru	7/4/48(U); 10/3/48(U); 10/27/48(S); 6/14/50(U); 8/10/54(U); 2/16/56(U); 7/18/62(S); 3/3/63(S); 10/3/68(S).
Portugal	10/10/46(U); 4/10/47(U); 1/1/62(U).
Senegal	12/17/62(U).
Sierra Leone	3/21/67(U); 3/23/67(S); 4/17/68(S).
Somalia	12/10/61(U); 10/21/69(S).
S. Korea	10/19/48(U); 5/16/61(S).
S. Vietnam	11/10/60(U); 2/27/62(U); 11/1/63(S); 1/30/64(S); 9/13/64(U); 12/19/64(S); 1/27/65(S); 2/19/65(C); 6/12/65(S).
S. Yemen	3/20/68(U).
Sudan	11/17/58(S); 3/2/59(C); 5/22/59(U); 11/9/59(U); 10/26/64(S); 12/27/66(U); 5/24/69(S).
Syria	3/30/49(S); 8/14/49(S); 12/19/49(S); 11/29/51(S); 2/25/54(S); 9/28/61(S); 3/28/62(U); 3/30/62(C); 3/8/63(S); 7/18/63(U); 2/23/66(S); 9/7/66(U); 2/26/69(C); 11/13/70(S).
Thailand	11/8/47(S); 4/6/48(S); 9/22/48(U); 2/26/49(U); 6/29/51(U); 11/29/51(S); 9/16/57(S); 10/20/58(S).

APPENDIX A (Continued)

Togo	1/13/63(S); 1/12/67(S).
Turkey	5/27/60(S); 2/22/62(U); 5/20/63(U).
Uganda	2/22/66(S).
Upper Volta	1/3/66(S).
Venezuela	12/10/46(U); 7/26/47(U); 9/12/47(U); 11/24/48(S); 9/29/52(U); 11/30/52(S); 1/1/58(U); 1/22/58(S); 7/21/58(U); 9/7/58(U); 4/19/60(U); 9/12/60(U); 12/21/60(U); 2/20/61(U); 6/26/61(U); 5/4/62(U); 6/2/62(U); 10/30/66(U).
Yemen	2/17/48(U); 4/2/55(U); 9/26/62(S); 11/4/67(S); 8/23/68(C).
Zaire	9/14/60(S); 11/25/65(S); 7/5/67(U).

a. Coup outcomes: S=successful; U=unsuccessful; C=compromise. Coded data is available for all 274 coups, but sufficient grievance data are restricted primarily to an n of 229.

APPENDIX B: ESTIMATION

The estimations of the parameter values of equations 6, 7, and 8 are based on the Marquardt (1963: 431) algorithm for nonlinear least squares. One proceeds by supplying the estimation routing with a set of initial estimates of the parameter values. Since it is known that the parameter values of a stationary process must fall within a stability region ($1 < \phi_i < 1$, $1 < \theta_j < 1$), it is possible to derive an initial set of rough guesses for the parameter values by inspecting the estimated acf values. The method for deriving these initial guesses is well defined in Box and Jenkins (1970: ch. 6). Given the initial estimates: $\beta_{io} = (\phi_{io}, \theta_{jo})$, imagine a grid superimposed on a coordinate system on which the initial guesses are located. Each point on the grid represents a potential value for the estimate β_i. In order to find the maximum likelihood value, one moves from the initial point (β_{io}) on the grid along β_i to an optimum point which provides the estimates most likely to produce the observed data. This is done by readjusting the initial estimates along the grid by a correction factor—$\delta = (\beta_i - \beta_{io})$, the difference of the initial guesses and another point on the grid—until the residual sums of squares conditional on ϕ_i, $\theta_j s(\phi, \theta) = (\Sigma X_t^2 \mid \phi, \theta)$, is minimized. The correction factor is obtained by regressing the sums of squares (conditional on the initial estimates) onto the partial derivative of the white-noise residuals. Or, as in the Taylor series, as $(X_{to}) = \Sigma(\beta_i - \beta_{io})w_{it} + (X_t)$, where $w = -\partial X_t/\partial\beta_i$. Adjustment in terms of δ is repeated until the parameters converge on their maximum likelihood values at which any subsequent readjustment will not improve the estimate by a small value e. It should be noted that the ordinary least-squares method is not appropriate for equations 6, 7, and 8 and, if used, will produce inefficient estimates.

APPENDIX C: GOODNESS-OF-FIT

The model's goodness-of-fit is checked by testing the randomness of the residual terms, a_t. If the residuals are random, then the model provides a good fit. Nonrandomness indicates that the model has not accounted for all of the systematic variation in the time series. The test used to detect systematic trend in a series is known as the Q statistic. It considers all k autocorrelations of the residuals (as well as the original series when used in the identification process) and essentially checks whether these values are random or systematically related. The test is

$$Q = n \sum_{k=1}^{m} r_k(X),$$

where r_k is the k^{th} autocorrelation. The Q statistic is a distributed chi-square with $m-p-1$ degrees of freedom. A spot check of the ratio of the individual r_k value over its standard error provides an additional clue to the significance of each value. Unless the ratio (t) is greater than 1.5, the observed value must be assumed to be insignificant.