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COMMENT AND REPLY

COMMENT ON YAMAGUCHI, *ASR*, APRIL 1996

POWER IN EXCHANGE NETWORKS: CRITIQUE OF A NEW THEORY*

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Yamaguchi (1996) offers a new theory of power in social exchange networks, claiming empirical support superior to that of alternative theories. We show that this is not the case and reveal internal theoretical contradictions, arbitrary parameter values, misrepresentations of the published evidence, and failed empirical tests.[1]

INTERNAL CONTRADICTIONS

Internal contradictions are self-defeating to a theory, and Yamaguchi's theory (henceforward Y's theory) has at least two. First, Y's theory declares that two exchange relationships such as those in B–A–C are *independent* if an A–B exchange does not affect A's demand for C's resources (p. 311). A–B and A–C are thus "de-coupled," and no position holds structural power. Contradicting this, however, Y's theory *does* predict structural power under independence in all networks Yamaguchi examines. As he notes, such power is associated with "negative connection" (e.g., Cook et al. 1983), a condition he explicitly distinguishes from independence.

Second, *substitutability* (which Yamaguchi equates with negative connection) exists when an A–B exchange *decreases* A's demand for C's resources (p. 310). This induces structural power. Yet in nearly all of the networks Yamaguchi examines, predicted power differences for substitutability are equaled or exceeded by power differences under independence.

ARBITRARY "*S*-VALUES"

The value of the *coefficient of elasticity of substitution* (s) reflects whether network ties are *independent* ($\log(s) = 0$), *substitutable* ($\log(s) > 0$), or *complementary* ($\log(s) < 0$, where A–B exchange *increases* A's demand with C). Y's theory generates predictions only if s is assigned a value. Yamaguchi fails to provide a model to specify s-values, and this failure greatly broadens the range of potentially supportive results. Although the absence of a model for obtaining s-values may enhance empirical corroboration, it actually subverts the theory's predictive power (Popper 1965). Put differently, one consequence of having no *a priori* method for assigning s-values is that the theory permits drawing the bull's-eye around the arrow. The value of s can be assigned *a posteriori*, increasing the apparent fit of the theory.

Yamaguchi declares $0 < \log_2(s) \leq 3$ for all substitutable ties. Yet his only justification for this severe upper bound on s is the ostensible "transaction costs in switching partners" in network experiments (p. 317). This important claim has no empirical basis. In fact, by Yamaguchi's own definition for "substitutable," only *large* s-values make sense for the experiments he cites. As Yamaguchi defines substitutable: (1) two or more potential part-

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[1] There are other important issues we could not address due to space restrictions, and a fuller analysis of Yamaguchi's article is available upon request.

ners must be viable substitutes for one another—when one partner satisfies demand, demand for the other is eliminated; and (2) *ceteris paribus,* subjects are indifferent to exchanging with different partners—there are no switching costs. Regarding point 1, in a B–A–C network under the typical 1-exchange rule, an A–B exchange eliminates A's demand for exchange with C *by design*; A knows that exchange with B precludes exchange with C. Furthermore, the experiments that Yamaguchi cites employ various devices that eliminate all known costs or impediments to completing exchanges. As for point 2, experiments also are designed to eliminate switching costs. In the computerized Iowa protocol, for instance, the partner offering the best deal is selected automatically, which prevents any special commitments or costs of switching partners. Such issues are not mere technicalities: The predictions of Y's theory fail when s is correctly specified, as we show next.

MISREPRESENTATIONS AND FAILED EMPIRICAL TESTS

Yamaguchi claims that his predictions are "consistent with results from experimental studies of power" (p. 308), enjoy a "high consistency" with published experimental tests (p. 308), and "attain a good fit with experimental results for more structures than [alternative] measures" (p. 311). We challenge these claims.

Complimentary 5-Line Network

For the 5-line network (F_1–E_1–D–E_2–F_2) with complimentary ties, Yamaguchi compares his theory's predictions to Yamagishi, Gilmore, and Cook's (1988) results. Y's theory expresses each position's predicted and observed profits as a proportion of all profits in the network at equilibrium. The first row of part A of Table 1 shows Yamagishi et al.'s observed means by network position.[2] Subsequent rows show predicted Y-theory values for slight complementarity and for independence. Without conducting statistical tests or justifying s-values, Yamaguchi declares a "modest" fit for his theory, apparently because observed means *seem* close to predictions for complementarity. However, predictions for independence fit the data virtually as well, so actually Y's theory fails this test.[3]

Substitutable 5-Line Network

Y's theory predicts a relatively flat power distribution in the substitutable 5-line network, in sharp contrast to alternative theories.[4] Yamaguchi presents results from Cook et al. (1983) that appear supportive. However, several factors bias his presentation of those data, and each factor reduces the apparent discrepancy between the predictions of Y's theory and the experimental data.

(1) Cook et al. (1983) reported on two conditions, one of which mitigated structural power by reducing subjects' interests in exchanging: The monetary value of profit points was reduced by 80 percent. Yamaguchi combines data from *both* conditions, and the structural effect appears to be reduced.

(2) Yamaguchi neglects to compensate for an added low-profit (8-point) F_1–F_2 tie in Cook et al.'s (1983) experiment. The effect is to inflate the profits of all low-power actors by 4 points—half the low-profit pool—and thus to further deflate apparent profit differentiation relative to the pure 5-line.

(3) Cook et al. (1983) reported each position's average profits from exchanges with each partner, but not the frequencies of exchanges with those partners. For example, to calculate E_2's true profit per exchange one must obtain a weighted mean of (a) E_2's profits with D, and (b) E_2's profits with F_2, where the weighting reflects the proportion of type a and type b exchanges. Based on

[2] Yamaguchi does not offer criteria for determining "outliers," and he excludes data from the first trial block of the experiment that would have severely damaged the apparent fit of his model.

[3] Relative to $\log_2(s) = 0$, the mean error when $\log_2(s) = -1$ is reduced by just .008; the mean-squared error is reduced by .001. Network Exchange Theory predictions for complimentary networks offer comparable or superior fit without the potential for post hoc parameter assignments (Szmatka and Willer 1993, 1995; Willer and Skvoretz 1995, 1997).

[4] In substitutable networks—which, again, Yamaguchi equates with "negative connection"—in each round actors negotiate the division of 24 points associated with each of their ties, and they may exchange once.

Table 1. Observed and Predicted Exchange Outcomes for Selected Exchange Networks

Network	Network Position		
	D	E	F
A. 5-LINE, COMPLEMENTARY			
(1) Observed (Yamagishi et al. 1988)[a]	.3133	.1931	.1502
Y-Theory Predictions:			
(2) Complementarity, $\log_2(s) = -1$	.3333	.2500	.0834
(3) Independence, $\log_2(s) = 0$	.2500	.2500	.1250
B. 5-LINE, SUBSTITUTABLE			
(1) Observed (Cook et al. 1983, corrected)[b]	.1436	.3303	.0978
(2) Observed (Markovsky and Lovaglia)[c]	.1159	.3464	.0957
Y-Theory Predictions:			
(3) $s = \infty$	.1667	.2500	.1667
(4) $\log_2(s) = 2$	.1864	.2500	.1568
(5) $\log_2(s) = 3$	.1764	.2500	.1618
C. 31-STAR, SUBSTITUTABLE			
(1) Observed (Markovsky et al. 1988)	.0635	.2355	.0767
Y-Theory Predictions:			
(2) $s = \infty$	.1250	.1667	.1250
(3) $\log_2(s) = 2$	.1525	.1667	.1158
(4) $\log_2(s) = 3$	.1383	.1667	.1205

[a] Consistent with Yamaguchi (1996), "observed" profit values have been re-scaled to sum to 1.0. In this row, for example, the 5-line network includes one D, two Es, and two Fs, yielding .3133 + .1931 + .1931 + .1502 + .1502 = 1.0.

[b] Cook et al.'s observed profit values were corrected using the procedure described in points 1 through 4 on pages 834 and 835.

[c] See footnote 5, below.

Markovsky et al. (1993), E's overall mean profit is then approximately .625 times its mean profit from exchanges with F, plus .375 times its profit from exchanges with D.[5] Yamaguchi does not account for this weighting, and this further understates actual profit differences.

(4) In transforming observed means, Yamaguchi first lets D = $\text{profit}_D/\text{profit}_E$, F = $\text{profit}_F/\text{profit}_E$, E = 1.0, then proportionately reduces these to make the five Y-theory values sum to 1.0. The problem is that assigning E = 1.0 is wrong. To be consistent with D and F, E must also be based on relative profits—in this case E should equal the sum of $\text{profit}_E/\text{profit}_D$ and $\text{profit}_E/\text{profit}_F$, each weighted by their respective proportions of exchanges. E's ratio is then .375(13.94/10.06) + .625(15.43/8.57) = 1.644, *not* 1.0. Using 1.0 further understates E's profit advantage.

The first row of part B of Table 1 shows the results of the Cook et al. (1983) experiment with corrections for points 1 through 4 above.[6] For comparison, the second row displays previously unpublished findings from Markovsky and Lovaglia that employ new experimental procedures. Row 3 contains predicted Y-theory values for $s = \infty$. Rows 4 and 5 use $\log_2(s)$ values of 2 and 3, for which Yamaguchi claims his model fits well.

Yamaguchi's model simply does not work when the data transformations are done correctly. It underestimates observed profit differentials by 55 to 73 percent (depending on the value of s), with a mean error many times

[5] These proportions conform reasonably well to our 5-line results (available on request from Markovsky and Lovaglia).

[6] Had Yamaguchi used late-trial means instead of all-trial means to more closely approximate the equilibrium exchange rates he claims to predict, the fit of his model would decline even further.

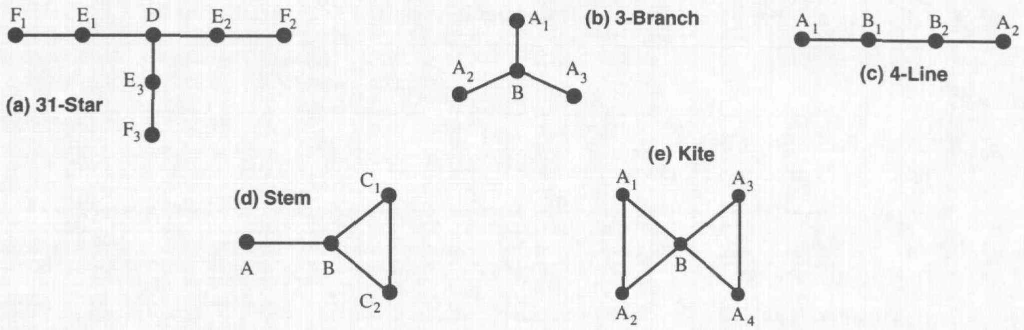

Figure 1. Some Exchange Networks Discussed in Yamaguchi (1996)

greater than those typical in Network Exchange Theory (e.g., Lovaglia et al. 1995).

31-Star Network

Yamaguchi did not check his predictions for the 31-star network (see Figure 1a) against results published in *ASR* (Markovsky et al. 1988). As shown in part C of Table 1, Y-theory predictions are far from the observed values for all network positions and underestimate power differences by 68 to 92 percent, depending on the value of s.

3-Branch Network

Skvoretz and Willer (1991) tested the 3-branch network (Figure 1b), predicting extreme profit differentiation under high substitutability and no profit differentiation under independence. Supporting these predictions, observed B–A profit values were 19.04–4.96 and 11.28–12.72, respectively. In contrast, Y's theory predicts the same degree of power differentiation (18–6) in the 3-branch for any value of $\log_2(s) \leq 0$ (i.e., for *either* substitutable or independent ties [Yamaguchi 1996, table 2]). Again, the data show that Yamaguchi's predictions do not hold.

Table 2. Observed and Predicted Exchange Outcomes for Weak-Power Networks

Network	Observed Profit for Actor B	Predicted Profit: Y's Theory	ER	GPI-RD
4-Line	14.05	12	16.0	14.5
Stem, B–A	15.29	12	18.3	15.6
Stem, B–C	16.49	12	15.2	13.7
Kite	14.05	12	12.5	13.7

Sources: Y's theory (Yamaguchi 1996); ER = exchange-resistance theory (Skvoretz and Willer 1993); GPI-RD = graph-theoretic power index with resistance and degree (Lovaglia et al. 1995).

Weak-Power Networks

Markovsky et al. (1993) distinguish "strong-power" networks, in which runaway bidding produces extreme profit disparities, from "weak-power" networks, whose structural properties keep profit differentials in check. Yamaguchi compares his predictions for three weak-power networks (Figures 1c, 1d, and 1e) to Skvoretz and Willer's (1993) results and to their exchange-resistance (ER) predictions. Table 2 displays Y-theory predictions (with $s = \infty$), ER predictions, and those of Lovaglia et al.'s (1995) model. (Lovaglia et al. employed the Markovsky et al. [1988] Graph-theoretic Power Index, modified for negotiation resistance and positional degree—the GPI-RD model).[7] As shown, Y's theory predicts no power differences, and the experimental data show otherwise.[8]

SUMMARY AND CONCLUSION

In sum, contrary to Yamaguchi's claim, predictions from his model are inconsistent with results from experimental studies of power in

[7] Lovaglia et al.'s (1995) data have been available since their presentation at the August 1993 meeting of the American Sociological Association.

[8] Yamaguchi confirmed that his theory predicts no power differences in these networks when $s = \infty$. He also confirmed that the theory cannot make predictions for some networks when $s = \infty$.

exchange networks. They do not fit experimental data for most of the network structures that he discusses, even when the s-values he selected are used. When corrected s-values are used, Yamaguchi's model fits none of the available data.

Nothing makes for more efficient theory development than pointed criticism based on logic and empirical evidence. Using both, Yamaguchi's theory does not compare favorably to others in the literature. Alternative theories, such as network exchange theory, generate more accurate predictions, contain no contradictions, and do not permit the post hoc assignments of values to key coefficients. Contrary to Yamaguchi's claims, among all published alternatives, his theory fares worst.

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