


In a seminal work, Granovetter (1973) argued that the overlap of any two individuals' social networks varies directly with the strength of their tie to one another and explores the "impact of this principle on diffusion of influence in information, mobility opportunity, and community organization" (1973, p. 1360). The importance of weak ties in the diffusion and transmission of novel information are stressed throughout the work, but the author relied on an "intuitive" definition of tie strength to differentiate between weak and strong ties.

Granovetter suggested that "the strength of a tie is a combination of the amount of time, the emotional intensity, the intimacy (mutual confiding) and the reciprocal services which characterize the tie" (1973, p. 1361); however, he admitted that the "discussion of operational measures of and weights attaching to each of the four components is postponed to further empirical studies" (1973, p. 1361). With few exceptions, however, empirical studies of tie strength have yet to emerge. This is unfortunate in view of the possible theoretical importance of the concept.

Within the literature there is considerable controversy over the relative merits of "weak" versus "strong" ties and their effects on organizational outcomes. For example, the strength of interpersonal ties has been related to changes in group composition (McPherson, et al., 1992), job search, and its outcomes (Montgomery, 1992, 1994), interpersonal communications (March, 1995), and organizational effectiveness (Nelson & Mathews, 1991b). While a complete discussion of the controversies surrounding the strength of ties arguments is beyond the scope of this study, it should be noted that at least two competing views of tie strength have emerged: (1) weak ties within and between groups are necessary to promote stability, solidarity,

These studies have, however, used various proxy measures such as frequency of contact, proxied friendship, and overlap in social circles as indicators of tie strength (e.g., Marsden & Campbell, 1984). Lack of empirical verification of the components of tie strength and lack of consistency in the use of proxy measures has limited the potential resolution of the controversy and made comparisons across studies difficult.

Marsden and Campbell (1984) dealt specifically with this problem by developing a series of structural equations describing tie strength. In their model, tie strength is viewed as a “unidimensional unobserved concept or ‘point variable’ intervening between its predictors and indicators” (1984, p. 490). Thus, tie strength is a “common factor underlying the indicators . . . and all correlations between predictors and indicators are explained by the intervening concept of tie strength” (Marsden & Campbell, 1984, p. 490).

The distinction between indicator and predictor variables is an important concept. Indicators are actual components of tie strength corresponding to Granovetter’s (1973) four components. These are variables such as the frequency and intensity of contact, advice-giving, intimacy, and mutual confiding. Conceptually, indicators can be characterized as endogenous variables. Predictors, however, are aspects of relationships that are related to but are not direct components of tie strength. Predictors are conceptually exogenous to tie strength. For example, one might reasonably expect that siblings (a predictor of strong ties) would have a more intimate and confiding relationship (indicator of strong ties) than classmates (predictor). Thus, predictors are elements of the relationship that may influence the nature of the tie while indicators are those elements which actually determine the strength of the relationship.

A problem with the Marsden and Campbell’s (1984) model is the amount of “contamination” of indicators by predictors. For the model to be successful, “correlations of indicators with predictors must generally be smaller than the correlations of indicators with one another” (Marsden & Campbell, 1984, p. 493). If this is not the case, the risk is run of “confounding the interpretation of the unobserved variable for strength” (Marsden & Campbell, 1984, p. 493). Significant problems occur in this respect, making interpretation of their results problematic.

The purpose of this study was to examine further the relationship between predictors and indicators of the strength of ties between individuals. The existence of significant relationships between the two sets of variables would serve to corroborate the findings of Marsden and Campbell (1984).
**METHOD**

**Sample**

Data were collected from 131 students (freshmen and sophomores) at a southeastern university. There were 67 men and 64 women. The mean age was 22 years. Each was given a questionnaire (available from the first author) and requested to respond with a specific person (hereafter referred to as the "target") in mind. Respondents were unaware of the purpose of the study and of the significance of the questions.

**Measure**

A review of the literature, relying most heavily on the Mansen and Campbell (1984) analysis, provided the basis for a 13-item scale assessing tie strength. Items potentially related to both quantitative and qualitative factors were included. Participants were asked to identify a specific individual, i.e., the target, as the referent for their responses and to identify "how close" they were to the target before responding to the items. Responses were requested on the amount of contact, the nature of the relationship, the amount of mutual confiding, and the amount of advice-giving and advice-taking between the individual and the target. Additionally, demographic data (age and sex) of both respondent and target were collected. Data from the questionnaire were used to construct a set of 21 variables. These variables were divided into sets of predictors and indicators which are presented in Table 1.

**Table 1**

<table>
<thead>
<tr>
<th>Item</th>
<th>Scale of Used by the Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Closest acquaintance</td>
<td>friend</td>
</tr>
<tr>
<td>2. Number of reported contacts or encounters, in an average week.</td>
<td></td>
</tr>
<tr>
<td>3. Number of conversations with the individual in an average week.</td>
<td></td>
</tr>
<tr>
<td>4. How often does respondent ask individual for advice?</td>
<td></td>
</tr>
<tr>
<td>5. How often does individual ask respondent for advice?</td>
<td></td>
</tr>
<tr>
<td>6. Does respondent discuss personal problems with individual?</td>
<td></td>
</tr>
<tr>
<td>7. Does individual discuss personal problems with respondent?</td>
<td></td>
</tr>
</tbody>
</table>

(continued on next page)
TABLE 1 (Cont'd)

<table>
<thead>
<tr>
<th>Item</th>
<th>Scale (0 Used by the Item)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 1</td>
<td>equal to 1 if both respondent and individual were male, 0 otherwise</td>
</tr>
<tr>
<td>Item 2</td>
<td>equal to 1 if both respondent and individual were female, 0 otherwise</td>
</tr>
<tr>
<td>Item 3</td>
<td>individual's age divided by respondent's age</td>
</tr>
<tr>
<td>Item 4</td>
<td>equal to 1 if respondent and individual were related, 0 otherwise</td>
</tr>
<tr>
<td>Item 5</td>
<td>equal to 1 if respondent and individual were roommates, 0 otherwise</td>
</tr>
<tr>
<td>Item 6</td>
<td>equal to 1 if respondent and individual had a class together, 0 otherwise</td>
</tr>
<tr>
<td>Item 7</td>
<td>equal to 1 if from the same hometown, 0 otherwise</td>
</tr>
<tr>
<td>Item 8</td>
<td>equal to 1 if respondent and individual were both members of the same organization, 0 otherwise</td>
</tr>
<tr>
<td>Item 9</td>
<td>number of years the individual had been married</td>
</tr>
</tbody>
</table>

Analyses

Analyses of the data were twofold. First, a factor solution was computed from the set of indicator variables. This analysis was performed to assess the adequacy of Gramovetser's intuitive conceptualization of tie strength. These factors served as proxies for the components of tie strength and the resulting factor scores as dependent variables in subsequent analyses. Second, the relationship between these (dependent) factor scores and the (independent) variables of the predictor set was assessed by ordinary least squares. This procedure was performed to examine implications derived from the Marcon and Campbell (1984) analysis.

Remarks

Factor Solution of Indicator Variables

An important assumption here is that the variables included are significant components of tie strength. While no attempt was made to distinguish between strong and weak ties, it is assumed that the variability in the set of indicators is indicative of differing strengths of ties. This assumption suggests that the factors explaining the most variance in the data set are the most important in explaining the variability of the strength. With this consideration in mind, the 131 observations on the indicator items were factor analyzed. Means and standard deviations are presented in Table 2.
TABLE 2  
**Means and Standard Deviations of Indicator Variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.22</td>
<td>1.50</td>
</tr>
<tr>
<td>2</td>
<td>6.24</td>
<td>9.90</td>
</tr>
<tr>
<td>3</td>
<td>19.45</td>
<td>24.54</td>
</tr>
<tr>
<td>4</td>
<td>2.63</td>
<td>1.28</td>
</tr>
<tr>
<td>5</td>
<td>2.80</td>
<td>1.23</td>
</tr>
<tr>
<td>6</td>
<td>3.44</td>
<td>1.33</td>
</tr>
<tr>
<td>7</td>
<td>3.53</td>
<td>1.37</td>
</tr>
<tr>
<td>8</td>
<td>1.94</td>
<td>1.95</td>
</tr>
<tr>
<td>9</td>
<td>2.57</td>
<td>1.35</td>
</tr>
<tr>
<td>10</td>
<td>2.97</td>
<td>1.37</td>
</tr>
<tr>
<td>11</td>
<td>1.92</td>
<td>.91</td>
</tr>
<tr>
<td>12</td>
<td>1.66</td>
<td>.89</td>
</tr>
</tbody>
</table>

Several steps were taken to identify the “best” factor solution. A principal components analysis was performed to seek a baseline for comparison to the factor solutions. Several different factor solutions were attempted and analyzed. A scree plot of eigenvalues was developed and the residual matrix was computed (Johnson & Wichern, 1988).

A four-factor solution was deemed appropriate using the scree plot. Table 3 presents the factors, eigenvalues, percent of variance explained, and cumulative percent explained for each of the 12 factors. Table 4 presents the varimax rotated factor loadings and total variance explained by the four-factor solution. It can be seen that slightly more than 90% of the variability in the data is explained by these factors.

Inspection of the factor loadings allows a description of the four factors. The first factor is comprised primarily of the underlying items—6 (Heav
often do you consider this person a close friend?); 7 (How close are you to this person?); 8 (How long have you known this person?); 9 and 10 (the flow variables); 12 (the intensity of confiding); and 1 (measure of friendship). These relate directly to Ganser's (1973) notion of intimacy as the mutual confiding factor. This factor is referred to as Intimacy.

### TABLE 4

<table>
<thead>
<tr>
<th>Variable</th>
<th>Factor 1: Intimacy</th>
<th>Factor 2: Time</th>
<th>Factor 3: Services</th>
<th>Factor 4: Intimacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.60</td>
<td>.29</td>
<td>.48</td>
<td>.17</td>
</tr>
<tr>
<td>2</td>
<td>.18</td>
<td>.76</td>
<td>.16</td>
<td>.40</td>
</tr>
<tr>
<td>3</td>
<td>.12</td>
<td>.82</td>
<td>.33</td>
<td>.50</td>
</tr>
<tr>
<td>4</td>
<td>.31</td>
<td>.42</td>
<td>.80</td>
<td>.19</td>
</tr>
<tr>
<td>5</td>
<td>.37</td>
<td>.24</td>
<td>.81</td>
<td>.16</td>
</tr>
<tr>
<td>6</td>
<td>.32</td>
<td>.15</td>
<td>.24</td>
<td>.04</td>
</tr>
<tr>
<td>7</td>
<td>.61</td>
<td>.11</td>
<td>.27</td>
<td>.69</td>
</tr>
<tr>
<td>8</td>
<td>.49</td>
<td>.11</td>
<td>.17</td>
<td>.97</td>
</tr>
<tr>
<td>9</td>
<td>.78</td>
<td>.15</td>
<td>.62</td>
<td>.36</td>
</tr>
<tr>
<td>10</td>
<td>.22</td>
<td>.19</td>
<td>.35</td>
<td>.44</td>
</tr>
<tr>
<td>11</td>
<td>.32</td>
<td>.10</td>
<td>.09</td>
<td>.10</td>
</tr>
<tr>
<td>12</td>
<td>.87</td>
<td>.36</td>
<td>.58</td>
<td>.20</td>
</tr>
</tbody>
</table>

**% Variance explained**

- Factor 1: 60.4%
- Factor 2: 15.8%
- Factor 3: 8.9%
- Factor 4: 6.8%

**Total variance explained:** 91.1%

*Note:* Loadings of .45 or greater in all factors were considered significant.

Variables 2 (number of contacts) and 3 (number of hours spent with the individual) load heavily on Factor 2. This factor correlates most nearly to Ganser's (1973) amount of time spent together in the relationship. These variables indicate both the frequency of contact and number of hours spent with the individual. This factor is referred to as Time.

The third factor can be seen as a measure of the reciprocal services in the relationship. Variables 4 and 5 (the advice variables) are measures of how comfortable the respondent and individual feel about requesting advice of each other. This corresponds to Ganser's (1973) "reciprocal services" component and is referred to as Services.

Factor 4 is an indicator of the intensity of the relationship. Item 8 (hours divided by number of contacts) has the highest loading. It is assumed that the values indicate the intensity of the relationship. The rationale is that those engaged in more intimate relationships will spend more time together and each contact will be of longer duration than that of a less intense relationship. Item 3 had a moderate loading on this factor, which was labeled Intimacy. These results provide support for Ganser's (1973) four-factor conceptualization of intimacy. The four orthogonal factors derived from...
the set of indicator variables closely correspond to its "intuitive" compo-
nents. 

Relationship Between Indicators and Predictors 

The question of prime interest in this study is the relationship between predictor variables and the components of tie strength. Tie strength is viewed not as a unified concept but as a construct composed of the four factors derived in the previous section. Estimating the strength of relationships involves the following equation for each of the four factors. The first factor equation provides an example. 

\[
E_{INTIMACY} = b_0 + b_1(MALE) + b_2(FEMALE) + b_3(AGE) + b_4(RELATIVE) + b_5(ROOMMATE) + b_6(CLASS_TOGETHER) + b_7(HOMETOWN) + b_8(SAME_ORGANIZATION) + b_9(YEARS_KNOWN)
\]

Analyses were conducted to test for collinearity, autocorrelation, and heteroscedasticity in the data. Correlations, variance inflation factors (VIFs), and the condition number (Belsley, Kuh, & Welsch, 1980; Kleinbaum, Kupper, & Muller, 1988) were inspected for evidence of multicollinearity. The Durbin-Watson (DW) and White's test were performed to test for autocorrelation and heteroscedasticity, respectively. Tests for all three potential problems were nonsignificant results are available.

The F ratios in Table 5 show that all four equations are statistically sign-
ificant at the .05 level. Also, there is support for the assertion that "pre-
dictors of strength," for example, kinship and neighboring, are not strongly related to the concept as evidenced by the relatively low values of the ad-
justed R². Predictors obviously affect the indicators of tie strength but are not strong enough to be used as proxies. It is apparent that Marsden and Campbell's (1984) finding of "contamination" of indicators by predictors is supported in this study.

Further inspection of Table 5 indicates several interesting results. ROOMMATE, CLASS TOGETHER, and SAME ORGANIZATION are each significantly, but negatively, related to the INTIMACY factor. This is counterintuitive until one considers the sample was comprised mostly of col-
lege freshmen. This result could be explained by the fact that intimate rela-
tions take time to form (notice that YEARS_KNOWN and INTIMACY, al-
though not statistically significant, are positively related) and perhaps the requisite length of acquaintance had not occurred. This highlights a short-
coming of this study, however. The trained and homogeneous sample makes generalizations to a larger population inappropriate.

ROOMMATE and MALE were both statistically significant \( b = 1.14, \ p < .001 \) and \( b = -3.9, \ p < .05 \), respectively; and positively related to TIME. The interesting results, however, the change in sign for these variables
<table>
<thead>
<tr>
<th>Predictors</th>
<th>Intimacy</th>
<th>Time</th>
<th>Services</th>
<th>Intimacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>-0.15</td>
<td>0.71</td>
<td>-0.19</td>
<td>1.98*</td>
</tr>
<tr>
<td>Female</td>
<td>0.23</td>
<td>1.09</td>
<td>-0.60</td>
<td>0.14</td>
</tr>
<tr>
<td>Age</td>
<td>0.24</td>
<td>0.35</td>
<td>-0.02</td>
<td>0.03</td>
</tr>
<tr>
<td>Relative</td>
<td>0.59</td>
<td>1.17</td>
<td>-0.24</td>
<td>0.20</td>
</tr>
<tr>
<td>Distance</td>
<td>-0.64</td>
<td>2.21*</td>
<td>1.14</td>
<td>0.25*</td>
</tr>
<tr>
<td>Close together</td>
<td>-0.75</td>
<td>2.96*</td>
<td>0.11</td>
<td>0.46</td>
</tr>
<tr>
<td>Hometown</td>
<td>0.16</td>
<td>0.39</td>
<td>-0.09</td>
<td>0.35</td>
</tr>
<tr>
<td>Same organization</td>
<td>-0.59</td>
<td>2.13*</td>
<td>-0.12</td>
<td>0.47</td>
</tr>
<tr>
<td>Years known</td>
<td>-0.02</td>
<td>0.83</td>
<td>-0.04</td>
<td>0.80</td>
</tr>
<tr>
<td>Intercose</td>
<td>-0.69</td>
<td>0.05</td>
<td>-0.20</td>
<td>0.28</td>
</tr>
<tr>
<td>$p$</td>
<td>4.37*</td>
<td>5.37*</td>
<td>3.82*</td>
<td>2.12*</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.19</td>
<td>0.23</td>
<td>0.16</td>
<td>0.07</td>
</tr>
<tr>
<td>Durbin-Watson</td>
<td>2.31</td>
<td>2.11</td>
<td>2.03</td>
<td>1.94</td>
</tr>
</tbody>
</table>

*(p<0.05, 0.01)*.

(both were negatively related to INTIMACY), suggesting that care should be taken when choosing a proxy for tie strength to avoid potential confounding effects. For example, the choice of number of contacts as a proxy would systematically overestimate the importance of simply being roommates, i.e., being in close physical proximity, and would underrepresent the relevance of intimacy in the relationship, a more important component of tie strength. Indeed, the fact that signs change, depending on the particular factor under consideration, may be one of the most important results of this study. These confounding effects will have an important bearing on the choice of an appropriate proxy.

A final finding is the negative relationship of scores on YEARS KNOWN and INTENSITY (YEARS KNOWN is negatively related to each of the factors except INTIMACY). This lends credence to the postulate that "returns (in terms of tie strength) to increased duration of a relationship decline with increasing length of acquaintance" (Marsden & Campbell, 1984, p. 488). While the length of acquaintance may enhance the intimacy in a relationship, the other factors composing strength may suffer.

**Discussion**

Once determinants of tie strength are empirically identified and verified, appropriate proxy measures can be developed. To proceed otherwise is, in a sense, putting the cart before the horse. How can a proxy measure be proposed when the underlying concept has not been rigorously defined?
This is what has occurred in most of the literature using the concept of strength of tie.

Researchers have taken Granovetter's (1973) theoretical discussion and applied the concept in various ways. For example, organizational effectiveness, conflict, and performance have been analyzed from a network perspective based on the strength of ties between individuals in the organization. In much of the research, measures of tie strength have been operationalized through various proxy measures with little objective justification or support. Without an empirical basis provides may or may not be appropriate measures of the underlying concept. The current research is a step in the direction of providing that support.

Researchers should broaden and expand the size of the sample. Also, this study did not take into consideration the effect of tie strength within a network of relationships. A more effective method would be to identify first a network within an organization and then attempt to determine the operative components of the strength within that network. For example, in a network of ten individuals, information could be gathered from each concerning his relation to the other nine members. It is not entirely clear that a generalized view of tie strength, as proposed in this study, is separable from the specific network of interest. Research within a specific organizational setting and dealing with a particular type of network (whether instrumental, affective, communication, or power) would appear to have potential for furthering inquiry in this area.

REFERENCES