A Model of Robust Positions in Social Structure*

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Abstract: What makes an actor's position in a network robust, rather than fragile? What conditions, in other words, strengthen the foundations of a social position? Melding research attentive to network range with research on network spillovers, we conceive of robustness as the consequence of wide support from durable sources, and portray fragility as the byproduct of dependency on tenuously situated others. We then construct a network model of fragility and robustness by admixing Herfindahl's measure of concentration with Bonacich's measure of status. Consistent with our theoretical perspective, we find that fragility, net of status, exerts negative effects on favorable outcomes, in two empirical settings: managers' performance evaluations in U.S. electronics assembly firm, and changes in status among the members of Newcomb's fraternity. Implications for theories of status and of robust action are discussed.

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1. Introduction

What makes an actor's position in a network robust, rather than fragile? What conditions, in other words, strengthen the foundations of a social position? Various approaches have long equated robust positions with diversification, and fragile, vulnerable ones with concentration. For instance, the early exchange-theoretic treatments of Emerson (1962) and Blau (1964) pictured occupants of fragile positions as those who depend primarily on just one other entity in the network. Since then, many investigations have discussed both the hazards of relying on a single source and the advantages that result from ties to a wide range of others. Examples of this theme appear in the core tenets of resource dependency theory (Pfeffer and Salancik 1978), ecological conceptions of niche width as a shelter from environmental change (Hannan and Freeman 1989; Peli 1997), and network-theoretic accounts of the social structures that sustain malleability and preserve options in complex games (Padgett and Ansell 1993; Zuckerman et. al. 2003). It is thus well understood that the range of an actor's ties in a network is an important determinant of the robustness of its position.

In what follows, we develop a conception of fragility and robustness that concurs with these earlier lines of research, but also departs from them in a salient respect. While using notions of diversification and concentration, we also construct our approach from the concepts of "decoupling" and "coupling" developed in White's (1992) theory of identity and control. Decoupling refers to clean breaks and sharp distinctions between social actors, as when consumers' perception of an industry is unaffected by the practices of its overseas suppliers. Conversely, coupling refers to close connections that yield consequences beyond those of mere contact, as when an executive's style of leadership spills over and colors others' opinions of her direct reports (White 1992, pp. 78-9, 177-8; cf. White 2002, pp.200-220). Therefore, to be coupled with another actor is not simply to have contact or exchange with that actor. It is also to be intertwined with that actor's identity and network. In networks of intangible flows, such as flows of recognition and esteem among scientists (Merton 1968), coupling equates to the influence of another's identity on one's own. And in networks of tangible flows, such as goods and services moving among production markets, coupling is observable when the profitability of a given market responds to shocks felt in the networks of contiguous markets.

We contend that a conceptualization of robustness—or fragility, its theoretical complement—must take into account concentration *and* coupling. We define the occupant of a fragile position as one who is both highly dependent on and closely coupled with others who are *themselves* tenuously situated in the network. An example of a fragilely positioned non-profit is one whose support comes exclusively from an unpopular politician (Hannan 1998:149-150). An example of a fragilely positioned company is one whose footing resides solely in an uncertain market (White 2002:246-7). In what follows, we develop a network model of fragility and robustness—one that places emphasis jointly on concentration and coupling.

Our motivations for doing so are theoretical as well as methodological. First, much prior work suggests that the explicit modeling of effects of fragility will further our theories of actors' identities in markets, such as a scientist's prestige in her discipline or a company's status in its industry. There is a wealth of research suggesting that fragility attracts identity-related penalties.

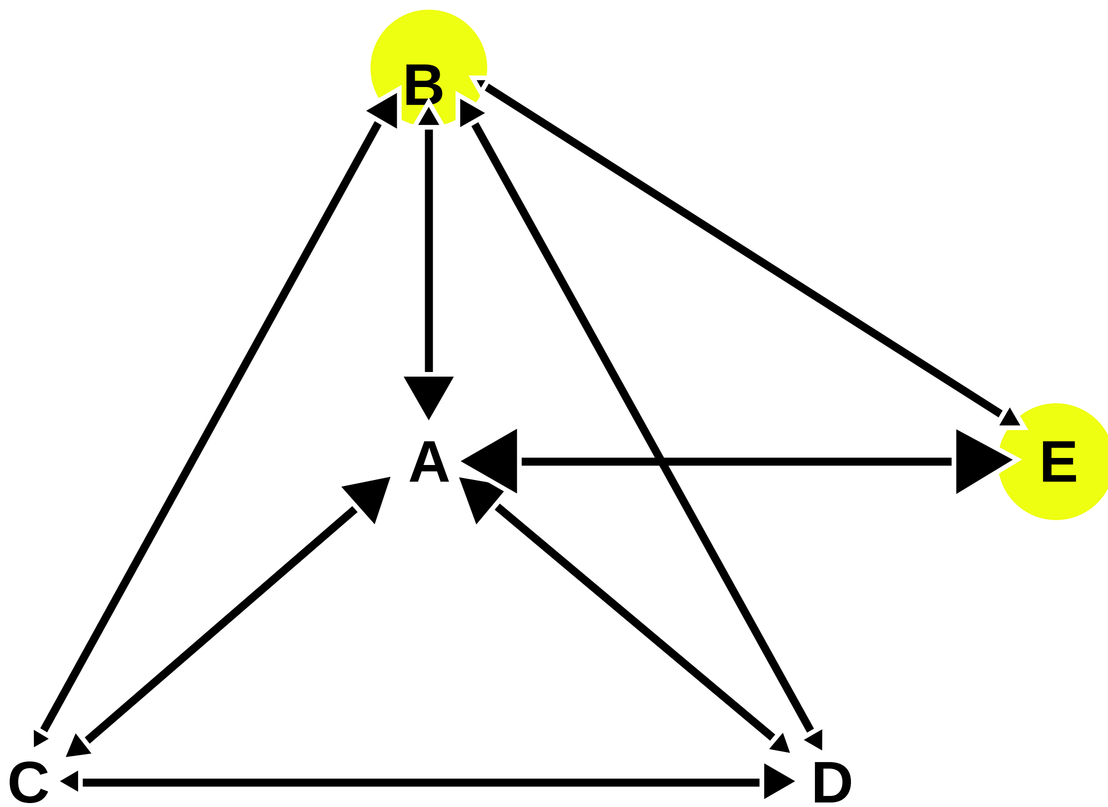
Underpinnings of this idea have a long history, starting with Weber's ([1922]1978) comparison of two distinct types of charismatic leaders. The first (and most familiar) type of charismatic leader is the extraordinary figure whose military exploits, intellectual powers, or miraculous works elicit the deference of a large community of followers. This individual, standing on a wide base of support, inhabits what for us is a robust position. Conversely, for Weber, the second type is the person whom the first type eventually (with age) consecrates as his or her successor. The second type's social standing therefore rests precariously on the sponsorship of the original charismatic leader. Unlike the "pure" charisma of the predecessor, mere "hereditary charisma" or "lineage charisma" (Weber pp. 248, 1135-7) marks the successor's role—a role that it is not nearly as legitimate as that of the first type. Thus, this second type is fragilely situated, having been chosen by the original leader, and frequently evokes suspicion and conflict among prospective followers—those whose allegiance the first type garnered with relative ease. Weber's distinction is important because it brings into relief the unfavorable perceptions that damage fragilely situated actors. With fragility often come reactions that erode legitimacy.

Some additional work that concurs with our conception of fragility and its consequences includes Coser's (1974) discussion of the acute stigmatization that often goes hand-in-hand with absorption in a servile role, and Abbott's (2001, p. 247) observation that prestige turns more significantly on one's range of future career options—that is, on the absence of fragility—than on a history of training and employment in high-status institutions. Consequently, we are persuaded that our theories of social status (and of outcomes affected by it) will profit from taking into account actors' locations on a continuum bounded by fragility and robustness. There is much reason to expect that fragility (robustness) decreases (amplifies) one's status in the future, and also influences the many performance-related outcomes that status is thought to improve.

This expectation brings us to our second motivation, which is methodological in character. We believe that a measure of positional fragility may be a necessary addition to many of our empirical models of status effects, because of what received measures of status end up masking. Although the existing literature offers a number of productive methods for arraying individuals in a status ordering, we find Bonacich's (1987) measure particularly valuable, because it permits the researcher to operationalize status as a state enjoyed by those who are highly regarded by others who are highly regarded. Used broadly in empirical research and in formal models, Bonacich's measure has this compelling feature: It folds into the computation of an actor's status score an added boost insofar as that actor receives deference from those who themselves receive deference. This feature has the important payoff of allowing the researcher to distinguish status from popularity, for instance. A high status person gets endorsements from elites, while a popular person just gets lots of endorsements.

Yet, despite its validity, it only partly takes into account the influence of others' identities on a given actor's status. Consider figure 1 as an illustration. We use figure 1 informally here to show that two positions may equal each other in status and nonetheless differ significantly in fragility, before we illustrate this distinction between status and fragility more formally in our next section on measurement. Figure 1 contains five people—*A*, *B*, *C*, *D*, *E*.

Figure 1



The double-headed arrows denote ties through which respect flows. Levels of respect are not symmetric in this network. We represent the sender's respect for the receiver by the area of the arrowhead directed at the receiver. Clearly, all members of this clique highly esteem *A*, who has appreciably more regard for *E* than for *B*, *C*, or *D*. More importantly, if we view each person's status as proportional to the sum of the areas of incoming arrowheads, it is then apparent that *B* and *E* enjoy nearly the same status in the system. Their total amounts of respect received are about the same.

We emphasize, however, that the positions of *B* and *E* in this network still differ considerably. *E*'s position is much more fragile than *B*'s—or, stated differently, *B*'s position is significantly more robust. Were A to leave the network, for instance, *E*'s life chances would likely drop more precipitously than would *B*'s. As an occupant of a fragile position, *E* should face greater difficulty sustaining his or her status in the future. We expect this type of position to attract negative responses from the other members of the network.

Of equal importance to our approach is the assertion that *E*'s position would be *even more* fragile if *A*'s position were to become less robust. Thus, we view fragile positions as those that are dependent on and coupled with other fragile positions. We turn next to a description of our method for measuring fragility, before presenting analyses of its effects in two empirical settings: the first is a sample of managers in an electronics assembly firm, which allows us to examine the cross-sectional association between fragility and managers' performance evaluations; the second is Newcomb's (1961) classic panel of friendship ties in a college fraternity, which we use to investigate the effect of fragility on individuals' future status.

2. Measuring Fragility and Robustness

We construct a network model of fragility and robustness from two previously disparate measures. We draw on the Herfindahl index to account for concentration, and then admix it with Bonachich's (1987) eigenvector measure to account for coupling. The Herfindahl index has long been used to assess industry concentration, where it is written as the sum of firms' squared market shares (Schmalensee 1989, pp. 966-7; McLean and Padgett 1997). It has also been utilized to quantify religious homogeneity within a geographical area (Ellison et. al. 1997). We take it as our point of departure to gauge fragility, because it aptly captures the degree to which one node in the network depends wholly on just one other node, rather than diversifying across all others.

Table 1: Flows of Deference Among Actors in Figure 1

	[A]	[B]	[C]	[D]	[E]
[A]	0	0.9	0.9	0.9	1
[B]	0.5	0	0.75	0.65	0.1
[C]	0.25	0.5	0	0.25	0
[D]	0.25	0.25	0.5	0	0
[E]	1	0.25	0	0	0

If we consider the 5-by-5 matrix $\mathbf{X}$ in table 1, where actors A through E correspond to the nodes in figure 1, and the entries in $\mathbf{X}$, x_{ij}, tally flows of respect (recognition, esteem, deference, precedence, honor, or support) directed from column actor j to row actor i, then we can express the Herfindahl index for this network as $H_i = \sum_{j}^{n-1} d_{ij}$, where $d_{ij} = \left[x_{ij} / \sum_{j}^{n-1} x_{ij} \right]^2$, and $n = 5$. When applied to matrices like $\mathbf{X}$, the Herfindahl index thus entails these straightforward steps: divide each entry through by its row sum; square the resulting proportions; and then collect the row sums of each squared proportion. If for actor i the index H_i equals unity, i then receives all of his or her respect from just one other actor in the network. Under this scenario, i is completely dependent. If, by contrast, the index for a given actor equals $1/(n-1)$, that actor is then minimally dependent, and his or her position is consequently far less fragile. The Herfindahl index therefore serves as an apposite baseline for measuring the fragility of social positions.

Used by itself, however, it has limitations. When applied to a social network, it only considers the nodes directly tied to the focal actor, making no allowance for the identities and networks of *these* nodes to exert influence on the focal actor. To deploy the Herfindahl index in this context is therefore to assume complete decoupling. Although full decoupling—that is, the absence of network spillovers—may accurately describe some social structures, it is surely not true of most. Consequently, to build into our measure of fragility the possibility of coupling, we turn to Bonacich's (1987) status measure, whose main elements we now summarize as the backcloth of our approach.

Using further the matrix $\mathbf{X}$ in table 1 as a reference point, Bonacich's method (1987:1172-1175) computes the status of i as $S_i(\alpha,\beta) = \sum_j (\alpha + \beta S_j) x_{ij}$. Or, when written as an infinite sum[1] $\mathbf{S}(\alpha,\beta) = \alpha \sum_{k=0}^{\infty} \beta^k \mathbf{X}^{k+1}\mathbf{1} = \alpha(\mathbf{X1} + \beta\mathbf{X}^2\mathbf{1} + \beta^2\mathbf{X}^3\mathbf{1} + ...)$ Moving from right to left in the first equation, for $S_i(\alpha,\beta)$, x_{ij} again denotes the respect (recognition, esteem, deference, precedence, honor, or support) j directs to i, S_j is the status of j, β is a parameter consistent with White's (1992) notion of coupling in networks (cf. Bonacich 1987: 1174) which cannot exceed the inverse of the norm of the maximum eigenvalue of $\mathbf{X}$ (Bonacich 1987, n. 6), and α is a scaling constant.[2] Turning to the corresponding infinite sum $\mathbf{S}(\alpha,\beta)$, $\mathbf{1}$ is a column vector of ones.

The intuition underlying the measure hinges on the parameter β. When β equals zero, $i's$ status is just the sum of the flows of respect directed to i from the other actors in the network—simply $i's$ row sum in $\mathbf{X}$ adjusted by the scaling constant alpha, in other words. As β rises, flows of respect carry greater force when they come from higher status actors. To the extent that β exceeds zero, the status of j affects the status of i through $j's$ respect for i.

While many researchers have productively harnessed $\mathbf{S}(\alpha,\beta)$ to investigate status effects (Podolny 2005, for a review), we are unaware of models that have simultaneously considered the

[1] In matrix form, $\mathbf{S}(\alpha,\beta) = \alpha(\mathbf{I} - \beta\mathbf{X})^{-1}\mathbf{X1}$, where $\mathbf{I}$ is an identity matrix and $\mathbf{1}$ is a column vector of ones.

social-structural foundations on which endowments of status actually reside—specifically, whether such foundations are fragile or robust. Going back to our discussion of figure 1—and of actors B and E in particular—two status positions may appear equal, but nonetheless rest on very different reinforcements. This contrast between status and fragility is not unlike a case of two skyscrapers of equal height that nevertheless stand on markedly dissimilar foundations.

Consequently, we shift attention from totals (Bonacich's row sums) to dispersions (Herfindahl's summed squared proportions), while at the same time allowing for coupling in the network. Melding the two approaches we have just reviewed achieves this. More specifically, we express our measure of fragility as follows, where F_i represents the fragility of actor i:

$$F_i(a,b) = \sum_j \left(a + bF_j\right) d_{ij} \qquad (1)$$

The core elements in equation (1) are d_{ij} and b. Recall that, in discussing the Herfindahl index, we set $d_{ij} = \left[x_{ij} / \sum_j^{n-1} x_{ij} \right]^2$, where x_{ij} signified the respect going from j to i, so that d_{ij} was the squared proportion of $j's$ respect for i. Summarizing Bonacich's measure, we also stressed the salience of the parameter β, underscoring its affinity the notion of coupling. The parameter b in equation (1) for fragility is the analog of β for status, and a like α is a scaling constant. Since F_j denotes the fragility of actor j, b determines the extent to which the fragility of j contours the fragility of i.

To view coupling among fragility levels from another vantage point, re-express equation (1) as an infinite sum, where d_{ij} is an entry in the matrix $\mathbf{D}$:

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[2] The scaling parameter α is generally selected so that the squared length of the status scores equals the number of

$$\mathbf{F}(a,b) = a\sum_{k=0}^{\infty} b^k \mathbf{D}^{k+1}\mathbf{1} \tag{2}$$

To get equation (2) to converge, it is well known that $b < \lambda$ must hold, where λ equals the reciprocal of the norm of the largest eigenvalue of $\mathbf{D}$. Given this constraint, we write the relationship between b and λ as follows, where c denotes a *coupling coefficient*.

$$b = \mathrm{c} \cdot \lambda \tag{3}$$

Thus, for $\mathrm{c} = 0$, full decoupling is taken to characterize the network, and fragility therefore correlates perfectly with the Herfindahl index. Under $\mathrm{c} = 0$, in other words, fragility reduces to concentration. Conversely, as $\mathrm{c} \to 1$, each actor's fragility score, F_i, is increasingly affected by the fragility score F_j of those on whom i depends.

Of course, the substantive interpretation of c will vary across different kinds of networks. Consider first a network through which intangible resources circulate. Here, a researcher would select a high value of c when the members of the audience attach significance to cases in which individuals are "propped up" by others who are in turn weakly positioned. Stated differently, $\mathrm{c} \gg 0$ accommodates settings in which actors' identities spill over and affect each other. A promotion tournament—for instance, one comprised of junior executives racing each other for a senior position—fits this image. There, gossip likely mars contestants whose strongest endorsements issue from the most weakly positioned vice chairmen. Consequently, just as the parameter β for status "can be thought of the radius" inside of which the analyst chooses to evaluate the status formation process (Bonacich 1987, p. 1174), the coupling coefficient c from equation (3) could correspond to the weight applied to contiguous actors' identities when quantifying fragility.

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actors in the matrix, which allows for meaningful comparisons across networks of different sizes.

Consider now a network through which tangible resources flow, such as the network of loans and business opportunities tying together the Florentine families trenchantly analyzed by Padgett and Ansell (1993). Using data of this type, a researcher would choose a large value of c when measuring fragility, insofar as economic shocks reverberate over long distances through the chains of the network. Under such conditions, assuming the goal for families is economic and political survival, it would especially risky for a given family to depend appreciably on small set of counterparts whose own alliances are sparse. Therefore, for networks of tangible flows, the coupling coefficient c from equation (3) could correspond to the weight given to adjacent actors' economic networks.

With these descriptions in place, we can now express robustness as the complement of fragility. That is, the occupant of a robust position is one who is *not* dependent on dependents, but is anchored solidly in multiple nodes that are in turn durable constituents of the network. We define robustness as follows.[3]

$$\mathbf{R}(a,b) = \mathbf{1} - a\sum_{k=0}^{\infty} b^{k}\mathbf{D}^{k+1}\mathbf{1} \qquad (4)$$

To bring forward more concretely the contrast between status and fragility, Table 2 reports levels on both measures for actors A through E. Following much earlier research, we set β equal to ¾ of the inverse of the norm of the largest eigenvalue of $\mathbf{X}$, and similarly set b equal to ¾ of the inverse of the norm of the largest eigenvalue of $\mathbf{D}$, that is, from equation (3) we selected $c = .75$.

[3] We choose the scaling constant a so that the sum of squared fragility scores equals the number of actors in the matrix. We could also of course substitute in place of $\mathbf{1}$, as the minuend, a column vector of constants equal to the largest fragility score plus the smallest fragility score, in order to linearly convert fragility scores into robustness scores. Using

Table 2. Status and Fragility Scores for Actors in Figure 1

	Status	**Fragility**
[A]	1.63	0.73
[B]	0.94	0.78
[C]	0.55	0.88
[D]	0.51	0.92
[E]	0.94	1.50

The first column reports status scores, the second column reports fragility scores. Mirroring the diagram in figure 1, A enjoys the greatest status, while D is least prestigious. In addition, although B and E equal each other in status levels, $E's$ position exceeds $B's$ in fragility almost by a factor of two. Whereas E is fragilely sited, $B's$ standing is comparatively robust.

Our comparison of B and E as status-equivalents underscores the possibility that a more complete view of status-based processes will take shape as network-analytic investigations give emphasis to dispersions, not just totals. We often define status as a "stock" built up from "flows" of deference (Podolny and Phillips 1996; Parsons 1963), or similarly, to use Merton's (1988, p. 620) vivid terms, implicitly conceive of status as an intangible asset that "takes the form of pellets of peer recognition that aggregate into reputational wealth." While agreeing with this basic imagery, we also believe it is important to focus on these "flows" or "pellets" in a manner that both captures the fragility of an actor's social position and creates a richer picture of that actor's life chances in its network. We therefore turn next to empirical analyses in two datasets that consider the effects of fragility net of status.

3. Managers' Performance Evaluations in an Electronics Company

the max plus the min has the benefit of making the robustness distribution a mirror image of the fragility distribution, with the same endpoints and variance.

We begin with a sample of 183 managers in a division of large U.S. electronics assembly firm, which we refer to as "Electronics." Our dataset records managers' age, gender, function, product group, performance evaluation, and ties to other managers. We chose these data because they allow us to investigate the consequences of fragility for managers' performance evaluations. If our theoretical approach is correct, these data will offer evidence to suggest that more fragilely positioned managers receive lower appraisals in the workplace.

We calculate status and fragility scores for managers at Electronics using a 183-by-183 matrix of binary indicators $\mathbf{E}$. Cell E_{ij} of $\mathbf{E}$ equals one if manager j cites manager i in a deference-related manner, zero otherwise. These status-conferring citations can take one of two forms: j names i as a boss or as a work-related discussion partner. $\mathbf{E}$ is asymmetric, such that E_{ij} need not equal E_{ji}, and is therefore suited to the measurement of status.

To do so, we apply Bonacich's (1987) measure described previously to the matrix of citations, setting β equal to ¾ of the reciprocal of largest eigenvalue of $\mathbf{E}$. Using this approach, a high status manager is one who receives deference-related citations from others who themselves inhabit elite positions at Electronics.

We apply $\mathbf{F}(a,b)$ from equation (2) to measure managers' levels of fragility. Since some managers receive no citations from others in the network, we assign zeros to their rows in $\mathbf{D}$, which would otherwise remain undefined after applying the two transformation rules—dividing through by row sums and squaring resulting proportions—for going from $\mathbf{E}$ to $\mathbf{D}$. Additionally, although we believe it is plausible to assign to the coupling coefficient c a value above zero, we use five different levels of coupling coefficient c to estimate models predicting performance evaluations as a function of fragility. More precisely, we let c take these values: 0, .25, .5, .75, and .99. We believe that calculating fragility with $\mathrm{c} > 0$ is appropriate for this empirical setting, because we believe that ties in the Electronics network are sufficiently transparent, either through direct observation or office gossip, for meaningful network spillovers to occur. We therefore expect stronger effects of fragility when coupling is accounted for.

We estimate equations predicting the performance evaluation of each manager—an ordinal outcome that assumes values of 1, 2, or 3—using ordered logit models (McCullagh 1980). These equations take the form:

$$\ln\left(\mathrm{P}(Y_i \geq k)/\mathrm{P}(Y_i < k)\right) = \mathbf{Z}_i\,\Theta + \gamma S_i + \theta F_i \quad (5)$$

where $k \in \{1,2,3\}$ is the category of interest, $\mathbf{Z}_i$ contains adjustments whose coefficients reside in Θ, and S_i and F_i are status and fragility scores respectively for the *i*th manager. We anticipate $\gamma > 0$ and $\theta < 0$.

In addition, the ordered logit assumes a latent variable Y_i^*, which for these data signifies the continuous performance evaluation that managers would receive if those appraising them were in fact unconstrained by the three categories. Thus, $Y_i = 1$ if $Y_i^* < 2$, $Y_i = 2$ if $2 \leq Y_i^* < 3$, and $Y_i = 3$ if $Y_i^* \geq 3$. Several adjustments reside in $\mathbf{Z}$: age, a dummy variable for women, a *no cites* indicator set to 1 if $i's$ rows in $\mathbf{E}$ were all zeros, as well as seven indicators for function (where the reference category is administration), and four for product group. Correlations and descriptive statistics for variables in our analyses appear in Table 3.

Moving to the results of model 1 in Table 4, we find initial evidence of a strong association between managers' status and performance evaluations (3.82 *z*-test). A standard deviation increase in status elevates the odds of a categorical shift more than threefold (exp[1.26*.9] = 3.12). Additionally, although the effects of age, gender, and the absence of citations are indiscernible, there is a significant variation across functions (with human resource managers receiving the lowest ratings) and product groups.

Turning to models 2 and 3, we introduce measures of fragility from equation (2). In model 2, we set the coupling coefficient c equal to zero, and for model 3, we set c equal to .50. In both models, coefficients undergo shifts. For instance, the coefficient on the *no cites* indicator is now strongly negative—those bereft of incoming ties get lower evaluations—and the effect of status falls in magnitude, while nonetheless retaining its significance as a one-tailed test (1.81 *z*-test in model 3). Furthermore, the effects of fragility are negative and substantial in both models (-2.73 *z*-test in model 2, -3.01 *z*-test in model 3). Using the estimate in model 3, a standard deviation shift in fragility attenuates the odds of upward movement by more than 50% (exp[-1.13*.665] = 0.47). This result concurs with the expectation that fragility carries negative consequences—or alternatively, that robust positions bestow advantages. Consequently, we see preliminary evidence of actors' locations on a continuum defined by fragility and robustness mattering beyond their status.

Comparing models 2 and 3—and of the significance levels of fragility, in particular—takes us to the question of what level of coupling is most appropriate for measuring fragility in this empirical domain. In assessing managers' fragility levels at Electronics, are we correct to assume network spillover? We have reason to do so, given the likelihood of information transfer concerning which manager is tied specifically to whom in a network of this middle-range scale. Ultimately, the choice of c must depend first on theory and second on the researcher's understanding of the particular social context under study.

Yet, we can also, in a preliminary sense, assess the prudence of choosing $c > 0$ by determining which realization of our fragility measure most strongly predicts the outcome. In the extreme, just one rendering of the metric would exert a discernible effect. Although this is not the case for the Electronics data, fragility with $c = .5$ does allow us to dispense with the null of no effect with greater confidence than fragility with $c = 0$ (-3.01 *z*-test for $c = .5$, versus -2.73 *z*-

test for $c = 0$).[4] Thus, we detect suggestive evidence that fragility and robustness are better measured with attention to coupling in the Electronics data.

4. Status Dynamics in Newcomb's Fraternity

We analyze Newcomb's (1961) panel data on the social structure of a college fraternity to assess the consequences of fragility for individuals' future changes in status. Used in several earlier studies (White, Boorman, and Breiger 1976; Doreian et. al. 1996; Gould 2002; Moody, McFarland, and Bender-deMoll 2005), it offers at least three salient advantages. First, it allows us to compute time-varying levels of fragility and status. In this study, 17 male college students stayed expense-free for a semester-long period in a fraternity-like home, where they were required weekly, for fifteen weeks, to rank each other from 1 to 16 according to "favorableness of feeling." These appraisals convert easily into asymmetric matrices suitable for the construction of time-varying status and fragility scores. With them, we can assess the impact of fragility on future status, net of its current level, making possible a conservative test of our contention that fragility is status-eroding. Second, participants in the experiment did not know each other before its inception, because they were transfer students. This feature of the research design permits us to focus exclusively on dynamics that occur within, rather than starting before, the 15-week window. Third, these data allow us to disentangle the effect of fragility from those of individuals' time-constant characteristics. We expect an individual's future status to decline as his position becomes increasingly fragile.

We began by constructing fifteen seventeen-by-seventeen matrices $\mathbf{N}_t$ for members of Newcomb's study to test this expectation. We used these matrices to calculate status and fragility

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[4] The strength of the significance tests follow a curvilinear pattern and reaching a global maximum for $c = 0$. For the full set of values of c —0 , .25, .5, .75, and .99—the corresponding *z*-tests are these: -2.73, -2.92, -3.01, -2.73, -1.69. Comparing log likelihoods across the five non-nested models also shows that the overall level fit follows a similar same pattern, peaking at $c = .50$. The corresponding log likelihoods are the following: -150.44, -149.94, -149.63, -150.21, -152.69.

scores. Cell N_{ijt} of $\mathbf{N}_t$ equals 16 if individual j gave i a ranking of 1 in terms of likeability, and equals 1 if j gave i a ranking of 16. Linearly reverse-coding the rankings thus transforms them into status-conferring flows from columns to the rows of $\mathbf{N}_t$. To this asymmetric matrix, we again apply Bonacich's (1987) status measure, setting β equal to ¾ of the reciprocal of largest eigenvalue of $\mathbf{E}$. Using this approach, a high status individual is the target of status-generating sentiments from others who are themselves favorably appraised.

Next, we use $\mathbf{F}(a,b)$ from equation (2) to compute individuals' fragility scores. We believe it is appropriate to assign to the coupling coefficient c a value greater than zero, but nonetheless investigate results from models using five distinct levels of c—in particular, $\mathrm{c} \in \{0,.25,.5,.75,.99\}$. While we anticipate a negative association between fragility and fraternity members' future status, we also wish to assess our assertion that coupling is an axial component of fragility.

The models we estimate are of the form:

$$S_{i,t+1} = \rho S_{it} + \varphi F_{it} + \mu_i + \tau_{t+1} + \varepsilon_{i,t+1} \tag{6}$$

where S_{it} and F_{it} denote the status and fragility scores, $i = 1,...,17$ and $t = 1,...,14$. With lagged status included, equation (6) models dynamics of adjustment, as a function of time-changing levels of fragility. The inclusion of lagged status also guards against the possibility of mean reversion.[5]

[5] Consider, as an instance of mean reversion, the following case, which the inclusion of lagged status rules out: Imagine that, early in the study period, individual *i* enjoys a groundswell of good fortune, which lowers his fragility and raises his status in the next time period. Then, subsequently in the panel, he is down on his luck, so that his fragility rises just as his future status reverts. This pattern would account for a negative effect of fragility on future status, were the lagged dependent variable excluded from the model. By including it as a regressor, we absorb the effects of unobservable good fortune that are unaccounted for by the fixed effects for individuals and period.

We also enter fixed effects to absorb invariant, subject-specific propensities to fill fragile or robust positions, which are represented by μ_i. These sweep out fraternity members' levels of prior educational attainment, confidence, charisma, social skill (Leifer 1988), and all other stable traits that plausibly channel sorting into footings in networks (cf. Gould 2002, pp. 1143-4). Using a fixed-effects specification thus eliminates all between-person variation, so that the coefficients reflect within-person effects of fragility on changes in status. Additionally, as denoted by the indicators τ_{t+1}, we adjust for all manifestations of temporal heterogeneity, such as reciprocity, transitivity, and all other global properties of the network (Doreian et. al. 1996; Moody, McFarland, and Bender-deMoll 2005). Since τ_{t+1} enter jointly with μ_i, the effect of age is also fully accounted for. Correlations and descriptive statistics for variables in our analyses are included in Table 5.[6]

Turning to Table 6, model 1 contains just lagged status and fixed effects for individuals and periods as a baseline. Variation in fraternity members' average levels of status growth is clearly pronounced, reinforcing the merits of the within-estimator. The important contrast is between models 2 and 3, however. In model 2, we add a measure of fragility F_{it} with the coupling coefficient $\mathrm{c} = 0$, and in model 3, we enter F_{it} with $\mathrm{c} = .99$. That is, model 2 assumes decoupling—so that F_{it} reduces to the Herfindahl index—whereas model 3 posits coupling, with adjacent actors' positions influencing the fragility of a given actor's position in social structure.

Keeping with our discussion thus far, we find that the effect of fragility is indiscernibly different from zero in model 2, but significant under a one-tailed test in model 3 (-1.21 *t*-test in model 2, versus -1.73 *t*-test in model 3). When estimating other models—with c equal to .25, .5, and .75—we also found that fragility is significant *only* at the highest possible level of coupling,

[6] We report within-person correlations and standard deviations because our estimator focuses only on within-person variance.

$c = .99$. The contrast between models 2 and 3 is important, because it offers support the supposition that taking coupling into account is necessary for understanding the link between positional fragility and the dynamics of prestige.[7]

We take two additional steps to further assess our primary finding that fragility antecedes declines in status, before moving to a discussion of scope conditions and of implications for future investigations. *First*, we guard against the possibility that other dimensions of fraternity members' social-structural locations account for the observed effect of fragility. One particularly important dimension to consider is the level of closure characterizing a given position. Much recent research has shown that closure favorably affects the process by which coveted reputations emerge in networks (Burt 2006). Since closure may also influence fragility, we enter as an added adjustment Burt's (1992) measure of constraint, which we expect will increase growth in status. To calculate constraint C_{it} in equation (7), we symmetrize the matrix of flows, working from a matrix that equals the original matrix $\mathbf{N}_t$ plus its transpose, and designating by p_{ij} the relative strength $i's$ connection to j, where $i \neq j \neq q$.[8]

$$C_{it} = \sum_j \left[p_{ij} + \sum_q p_{iq} p_{qj} \right]^2 \qquad (7)$$

We also construct a proxy for fraternity members' sycophantic behavior (cf. Burt 1976:104-109). This is because it is easy to imagine that (at least some) occupants of fragile roles

[7] When both measures of fragility enter model 1 jointly (in an equation unreported, but available if requested), the coefficient on $F_{it|c=0}$ stays insignificant (with a coefficient of .1728, and a 1.37 *t*-test), whereas the parameter for $F_{it|c=.99}$ continues to exert a negative effect (with a coefficient of -.1718, and a -1.90 *t*-test). Through regressing S_{it+1} on $F_{it|c=0}$ and $F_{it|c=.99}$, the estimate on $F_{it|c=.99}$ reflects the variation that is orthogonal to $F_{it|c=0}$. Thus, the persistence of the effect of $F_{it|c=.99}$, where coupling is taken into account, further suggests the salience of network spillovers over immediate dependencies.

act obsequiously, whereas occupants of robust positions advantageously carry themselves with much bluster, particularly in a fraternity-style setting. We have argued, building on prior sociological theory, that fragility undermines legitimacy, and is therefore status-eroding, whereas robustness solidifies legitimacy and is consequently status-enhancing. We nonetheless address the counter-possibility that locations on an axis marked by fragility and robustness are in fact invisible to others in a network, making them by definition inconsequential, in a direct sense, for processes of growth and decline in status. If this alternative view is descriptive, then an easily-tracked, conduct-related correlate of fragility, such as sycophantic conduct, may well fuel the effect we observe. While the fixed effects μ_i absorb time-constant, intrinsic propensities to behave subserviently, conduct of this type may have a time-varying component as well.

We therefore constructed an additional measure by working from the premise that each dyadic exchange may be represented spatially. More precisely, we suggest that each dyadic exchange maps to coordinates on a two-dimensional state-space, with $j's$ ranking of i from 1 to 16 on the ordinate, and $i's$ ranking of j from 1 to 16 on the horizontal.[9] The main diagonal then marks symmetric exchange, along which j and i appraise each other equally. Consider now an extreme, where j gives i a 16, but i nonetheless ranks j at the top, giving j a 1. The full triangular area above the diagonal corresponds to $i's$ maximally obsequious performance in this implicit trade. Conversely, at the opposite extreme—where j gives i a 1, and i nevertheless ranks j at 16—the full triangular area *beneath* the line of symmetry now represents $i's$ *minimally* obsequious conduct. Letting each triangular area in this state space proxy for the asymmetric nature of the $j-i$ tie, and summing over all ties for i at t, yields a time-varying measure of sycophantic conduct A_{it}:

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[8] In the matrix $\mathbf{N}_t + (\mathbf{N}_t)^T$, ties thus vary in absolute strength from 2 to 32.

[9] We refer here to the original (untransformed) rankings from Newcomb's weekly surveys, where a score of 1 goes from the respondent to the fraternity member he likes most, and 16 to the one he likes the least.

$$A_{it} = \sum_{j=1}^{16} \frac{\Delta_{jit}^2}{2} \cdot \sigma_{jit} \tag{8}$$

where Δ_{jit} equals $j's$ ranking of i minus $i's$ ranking of j, and the indicator σ_{jit} equals 1 if $\Delta_{jit} > 0$, -1 otherwise. We expect A_{it} to diminish future status.

When we enter C_{it} and A_{it} in model 4, they affect future status consistent with our expectations, and fragility remains strongly negative (-2.77 *t*-test). Having accounted for the closure marking fraternity members' positions, as well as their time-changing levels of asymmetric exchange, we can conclude with greater confidence that tenuously positioned actors face identity-related penalties.

Second, we evaluate our primary result further by ensuring that the pattern of results does not hinge on any particular subject's series. We do so not only because of the size of Newcomb's panel, but also because of the fact that one member of the fraternity persistently garnered poor ratings. White, Boorman, and Breiger (1976, p. 759) drew attention to "a scapegoat … (man 10), who received one of the bottom three choices of each of the other 16 persons." Correspondingly, the intercept for the tenth individual is strongly and conspicuously negative across all models in Table 6. We therefore estimated a version of model 4 omitting the tenth individual.

Results of this approach appear in model 5. There, we see that our effect of interest stays strongly negative (-3.20 *t*-test for fragility), and that other coefficients go largely unaltered, leading us to conclude that the scapegoat does not disproportionately configure the effects we observe. To assess the findings more generally, we also estimated sixteen other versions of model 4 in which we omitted each of the other subjects of the study in turn. Without exception, across these sixteen alternative specifications, we found strong evidence of a negative effect of fragility, whose impact was always significant at standard levels of confidence.[10]

5. Discussion and Conclusion

Our aim in this article has been to conceptualize and develop a method for measuring the robustness of actors' positions in networks. We situated our approach on the backdrop of prior analyses using concentration versus diversification of social ties as salient constructs. We then brought forward the importance of taking into account coupling among the nodes that comprise a social system. Melding disparate approaches, we developed a measure of fragility that is attentive to the extent to which a focal actor is propped up by those who are themselves precariously situated. Various metaphors come to mind in this context. For instance, fragility is much like using an unbalanced ladder on a shoddy floor, whereas robustness is akin to sitting in a stable chair in a well-built home. Or, perhaps more vividly, fragility is analogous to being kept by a poor sugar daddy, where robustness results from many reliable income streams. Whatever the imagery, the important feature is an admixture of concentration and coupling. Fragility equates to dependency on dependents, and robustness to diversification across the diversified.

We then applied our measure in two distinct empirical settings and found similar results. In the Electronics data, we found that more fragilely positioned managers received lower performance evaluations. In Newcomb's panel, we found that more fragilely situated fraternity members faced declines in status over the course of a semester-long period. In each case, we found that fragility mattered beyond current status.

Thus, in addition to the empirical results we have presented, one of our primary contributions has been to demonstrate that an actor's ranking in a vertical ordering may be insufficient for accurately understanding either its status or network position more broadly

[10] These supplementary models are available upon request. Significance tests for fragility range from a minimum in absolute value of -2.17 when the sixteenth individual is deleted, to -3.20 when the tenth individual is omitted, as shown

construed. Starting with the clique in figure 1, we illustrated that, although metrics like Bonacich's (1987) eigenvector approach serve as powerful methods for inducing prestige orderings from relational data, our measure of fragility illuminates important, and otherwise occluded, distinctions between actors who appear status-equivalent, and yet have very different social footings. We believe that future analyses of the antecedents and consequences of status will profit from looking beyond the aggregation of prestige-conferring flows to the routes by which those flows converge on positions in social structure. When virtually all recognition or esteem emanates from a single vulnerable source, the receiver's position is considerably less robust.

We have also drawn attention to the importance of constructing network models that account for extra-local processes. We found in particular that taking coupling into account in the measurement of fragility was important for explaining variance in the outcomes we examined. Our results indicate that attention to ego-networks—a chosen actor's immediate contacts—alone may be insufficient. In this sense, our approach is consonant with other portrayals of processes traveling through chains of considerable length. Examples of work in this vein include Rapoport's (1963) models of interaction, White's (1970) analyses of vacancy chains, Tilly's (1990) discussion of immigration patterns, Abbott's (2001) analyses of event sequences, and Burt's (2007) models of reputational stability as a function of closure among indirect contacts.

As Burt (2007) argues, whether or not extra-local processes matter deserves careful scrutiny and carries central implications for research design. If causality resides entirely in the immediate network—that is, if decoupling is a characteristic feature of the population—then it is superfluous to capture the network as a whole. Actor-specific network data alone are sufficient. Conversely, attention to the full pattern of ties within a population becomes increasingly necessary insofar as identity-related spillovers occur. The approach we have taken indicates that collecting complete network data is important for moving toward full portrayals of status-related

in model 5.

processes.

Before turning to a discussion of implications for other lines of sociological theory, we note that there are important limitations of the perspective we have advanced. At least two conditions in particular bracket the generality of our viewpoint. *First,* in direct contrast to the point just made, there are surely empirical settings in which extra-local processes do not matter, and where decoupling therefore defines the network. In these settings, fragility is best measured just as a Herfindahl measure of concentration, without attention to contiguous actors' identities and networks. The level of transparency in a social structure (White 1992, pp. 106-111) contributes significantly to degree of coupling or decoupling within it, and thus shapes the measurement strategy that is most appropriate. Although many social systems allow incumbents (as well as observers) easily to map out who is connected to whom and in what way—consider, as extremes, a rank-order tournament or, less commonly, a matrix organization whose publicly displayed organizational chart actually reflects its informal structure—other systems are far more opaque, even for insiders. There, the concrete patterning of social ties is fuzzy and uncertain for all involved, and network spillovers are therefore rare. Consequently, an important scope condition for our approach is a reasonable level of transparency within the network. Coupled identities, where spillovers occur, necessarily entail transparency.

We therefore expect extra-local ties to matter appreciably in the estimation of fragility effects within transparent settings like investment banking, where firms' locations in public pecking orders are widely monitored (Podolny 1993). Conversely, for less penetrable settings—such as semiconductors (Podolny, Stuart, and Hannan 1996), where consumers likely have difficulty discerning the circuitous patterns of inter-firm patenting ties—we anticipate little in the way of network spillovers and thus suspect that firms' levels of fragility and robustness will be best calculated more restrictively.[11]

[11] There is an important caveat here: Thus far, we have discussed the measurement of fragility and robustness for matrices of intangible flows—recognition, esteem, and deference, for instance. By contrast, for systems of tangible

Second, in empirical settings different from our own, it is entirely plausible that what we have measured as fragility in equation (2) exerts *positive* effects on coveted outcomes. Consequently, in such settings, although its algebraic form will remain unchanged, our measure will require substantive recasting. Consistent with this possibility, Zuckerman's (1999, 2000) work clearly demonstrates the benefits of constructing a narrow, concentrated identity. When individuals or organizations winnow their focus to an existing category in a way that renders their performance easier to appraise, corresponding advantages result. There is also the possibility that concentration on another node in a network reduces learning costs, as when a student quickly assimilates the tacit knowledge of a single mentor, or a specialized firm more readily responds to distinctive customer preferences (Bruggeman 1997; Carroll and Hannan 2000; Bothner 2003).

Here, however, it is important to consider differences in where concentration comes from. Consider a well-known case from the computer industry as an example. Dell's choice historically to focus exclusively on the direct sales channel is markedly different from a fraternity brother who gets a disproportionate share of his social support from one other member of the house—although Herfindahl's index will be high for both. Dell's strategy has largely proven status-enhancing, but in Newcomb's fraternity we found that concentration is status-eroding. Where these cases differ is not in levels of analysis, but in matters of control. Where a computer vendor can deliberately decide to specialize within a specific segment, the fraternity brother has far less discretion over whether he receives the lion share of his social support from a particular peer. When this does occur, those other than himself are consequently the ones imputing meaning to his position, and they likely do so in ways that are unflattering.

Thus, keeping with Zuckerman's work and with ecological models of niche width, the

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flows, such as monetary flows between market sectors or larger economic aggregates, transparency probably operates differently. Consider, for example, models of intra-sectoral turnover as a function of structural position in a national economy (Burt 1992, pp. 208-227). Fragility at the sector level likely elevates rates of turnover. That is, firms in sectors that load heavily on sectors that are undiversified in their inputs should suffer replacement more frequently than incumbents of robustly situated sectors. More importantly, it is plausible to expect that chains of fragility are *more* consequential under conditions of low transparency—in other words, when incumbent firms have difficulty forecasting and preparing for shocks that surface remotely in intertwined, sector-level supply chains.

measure of fragility we have devised will necessarily be recast as a measure of *focus* in other contexts. In such contexts, actors receive rewards for establishing exclusive ties to those with narrow allegiances. When the cost of forging such ties varies inversely with actors' quality levels, as they often do in graduate training programs for instance, equation (2) will measure focus as a viable market signal in Spence's (1974) sense.[12]

To mitigate concerns about generality, in addition to describing how to substantively reframe our measure to accommodate different settings, we stress the pervasiveness of the social structural conditions that are consistent with the viewpoint we have advanced: our approach posits that actors sort into positions in a status ordering as a function of the recognition they receive, and that the network is sufficiently transparent that they are aware of the manner by which positions in this ordering are determined—whether they are solidly built or exist only precariously. While the conditions necessary for our perspective do not mark all social settings, they certainly characterize many. We believe our approach is generally applicable for methodological and theoretical reasons: both because of the frequency with which network-analytic study designs gather full data on status-conferring ties, and because of the frequency with which peer monitoring and gossip make the underpinnings of status positions transparent.

In addition replicating our results in other settings, especially in those where status has been shown to antecede performance-related outcomes, we see two particularly promising ways to proceed further. One next step is to more tightly link notions of fragility and robustness to etiologies of status. Another is to harness the approach we have developed to further pinpoint the structural foundations of robust *action*—or action that preserves options (Leifer 1988; Padgett and Ansell 1993). We offer preliminary sketches of how theories of status and of robust action

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[12] This point also raises the issue of *lineages*, if actors in a system span cohorts or generations. Under this scenario, equation (2) could measure purity of lineage, as when an artist or academic comes from the right (and narrow) line of teachers. Purity is then a byproduct of having collaborated exclusively with a master who was him or herself sharply discriminating as a disciple. For instance, this is almost certainly the legitimating process Saint Paul had in mind when, in his defense, he cited Gamaliel as his teacher (Acts 22).

might be extended in light of our approach.

We found in our analysis of Newcomb's data that fraternity members enjoyed increments in status as their positions within the social structure became more robust. This finding is consistent with Coser's (1974) discussion of the intangible penalties attached to occupancy of dependent roles, and with Abbott's (2001) observation that eliteness is a byproduct of possessing a wide range of future options. We interpreted this finding as evidence consistent with the premise that audience members esteem those in robust positions. There is of course also much anecdotal evidence to suggest that the robustness or fragility of an actor's position *on a purely structural level* directly influences how that actor gets perceived. The felt reality of this mechanism is apparent in the resentment generally reserved for those whose levels of attainment are widely thought to result from the support of a single sponsor. In arguing that structure directly affects perceptions, we sought to adjust as stringently as possible for fixed and time-changing behavioral processes in our empirical models.

Nevertheless, we believe that future work on the determinants of eliteness may benefit from examining some of the possible behavioral concomitants of robustness. These are actions that emerge from the durability of actors' positions and in turn contour their levels of prestige. We refer here in particular to actions that are permissible and sustainable exclusively for inhabitants of robust positions. Examples include the "attractive arrogance" Merton (1968, p. 61) ascribed to elite scientists, or excessive acts of generosity directed toward others who lack the resources to reciprocate. Through tracing out the links between robustness, modes of conduct, and harvests of deference, we anticipate that our conceptions of where status comes from are likely to sharpen.

On this point, there are also the important considerations that status is always zero-sum, and that robustly positioned actors are less likely to face outcomes often suffered by their less well-positioned counterparts. In particular, the notion that fragility invites disdain suggests further that more vulnerable actors end up unintentionally elevating the status of their more durable counterparts insofar as they suffer acts of aggression and other efforts to keep them in their "place" (cf. Painter 1986; Patterson 1991:404-5; Tilly 1998). Thus, the creation of increasingly fragile positions within a given social system may serve as a control mechanism that bolsters elites' stature, ensuring that they have a large supply of others down upon whom they can look.

Turning in conclusion to further implications for theory, we strongly suspect that robust positions, as we have defined them, render robust action more sustainable. Work on robust action has immediate precedents in Leifer's (1985) research on chess masters. This study found that the very best chess players are not those endowed with uncommon forecasting abilities, but rather those who can sustain flexibility with respect to (or remain robust with respect to) opponents' moves. More generally, robust action refers to strategic conduct that is difficult for a competitor to interpret and that therefore keeps its practitioner from getting absorbed in an undesirable role. For example, by acting robustly in a romantic relation, a suitor veils actual intentions and therefore circumvents appearing overly committed and becoming the less powerful; or by acting robustly in international relations, one nation wishing to conquer another adroitly provokes its target into starting the war and then successfully brands it as the instigator (Leifer 1988, pp. 867-9). Correspondingly, for a political figure, this strategy equates to maneuvering in ways that are indecipherable to opponents and therefore congenial to continued flexibility (Padgett and Ansell 1993).

We believe that attention to positional robustness may shed new light on the incidence of robust action. While we fully agree that social skills (Leifer 1988) and protean identities (Padgett and Ansell 1993:1263-4) greatly facilitate robust action, we contend as well that this strategy is significantly aided by durability of social position. This is because of the costs involved. Notwithstanding its many advantages, robust action has a dark side and can be dangerous. The cagey suitor invites accusations of insincerity and indecisiveness. Robust actors, though they may be exquisitely patient and shrewd, open themselves to the accusation that they are slow ciphers, lacking any core. In light of these risks, we conclude with a disconfirmable prediction. We expect robust action to be more likely from robustly positioned actors, because of the capacity of their positions in social structure to absorb, much like an insurance policy, the costs of social accidents.

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Table 3. Correlations and Descriptive Statistics For Variables in the Analysis (N=183)

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
[1] Performance	1.0000										
[2] Status	0.2415	1.0000									
[3] Robustness (c = .50)	-0.1932	-0.2682	1.0000								
[4] Age	-0.0866	0.1254	-0.0449	1.0000							
[5] Female	0.0277	-0.0029	0.0473	-0.1356	1.0000						
[6] No Citations	-0.1522	-0.1933	-0.5565	-0.0540	-0.0354	1.0000					
[7] Administration	-0.0114	0.0711	-0.1400	0.2034	-0.1519	0.1764	1.0000				
[8] Engineering	0.0813	-0.0029	-0.0493	-0.0354	0.0127	-0.0659	-0.3371	1.0000			
[9] Finance	0.0280	-0.0320	0.0147	-0.2076	0.0213	0.0053	-0.1638	-0.1190	1.0000		
[10] Human Resources	-0.1441	0.0582	-0.0261	-0.0248	0.0213	0.0053	-0.1638	-0.1190	-0.0578	1.0000	
[11] IT	0.1008	-0.0503	0.0669	-0.0730	0.2642	0.0479	-0.1358	-0.0987	-0.0479	-0.0479	1.0000
[12] Legal	0.0625	-0.0252	0.0824	0.0200	-0.0692	-0.1169	-0.1638	-0.1190	-0.0578	-0.0578	-0.0479
[13] Marketing	0.0910	-0.0528	0.1326	-0.0549	0.1628	-0.0367	-0.2386	-0.1733	-0.0842	-0.0842	-0.0699
[14] Operations	-0.1647	-0.0159	0.0379	-0.0031	-0.0784	-0.0776	-0.3136	-0.2278	-0.1107	-0.1107	-0.0918
[15] Product 1	-0.0648	0.1860	0.0996	-0.0442	0.1134	-0.1931	-0.1747	0.1699	-0.0882	-0.0369	0.0179
[16] Product 2	0.2171	-0.0550	-0.0630	0.0707	0.0137	0.0524	0.0748	-0.0673	0.0403	0.0403	0.0694
[17] Product 3	-0.1145	-0.0748	0.0247	0.1322	-0.0762	-0.0166	0.0568	-0.1311	0.1306	0.0334	-0.0528
[18] Product 4	0.0967	-0.0996	-0.0305	-0.1138	-0.0582	0.0409	-0.0417	-0.0045	0.0399	-0.0290	0.0004
[19] Product 5	-0.1121	-0.0882	-0.1147	0.0462	-0.0728	0.2862	0.2724	-0.1251	-0.0608	0.0403	-0.0504
Mean	2.2186	0.3694	0.7530	50.1749	0.0765	0.1913	0.3169	0.1967	0.0546	0.0546	0.0383
Standard Deviation	0.7003	0.9318	0.6598	7.5201	0.2665	0.3944	0.4666	0.3986	0.2279	0.2279	0.1923
Min	1	0	0	29	0	0	0	0	0	0	0
Max	3	9.396	2.483	67	1	1	1	1	1	1	1

Table 3 (Continued)

	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]
[1] Performance									
[2] Status									
[3] Robustness (c = .50)									
[4] Age									
[5] Female									
[6] No Citations									
[7] Administration									
[8] Engineering									
[9] Finance									
[10] Human Resources									
[11] IT	1.0000								
[12] Legal	-0.0479	1.0000							
[13] Marketing	-0.0699	-0.0842	1.0000						
[14] Operations	-0.0918	-0.1107	-0.1613	1.0000					
[15] Product 1	0.0179	-0.0369	0.0208	0.1070	1.0000				
[16] Product 2	0.0694	0.0403	-0.0886	-0.0559	-0.3621	1.0000			
[17] Product 3	-0.0528	0.1306	0.0487	-0.1219	-0.3793	-0.0670	1.0000		
[18] Product 4	0.0004	-0.0290	0.0079	0.0599	-0.5827	-0.1029	-0.1078	1.0000	
[19] Product 5	-0.0504	-0.0608	-0.0149	-0.1164	-0.3621	-0.0640	-0.0670	-0.1029	1.0000
Mean	0.0383	0.0546	0.1093	0.1749	0.6721	0.0601	0.0656	0.1421	0.0601
Standard Deviation	0.1923	0.2279	0.3129	0.3809	0.4707	0.2383	0.2482	0.3501	0.2383
Min	0	0	0	0	0	0	0	0	0
Max	1	1	1	1	1	1	1	1	1

Table 4: Ordered Logit Models Predicting Performance Evaluation

	1	2	3
Status	1.259	0.625	0.605
	(0.329)**	(0.347)+	(0.335)+
Fragility (c = .00)		-1.112	
		(0.407)**	
Fragility (c = .50)			-1.131
			(0.375)**
Age	-0.622	-0.709	-0.657
	(0.665)	(0.675)	(0.678)
Female	-0.031	-0.039	-0.037
	(0.022)	(0.022)+	(0.022)+
No Citations	-0.527	-1.919	-1.906
	(0.428)	(0.665)**	(0.628)**
Engineering	0.421	0.183	0.201
	(0.473)	(0.482)	(0.480)
Finance	0.036	-0.003	0.039
	(0.728)	(0.735)	(0.730)
Human Resources	-2.012	-1.809	-1.850
	(0.746)**	(0.739)*	(0.738)*
IT	1.818	1.890	1.938
	(1.044)+	(1.058)+	(1.047)+
Legal	0.616	0.735	0.630
	(0.737)	(0.759)	(0.752)
Marketing	0.922	1.014	1.051
	(0.558)+	(0.569)+	(0.573)+
Operations	-0.881	-0.993	-0.978
	(0.459)+	(0.466)*	(0.466)*
Product 2	3.174	3.099	3.048
	(0.907)**	(0.910)**	(0.910)**
Product 3	-0.473	-0.610	-0.643
	(0.643)	(0.647)	(0.647)
Product 4	1.015	0.908	0.860
	(0.454)*	(0.458)*	(0.459)+
Product 5	0.014	0.044	-0.047
	(0.687)	(0.686)	(0.698)
N	183	183	183
Log Likelihood	-154.15947	-150.44255	-149.61653

Standard errors in parentheses

† significant at 10%; * significant at 5%; ** significant at 1%

Table 5: Correlations and Descriptive Statistics for Variables in the Analysis of Newcomb†

	[1]	[2]	[3]	[4]	[5]	[6]
[1] Status t+1	1.0000					
[2] Status	0.7309	1.0000				
[3] Fragility (c = 0)	-0.4816	-0.6131	1.0000			
[4] Fragility (c = .99)	-0.4695	-0.5670	0.9558	1.0000		
[5] Sycophant	-0.6869	-0.9013	0.5388	0.4617	1.0000	
[6] Constraint	-0.3942	-0.5955	0.5127	0.3720	0.6171	1.0000
Mean	0.9500	0.9511	0.9813	0.9706	0	0.2471
Standard Deviation	0.1093	0.1094	0.1066	0.1437	4.4121	0.0031
Min	0.1794	0.1794	0.7822	0.7377	34.1563	0.2350
Max	1.4963	1.4963	1.9030	2.1452	-27.2813	0.2621

† Within-individual correlations reported

Table 6: Models Predicting Future Status t+1 in Newcomb's Fraternity

	1	2	3	4	5
Status	0.56545	0.53436	0.52260	0.32897	0.28708
	(0.03475)**	(0.04444)**	(0.04255)**	(0.08848)**	(0.09562)**
Fragility (c = .00)		-0.05100			
		(0.04548)			
Fragility (c = .99)			-0.05612	-0.09097	-0.13266
			(0.03246)†	(0.03283)**	(0.04147)**
Constraint				5.62474	6.35938
				(1.78250)**	(1.83397)**
Sycophant				-0.00696	-0.00689
				(0.00217)**	(0.00228)**
Individual 2	-0.03537	-0.03823	-0.03802	-0.03310	-0.03740
	(0.02218)	(0.02231)†	(0.02213)†	(0.02160)	(0.02200)†
Individual 3	-0.24322	-0.24752	-0.25171	-0.25014	-0.26663
	(0.02688)**	(0.02714)**	(0.02720)**	(0.02642)**	(0.02948)**
Individual 4	0.08125	0.08173	0.08634	0.10606	0.11638
	(0.02331)**	(0.02330)**	(0.02338)**	(0.02329)**	(0.02446)**
Individual 5	-0.01592	-0.01891	-0.01941	-0.01255	-0.01621
	(0.02201)	(0.02216)	(0.02200)	(0.02193)	(0.02226)
Individual 6	0.00411	0.00492	0.00709	0.01263	0.01661
	(0.02202)	(0.02202)	(0.02199)	(0.02151)	(0.02179)
Individual 7	-0.03301	-0.03479	-0.03348	-0.03192	-0.03158
	(0.02201)	(0.02205)	(0.02191)	(0.02141)	(0.02158)
Individual 8	-0.11901	-0.12271	-0.12428	-0.12170	-0.13134
	(0.02400)**	(0.02421)**	(0.02408)**	(0.02345)**	(0.02485)**
Individual 9	0.10853	0.11149	0.11643	0.13834	0.15210
	(0.02400)**	(0.02413)**	(0.02432)**	(0.02430)**	(0.02613)**
Individual 10	-0.37663	-0.38466	-0.39038	-0.32671	(dropped)
	(0.03214)**	(0.03291)**	(0.03296)**	(0.03613)**	
Individual 11	-0.07876	-0.08484	-0.08442	-0.07581	-0.08012
	(0.02215)**	(0.02279)**	(0.02229)**	(0.02189)**	(0.02235)**
Individual 12	0.01472	0.01307	0.01886	0.03847	0.04874
	(0.02244)	(0.02247)	(0.02246)	(0.02366)	(0.02452)*
Individual 13	-0.00838	-0.01007	-0.01005	-0.00842	-0.01098
	(0.02201)	(0.02204)	(0.02192)	(0.02150)	(0.02173)
Individual 14	-0.06455	-0.06963	-0.06907	-0.05767	-0.06122
	(0.02238)**	(0.02282)**	(0.02243)**	(0.02246)**	(0.02294)**
Individual 15	-0.22678	-0.23440	-0.22894	-0.18847	-0.19210
	(0.02578)**	(0.02665)**	(0.02569)**	(0.02970)**	(0.03093)**
Individual 16	-0.33317	-0.32647	-0.31970	-0.28048	-0.28377
	(0.03050)**	(0.03107)**	(0.03134)**	(0.03214)**	(0.03367)**
Individual 17	0.14734	0.15145	0.15830	0.17040	0.19208
	(0.02601)**	(0.02625)**	(0.02665)**	(0.02742)**	(0.03107)**
Constant	0.48865	0.57128	0.58610	-0.58196	-0.67935
	(0.04246)**	(0.08503)**	(0.07045)**	(0.43804)	(0.44724)
N	238	238	238	238	224
R^2 within	0.5688	0.5714	0.5749	0.6032	0.5546

Standard errors in parentheses

† significant at 10%; * significant at 5%; ** significant at 1%