IDENTIFYING INFLUENCE: DEVELOPMENT AND VALIDATION OF THE CONNECTIVITY, PERSUASIVENESS, AND MAVEN SCALES

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The use of influential network members to facilitate the process of behavioral change has long been a goal of communication campaign designers, particularly in health settings. In a series of 3 studies, measures of 3 types of influential others (those who are highly connected, persuasive, and informed) who play an important role in the dissemination of information through social networks are developed and validated. Across studies, the data were, in the main, consistent with the hypotheses, suggesting that these indices measure what they purport to measure and that they do it with high reliability. The potential for the connectivity, persuasiveness, and health maven constructs to increase the effectiveness of the diffusion of behavioral change is discussed.

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Communication theory and research has emphasized the importance of influence in conceptual and empirical work examining opinion leaders and opinion leadership. These constructs play a pivotal role in large corpora of communication scholarship that are focused on the diffusion of innovations and social influence. For instance, based on an exhaustive review of the diffusion of innovations literature Rogers (2003, p. 388) concluded that “Change agents’ success in securing the adoption of innovations by clients is positively related to the extent that he or she works through opinion leaders.” Moreover, from early studies on factors shaping decisions in arenas as diverse as fashion, marketing, and public affairs (Katz & Lazarsfeld, 1955; Lazarsfeld, Berelson, & Gaudet, 1948) to contemporary health interventions designed to reduce serious threats, such as HIV infections (Kelly et al., 1992), or promote healthy practices, such as mammogram testing among members of certain
high-risk populations (Earp et al., 2002), opinion leaders have been shown to be crucial elements in the social influence equation.

Nevertheless, identifying network members who are highly influential may prove difficult. As scholars and practitioners alike have noted, simple strategies, such as equating influence with positions in social structure, for example, a leadership position, are inadequate (Katz & Lazarsfeld, 1955; Keller & Berry, 2003; Rogers, 2003). Notably, the choice of strategy to identify the highly influential is fundamentally a measurement issue, and measurement error, either in the form of designating those who are not highly influential as highly influential or failing to identify those who are highly influential, will result in misestimating their impact on the process of diffusion and social influence.

Scholars have used a number of methods to identify influential persons (Celentano et al., 2000; Earp et al., 2002; Kelly et al., 1992; Miller, Klotz, & Eckholdt, 1998; Soumerai et al., 1998; see Valente & Pumpuang, 2007, for a review). Nevertheless, with few exceptions (e.g., Flynn, Goldsmith, & Eastman, 1996), little work has focused on developing a highly valid and highly reliable means of identification that avoids prohibitively complex or time-consuming data collection efforts. More important, these few exceptions fail to address the full breadth of the influence construct. Seminal to any effort to measure a construct is the content validity of the measure, and an important part of establishing that a given measuring instrument has substantial content validity is showing that the definition of the concept is congruent with the content of the indicators included in the measuring instrument.

Although definitions of opinion leadership vary, Rogers’s (2003, pp. 37–38) notion that opinion leadership consists of the ability to influence others’ attitudes and behavior frequently and in a desired direction is a useful beginning point. Opinion leaders are those who exert opinion leadership, and the pivotal content validity question can be rephrased as, “What are the defining characteristics of such persons?” Classical (e.g., Katz & Lazarsfeld, 1955) and contemporary (e.g., Rogers, 2003) answers to this question suggest that opinion leaders have at least three particularly important characteristics. They are very knowledgeable in the sphere in which they exert opinion leadership, they are well connected socially, and they are effective at presenting their ample knowledge to their numerous contacts. These attributes form three quantitative, continuous dimensions of individual differences, with people anchoring the high ends of these dimensions being highly informed, connected, and persuasive. An opinion leader, or superdiffuser, is someone high on all three dimensions. At this point, it is unclear if there are critical values of these three attributes that produce qualitative, rather than just quantitative, differences in the ability to diffuse information or influence others, and, if so, what they might be. Although what constitutes being high on any of these dimensions remains somewhat arbitrary, the higher one is on all three dimensions, the higher the probability that one would be able to exert opinion leadership. To begin, it is useful to elucidate each of the constructs in greater detail.
Connectivity
The results of Travers and Milgram’s (1969) small-world experiment indicate that a handful of well-connected people serve to connect others who are far removed both in physical and social distance. As many subsequent studies reinforce (cf., Burt, 2004; Kochen, 1989), these highly influential people are recognized by others and are called upon when information needs to be transmitted or people need to be contacted.

Owing to their unusually high desire and ability to meet new people, those highly connected know many people. Notably, they are capable of bridging groups, bringing people and information together in ways that less connected persons could not. The more groups in which persons are involved, the greater the chance that they will be exposed to new information and the greater the chance the persons with whom they share that information will not have heard it before. These attributes make highly connected network members critical links in the spread of information, more critical than the average person.

The ability to bridge multiple groups results from the formation of weak-tie relationships (Granovetter, 1973). Some weak-tie relationships serve as bridges, a network connection that is the only connection between two groups. The process of serving as weak-tie bridges between groups confers great potential for influence, as people occupying these roles facilitate the transmission of information from one social group to another. When two people are connected only weakly, they are exposed to different groups, increasing the chance of unique information being available to either or both. It is these types of people—those who have a disproportionate number of weak-tie relationships—who are pivotal in transmitting information. Indeed, Burt (2004) provides evidence that these “between-group brokers” are more actively involved in the dissemination of new ideas. Furthermore, the rate at which that information travels is increased, because it is less likely that the person told will have heard it previously (Granovetter, 1973).

It is expected that preferences, or tolerance, for weak-tie relationships vary across people. Some may purposely limit their social circles, preferring to be close friends with a few people rather than casual friends with many. The highly connected are different; they are not troubled by the social parameters inherent in casual interaction.

With varying success, there have been a number of attempts to locate the well-connected and use them in information campaigns (Celentano et al., 2000; Earp et al., 2002; Kelly et al., 1992; Miller et al., 1998; Soumerai et al., 1998). Historically, the difficulty in these efforts is accurate and efficient identification of influence. One of the more successful attempts was the Kelly et al. use of popular group members to promote condom use in gay communities in three medium-sized Southern cities. The intervention resulted in a sizable reduction in high-risk sexual behavior and an increase in condom use in all three cities.

Persuasiveness
Research documents a number of overt behavioral and personality traits that are characteristic of effective persuasiveness. Those with a high need for cognition generate
more arguments and more valid arguments than those low on need for cognition and tend to be viewed as more competent at persuasion (Shestowsky, Wegener, & Fabrigar, 1998). Those with high internal control have been found to induce substantially more attitude change than those with high external control (Phares, 1965). Understanding others well, or effective audience analysis, can improve one’s suasive effectiveness, particularly if it leads to understanding the reason(s) targets hold their opinion (Hullett & Boster, 2001; Katz, 1960; Lapinski & Boster, 2001).

Perhaps as, or more, important is a fundamental characteristic. Persuasive people engage frequently in influence attempts, often advancing their opinions. They are able to conceive and articulate their positions on issues from different perspectives and are effective at enabling others to view favorably their side of the issue. It would be expected that persuasive people will be reluctant to concede points easily in an argument or shy away from controversial topics, while not being overbearing. Persuasive people would be highly argumentative and effective debaters.

**Mavens**

As applied to information diffusion the term “maven” first arose in marketing. Feick and Price (1987) used the term to refer to subject matter experts across broad consumer categories. They are described as “individuals who have information about many kinds of products, places to shop, and other facets of markets, and initiate discussions with consumers and respond to requests from consumers for market information” (p. 85). Mavens are deeply involved in markets and know information about products in a wide range of categories, even in categories of products they themselves do not use. Although “maveness” is viewed here as a quantitative, continuous variable, the term maven will be retained so as to fit with the previous literature.

Mavens are distinguishable conceptually from opinion leaders (Lazarsfeld, 1944) and early adopters. Although the concepts of opinion leaders and early adopters vary somewhat in technical discourse, generally it is believed that their involvement in markets is within a specific product category with which they have direct experience. In contrast, mavens have general market knowledge. In the sense that mavens have information across a wide range of categories, the concept becomes more similar to the generalized opinion leader construct proposed by those who have found that some people are opinion leaders in multiple areas at a rate higher than chance (King & Summers, 1970; Marcus & Bauer, 1964).

Feick and Price (1987) found mavens to be more aware of new products across categories and to have higher media usage than nonmavens. Brand criteria, such as quality, are considered by mavens to be more important than store criteria or emotional brand criteria (Williams & Slama, 1995). Mavens also like to discuss the deals they get and frequently volunteer advice to others regarding purchasing decisions. They find the research of purchasing decisions exciting and often view marketplace involvement as a route to self-expression. Mavens are typically recognized by others as such and are sought after by others for information (Feick & Price, 1987).
Although locating mavens in areas other than consumer behavior has not been investigated extensively, there is some evidence that such people exist. Belch, Krentler, and Willis-Flurry (2005) proposed the existence of teen Internet mavens, those who were relied on by their families to provide information from the Internet. They found that an adapted version of the maven scale correlated highly with Internet use and degree of influence in family decision making. It is plausible that such people exist in other areas as well (e.g., health behavior) and play a pivotal role in information dissemination, akin to market mavens and Internet mavens.

In the program of research presented in this article, the concept of a maven is extended from consumer markets to health behavior. Health behavior was chosen because it parallels consumer markets in terms of breadth; exercise, for example, is too specific (a parallel to, say, a consumer expert in electronics). Broader topics, however, also presented challenges—using knowledge of socially conscious behavior, for example, is nebulous. Health mavens would have knowledge of a broad range of health behavior and health topics, would enjoy volunteering health information to others, and would be recognized as health experts by others. A health maven would be asked health-related questions often and would serve as an information resource for others.

**Study 1**

Study 1 was designed to assess both the content validity of three sets of self-report items that were developed to identify connectivity, persuasiveness, and health mavens. Moreover, additional constructs were measured to examine both the convergent and divergent construct validity of each of the three focal scales.

It is difficult to conceive of someone with numerous weak-tie relationships who is reticent to communicate with other people; therefore, it is expected that the connectivity construct will correlate negatively and substantially with social anxiety. To a lesser extent, the same point can be made for persuasiveness. However, there is no reason to expect health mavens to have more or less social anxiety than those who lack domain expertise. Consequently, the correlation between the health maven index and social anxiety is expected to approximate zero.

It would be difficult to imagine a highly persuasive person who was loathe to engage in arguments, indeed, because it would be difficult to imagine a persuasive person who did not embrace opportunities to engage in arguments with others, it is therefore hypothesized that the persuasiveness index will correlate positively and amply with argumentativeness (Infante & Rancer, 1982). Furthermore, there is no theoretical reason to expect argumentativeness to correlate substantially with the connectivity or health maven constructs.

Finally, the health maven index is hypothesized to correlate positively and substantially with value-relevant involvement (Johnson & Eagly, 1989). It is anticipated that the well connected and highly persuasive will be either high or low in value-relevant involvement in approximately equivalent proportions; thus, there is no
reason to expect a substantial correlation between either of these constructs and value-relevant involvement.

To summarize, evidence consistent with a hypothesis of content validity would emerge if the indicators constructed to measure each of the three focal constructs fit the predicted three-dimensional factor solution. Evidence consistent with the construct validity hypotheses would emerge if scores on the connectivity measure (and to a lesser extent with the persuasiveness measure) correlated negatively and substantially with social anxiety but approximately zero with argumentativeness and value-relevant involvement; scores on the persuasiveness measure correlated positively and substantially with argumentativeness but approximately zero with value-relevant involvement; and if scores on the health maven measure correlated positively and substantially with value-relevant involvement but approximately zero with social anxiety and argumentativeness. A study was designed to assess these predictions.

Method
Subjects
The sample was composed of 189 students enrolled in undergraduate communication classes at a large university in the Midwestern United States. Females composed 66% of the sample. The mean age was 20.20 (SD = 2.81). Subjects received course credit for their participation.

Procedure
Participation was solicited, and the questionnaire was administered, in classroom settings. Subjects were instructed that participation would involve completing items measuring general communication behavior and traits. Questions from subjects were solicited, and after they were answered, the questionnaire was administered to those who agreed to participate. Completing the questionnaire took approximately 20 minutes after which subjects were dismissed.

Instrumentation
The questionnaire was composed of four items designed to identify connectivity, four items designed to identify persuasiveness, and four items designed to identify health mavens. Subjects also completed Leary’s (1983) social anxiousness scale, Infante and Rancer’s (1982) argumentativeness scale, and Cho and Boster’s (2005) value-relevant involvement scale. Items were phrased as statements with 8-point Likert response scales, ranging from disagree strongly to agree strongly. There is no reason for expecting the lack of a midpoint on the 8-point response scale to affect substantially tests of the dimensionality of the focal measures or tests of their construct validity. Notably, a response scale midpoint is not pivotal to any of the hypotheses.

Results
Measurement models
A confirmatory factor analysis (CFA; Hunter & Hamilton, 1992) was performed to test the fit of the model. A centroid algorithm was employed to estimate factor
loadings, and both internal consistency and parallelism analyses were conducted to test the fit of the model (Anderson, Gerbing, & Hunter, 1987; Hunter & Gerbing, 1982). Specifically, the internal consistency theorem \( r_{ij} = r_{iT} r_{jT} \), where \( i \) and \( j \) are alternative indicators of the same latent variable, \( T \) was used to generate predicted correlations between all items that were specified as alternative indicators of the same latent variable, and the parallelism theorem \( r_{ij} = r_{IT} r_{jU} r_{TU} \), where \( i \) is an indicator of a latent variable, \( T \), and \( j \) is an indicator of a latent trait, \( U \) was used to generate predicted correlations between all items that were indicators of different latent variables. Each predicted correlation (P) was then compared with its respective observed correlation (O) and the errors or residuals (i.e., the difference between the observed and predicted correlations, O–P) were inspected. The adequacy of the model can be judged by examining the factor loadings and the residuals. Specifically, ample factor loadings and small residuals are indicators of excellent fit.

First, the one-factor model was tested for the connectivity, persuasiveness, and health maven (CPM) constructs to ascertain if the items were indicators of a general opinion leadership construct. As predicted, the one-factor model failed; the residuals were large and more numerous than would be expected by chance, RMSE = .22. The predicted three-factor model for the CPM constructs was then tested. The results of this CFA showed that the factor loadings were ample, ranging from .62 to .96, and the residuals were modest, RMSE = .05. The correlation between the pairs of predicted and obtained correlations was .97. Thus, the data were judged to be consistent with the three-factor model.3

The indicators of each construct were then averaged to form indices. The distribution of the connectivity index (range = 1.00–8.00) was skewed negatively and leptokurtic, \( M = 6.02, SD = 1.30 \), and both standardized item \( \alpha \) (SIA) and Cronbach’s \( \alpha = .87 \). The persuasiveness index (range = 2.75–8.00) had a negative skew and was leptokurtic, \( M = 6.40, SD = 1.06 \), and both SIA and \( \alpha = .83 \). Finally, the health maven index was distributed normally (range = 1.25–8.00), \( M = 4.89, SD = 1.40 \), and both SIA and \( \alpha = .87 \). Although 15% of the respondents scored one or more standard deviations above the mean on the health maven scale, 11% scored one or more standard deviations above the mean on the connectivity scale, and 14% scored one or more standard deviations above the mean on the persuasiveness scale, only 1% of the Study 1 sample was at least one standard deviation above the mean on all three focal constructs.

Formal tests showed that the social anxiety, argumentativeness, and value-relevant involvement measures lacked both internal consistency and parallelism. Subsequently, items with the weakest factor loadings and those producing the largest errors of fit were removed from each measure until a set of internally consistent and parallel items were identified that produced data consistent with the hypothesized measurement model. CFA indicated that the data and model did fit closely. All observed interitem correlations were ample, and all residuals were within sampling error of zero (RMSE = .06).
Responses to indicators measuring the same construct were averaged to form social anxiety, argumentativeness, and value-relevant involvement indices. Scores on the social anxiety index ranged from 1.17 to 7.00 and were distributed normally ($M = 3.84$, $SD = 1.33$). The reliability was estimated as $SIA = .83$ and $\alpha = .82$. Scores on the argumentativeness index were distributed normally. They ranged from 1.43 to 7.57 with a mean of 4.97, a standard deviation of 1.21, and an estimated reliability of $SIA = .86$, $\alpha = .85$. The value-relevant involvement index was distributed normally (range $= 1.00–7.40$) with a mean of 4.54, a standard deviation of 1.36, and an estimated reliability of $SIA = .88$, $\alpha = .87$.

The final measurement model analysis consisted of a test of a six-factor model composed of the three focal constructs and the three construct validity test variables (i.e., social anxiety, argumentativeness, and value-relevant involvement). The two models analyzed thus far are nested within the six-factor model. Therefore, the components of the six-factor model that have already been tested across the two 3-factor models did not change. The importance of this analysis was the parallelism tests not yet performed among the three focal constructs and the three construct validity variables. Ample factor loadings and the modest overall RMSE $= .06$ indicated that the data fit the model closely.$^4$

Validity assessment

The data were also consistent with the construct validity hypotheses. Specifically, the connectivity index correlated substantially and negatively with social anxiety as hypothesized, $r'$ (correlation corrected for attenuation due to error of measurement) $= -.56, p(−.68 \leq r' \leq −.42) = .95$ and nominally with argumentativeness ($r' = .10, p[−.07 \leq r' \leq .26] = .95$) as well as with value-relevant involvement ($r' = .03, p[−.13 \leq r' \leq .19] = .95$). The persuasiveness index was correlated amply and positively with argumentativeness, $r' = .55, p(.41 \leq r' \leq .67) = .95$, moderately with social anxiety ($r' = −.25, p[−.36 \leq r' \leq −.02] = .95$), and nominally with value-relevant involvement ($r' = .10, p[−.07 \leq r' \leq .26] = .95$) as hypothesized. Finally, the health maven index correlated as hypothesized with value-relevant involvement ($r' = .51, p[.39 \leq r' \leq .64] = .95$), social anxiety ($r' = −.09, p[−.27 \leq r' \leq .06] = .95$), and argumentativeness ($r' = .12, p[−.05 \leq r' \leq .28] = .95$).

These results indicated that there was considerable variance in the correlations among the connectivity, persuasiveness, and health maven indices with social anxiety, argumentativeness, and value-relevant involvement. The predicted convergent effects were all ample, suggesting that the measures exhibited convergent validity (Campbell & Fiske, 1959). One might notice, however, that unlike the other divergent correlations, the divergent correlation between the persuasiveness and social anxiety indices was not within sampling error of zero. As noted previously, the association is unsurprising as some degree of affiliation is often required to persuade others.
Discussion
The results of Study 1 provided evidence of both content validity and construct validity for the three focal measures. All three of the measures, however, could be improved. Although it might be expected that the focal constructs are distributed normally, even in the population of undergraduate students, the connectivity and persuasiveness measures were not distributed normally. Moreover, none of the three measures had reliabilities exceeding $\alpha = .87$. As a result, a second study was conducted, with the goal of modifying the distribution properties and increasing the reliability coefficients of the measures. A second goal was to extend the nomothetic network developed in Study 1 so as to enrich the understanding of the focal measures.

Study 2
To pursue the initial goal, six items were added for each of the three indices, creating 10-item indices for each of the three focal constructs. If the new items for each measure are found to be highly content valid, are of equal quality, and the estimates from Study 1 replicate, then according to the Spearman-Brown prophecy formula, the revised connectivity, persuasiveness, and health maven measures will produce $\alpha \approx .94$ for the connectivity and health maven measures and $\alpha \approx .92$ for the persuasiveness measure. There was some evidence that subjects’ skewed responses to the connectivity and persuasiveness items were produced by a ceiling effect. Consequently, the additional items also provide a potential solution to this problem.

Additionally, Study 2 provided an opportunity to extend the construct validity tests performed in Study 1. The connectivity, persuasiveness, and health maven constructs might be thought of as similar conceptually to the constructs of opinion leadership and activism, so measures of these latter two variables were obtained to ascertain if there is an isomorphism or, alternatively, if there are important differences.

Method
Subjects
Study 2 sampled 178 students enrolled in undergraduate communication classes at a large university in the Midwestern United States. Course credit was given in exchange for participation. The sample was constrained to students at least 18 years old who had not participated in Study 1.

Of these 178 subjects, 73% were female. The mean age was 20.65 ($SD = 2.38$) years, with the subjects reporting that they had attended the university for a mean of 3.14 ($SD = 0.73$) years. When asked if they had ever held a leadership position, 85% responded “yes.”

Procedure
Participation was solicited in a classroom setting. The study was described as “an examination of social opinion and social behavior involving the completion of a
questionnaire that asks respondents to report the extent of their agreement with each item. The subjects were informed that 45 minutes were allocated for the completion of the questionnaire, and all opted to participate. At this point, the questionnaire was administered and a brief set of instructions regarding how to complete the items was reviewed before allowing the subjects to begin.

Instrumentation
In addition to demographic items, the questionnaire was composed of indicators of five separate constructs: connectivity, persuasiveness, health maven, opinion leadership, and healthy lifestyle activism. Subjects provided their responses on the same 8-point Likert response scales used in Study 1; responses ranged from disagree strongly to agree strongly. Responses were coded such that a higher number indicated more of the construct than a lower number.

The connectivity, persuasiveness, and health maven constructs were each measured by a set of 10 items. The six-item Flynn et al. (1996) opinion leadership measure was used to measure opinion leadership. The healthy lifestyle activism measure was a modified version of the conventional political activism orientation measure (Corning & Myers, 2002). The political focus of the items was changed to a healthy lifestyle focus by replacing references to politics with references to a healthy lifestyle without changing the structure of the items. The modified measure was employed to assess the anticipated tendency to engage in a low-risk form of healthy lifestyle activism at a point in the future. The construct was measured with a set of 10 healthy lifestyle activism items selected randomly from a larger set of 28 activism items on the Corning and Myers measure. It was hypothesized that the items forming each measure fit unidimensional measurement models so that it was expected that a five-factor model would fit the data.

Results
When testing the one-factor model for the CPM measures, the data did not fit the model, RMSE = .14. After eliminating problematic items, the three-factor model fit as predicted. Factor loadings were ample, and the residual errors were small, RMSE = .08. The correlation between the pairs of predicted and obtained correlations was .96. Finally, a five-factor model was tested combining the opinion leadership and healthy lifestyle activism items with the CPM items. Evidence generated by the analyses demonstrated that the five-factor model fit the data well. All factor loadings were ample, with no item possessing a factor loading less than .51. Finally, the average residual was modest, RMSE = .07.5

Consequently, the five sets of items were employed to form five indices. Six connectivity items were averaged to form an index. Responses on this index ranged from 1.33 to 8.00, exhibited a slight negative skew and slight leptokurtosis. The mean was 6.04 (SD = 1.10) with a reliability of SIA and $\alpha = .87$. Eight persuasiveness items were averaged to form the persuasiveness index. Responses on this index ranged from 1.88 to 8.00. The mean was 5.85 (SD = 1.10) and SIA and $\alpha = .92$. The distribution
of these scores was slightly skewed in a negative direction and was slightly leptokurtic. Seven health maven items were averaged to form the health maven index. Scores on this index ranged from 1.29 to 8.00. Scores were distributed normally with a mean of 5.00, a standard deviation of 1.57, and a reliability of SIA and $\alpha = .94$. Scores on the opinion leader index were distributed normally, ranging from 1.25 to 8.00. The opinion leader distribution had a mean of 4.32 ($SD = 1.43$). The reliability was SIA and $\alpha = .85$. Finally, scores on the healthy lifestyle activism index were also distributed normally, ranging from 1.00 to 8.00. The mean of these scores was 3.86 ($SD = 1.56$), with a reliability of SIA and $\alpha = .89$.

Although 17% of the respondents scored one or more standard deviations above the mean on the connectivity scale, 15% scored one or more standard deviations above the mean on the persuasiveness scale, and 19% scored one or more standard deviations above the mean on the health maven scale, only 1.7% scored at least one standard deviation above the mean on all three. By way of comparison, 15% scored at least one standard deviation above the mean on the opinion leadership measure, the comparable figure being 17% for the healthy lifestyle activism measure. Thus, if exceeding the mean by one standard deviation on all three focal measures is used to define a superdiffuser, then the measures introduced in this article are substantially more selective in identifying influence in comparison with what would be obtained employing the one standard deviation criterion with the opinion leadership or healthy lifestyle measures.

Examination of the bivariate correlation matrix suggested that only the health maven index is associated strongly with opinion leadership ($r = .81$). To provide a more rigorous test of the proposition that the health maven index, and only the health maven index, is a strong predictor of responses to the opinion leadership scale, the three focal measures (connectivity, persuasiveness, and health maven) were employed as predictors of opinion leadership. The results of the subsequent multiple regression analysis showed that when opinion leadership is regressed onto the connectivity, persuasiveness, and health maven indices, as well as all two-way and three-way interaction terms, only the health maven measure emerges as a substantial and statistically significant predictor. The standardized regression coefficient for the health maven scale was $\beta = .74$, $t(170) = 13.48$, $p < .001$.

Correlational analyses also suggest that only the health maven index is associated strongly with healthy lifestyle activism ($r = .54$). For the same reason, and in a parallel fashion, healthy lifestyle activism scores were regressed onto the connectivity, persuasiveness, and health maven indices as well as all two-way and three-way interaction terms. Once again, only the health maven scale emerged as a substantial and statistically significant predictor ($\beta = .52$, $t(170) = 7.72$, $p < .01$).

**Discussion**

The results of Study 2 replicate the presence of three internally consistent and parallel sets of indicators purported to measure the focal constructs: connectivity,
persuasiveness, and health maven. The additional items increased the mean level of reliability across the three measures from $\alpha = .86$ as observed in Study 1 to $\alpha = .91$. It is also worth noting that the response distributions for each of the measures moved toward normality relative to the distributions observed in Study 1. Given this set of findings, it is reasonable to conclude that in addition to creating measures more representative of their underlying constructs, the new items generally improved the psychometric properties of the connectivity, persuasiveness, and health maven measures.

Moreover, the regression analyses indicated that connectedness and persuasiveness contribute little to the prediction of opinion leadership or healthy lifestyle activism either as direct effects or nonadditively. This result is consistent with traditional conceptualizations of opinion leadership and activism which focus on tendencies to have expertise about new ideas or products but do not emphasize the characteristics of connectivity or persuasiveness. Despite the substantial association of the health maven measure with opinion leadership and with healthy lifestyle activism, tests of the measurement model indicate that the health maven items are not alternate indicators of opinion leadership or healthy lifestyle activism. Put differently, a measurement model in which the health maven items are included with the opinion leadership items as indicators of a common factor fails, the same being the case when the health maven items are combined with the healthy lifestyle activism items.

Although the evidence for the connectivity, persuasiveness, and health maven measures in Studies 1 and 2 is promising, there is at least one undesirable limitation of both studies; namely, the data were collected from student samples. Most diffusion attempts, of course, are not conducted on student populations. Sears (1986), among other scholars, has raised the question of whether the reliance of social scientists on student samples alters the picture of human behavior that emerges from empirical research. Young, college-aged adults differ psychologically from older adults, and these differences may qualify the findings of experiments. A number of these differences are germane to the idea of opinion leadership, such as the less-developed self-concepts and transitioning social networks of younger people. The only way to discover whether such differences affect the psychometric properties of the opinion leader measures is to investigate the issue directly. Study 3 does so by examining the content validity and reliability of the focal measures using a nationally representative sample of adults.

**Study 3**

Sears (1986) has argued that the dependence on student samples has shaped the scholarly community's view of human behavior in some important directions that are unrepresentative of the behavior of members of the whole U.S. population. Although not agreeing with all of Sears's conclusions, yet suspecting that some of his conclusions would be stronger had he included members of other cultures (e.g.,
see Nisbett, 2003), the soundness of the central thread of his argument requires serious consideration. To address this challenge, a third study was conducted in which a sample, substantially more representative of the entire U.S. population, was employed.

Method

Subjects
An Internet survey of 2,000 U.S. adults (18 years of age or older) was conducted using the Synovate eNation omnibus panel. The omnibus panel provides a nationally representative sample in which panelists are recruited into a pool of households using banner advertisements, mailing lists, and related procedures to promote participation. The S pool consists of more than one million households (approximately 1% of all U.S. households), and subjects must confirm formally that they consent to participate in research. Each day a survey is conducted, a new sample is drawn from the pool, and subjects are selected randomly within strata defined by population characteristics. The panel sample is matched on age, gender, income, and region to the U.S. Census Bureau’s monthly Current Population Survey (CPS, 2008), and results are weighted poststratification to CPS criteria. Additionally, Synovate weights the data to adjust partially for underrepresentation of Hispanics and ethnic minorities in the sample. Subjects were included in a prize drawing as an incentive to participate.

Procedure
Subjects received an invitation via electronic mail asking them to participate in a specific day’s omnibus survey. The invitation asked a specific member of the household, identified by age and gender, to participate. The invitation instructed that person to click on a link to the survey Web site. When subjects accessed the site, they were provided with instructions, asked questions confirming that they were the requested participant, asked survey questions for several unrelated topics, and asked a series of demographic questions.

Instrumentation
The items on the survey included five connectivity items, five persuasiveness items, and five health maven items (Table 1). Items were chosen from those used in Study 2. Responses were provided using 5-point Likert scales ranging from agree strongly to disagree strongly. A 5-point scale was used instead of the 8-point scale found in the earlier two studies because the survey firm used for the national sample typically uses a 5-point response scale, and the decision was made not to deviate from the scale to which the respondents were accustomed.

Results
The one-factor model was tested first, and found to fail as predicted, RMSE = .21. The three-factor model, in contrast, fit the data well. Although, in the main, the \( \chi^2 \) tests of fit produced statistically significant results, this outcome is influenced by
Table 1  Connectivity (C), Persuasiveness (P), and Maven (M) Items From Study 3

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<th>Item</th>
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</thead>
<tbody>
<tr>
<td>I’m often the link between friends in different groups (C)</td>
<td>I’m often the link between friends in different groups (C)</td>
</tr>
<tr>
<td>I often find myself introducing people to each other (C)</td>
<td>I often find myself introducing people to each other (C)</td>
</tr>
<tr>
<td>I try to bring people I know together when I think they would find each other interesting (C)</td>
<td>I try to bring people I know together when I think they would find each other interesting (C)</td>
</tr>
<tr>
<td>I frequently find that I am the connection between people who would not otherwise know one another (C)</td>
<td>I frequently find that I am the connection between people who would not otherwise know one another (C)</td>
</tr>
<tr>
<td>The people I know often know each other because of me (C)</td>
<td>The people I know often know each other because of me (C)</td>
</tr>
<tr>
<td>I am good at thinking of multiple ways to explain my position on an issue (P)</td>
<td>I am good at thinking of multiple ways to explain my position on an issue (P)</td>
</tr>
<tr>
<td>When in a discussion, I’m able to make others see my side of the issue (P)</td>
<td>When in a discussion, I’m able to make others see my side of the issue (P)</td>
</tr>
<tr>
<td>I am able to adapt my method of argument to persuade someone (P)</td>
<td>I am able to adapt my method of argument to persuade someone (P)</td>
</tr>
<tr>
<td>I can effortlessly offer multiple perspectives on an issue which support my position (P)</td>
<td>I can effortlessly offer multiple perspectives on an issue which support my position (P)</td>
</tr>
<tr>
<td>More often than not, I am able to convince others of my position during an argument (P)</td>
<td>More often than not, I am able to convince others of my position during an argument (P)</td>
</tr>
<tr>
<td>When I know something about a healthy lifestyle topic, I feel it is important to share that information with others (M)</td>
<td>When I know something about a healthy lifestyle topic, I feel it is important to share that information with others (M)</td>
</tr>
<tr>
<td>I like to be aware of the most up-to-date healthy lifestyle information so I can help others by sharing when it is relevant (M)</td>
<td>I like to be aware of the most up-to-date healthy lifestyle information so I can help others by sharing when it is relevant (M)</td>
</tr>
<tr>
<td>If someone asked me about a healthy lifestyle issue that I was unsure of, I would know how to help them find the answer (M)</td>
<td>If someone asked me about a healthy lifestyle issue that I was unsure of, I would know how to help them find the answer (M)</td>
</tr>
<tr>
<td>Being knowledgeable enough about healthy lifestyles so that I could teach someone else is important to me (M)</td>
<td>Being knowledgeable enough about healthy lifestyles so that I could teach someone else is important to me (M)</td>
</tr>
<tr>
<td>People often seek me out for answers when they have questions about a healthy lifestyle issue (M)</td>
<td>People often seek me out for answers when they have questions about a healthy lifestyle issue (M)</td>
</tr>
</tbody>
</table>

the large sample size. Notably, inspection of the residuals did not indicate any large errors. Moreover, the fit indices suggest close correspondence between the data and the model. Specifically, the RMSE = .03, and the correlation between the 105 pairs of predicted and obtained correlations was .99.7

The data were consistent with the three-factor model, so the five connectivity items, five persuasiveness items, and five health maven items were averaged to form three indices. The connectivity index approximated closely the normal distribution, albeit with a slight negative skew. The mean of the index was slightly larger than the midpoint of the scale, \( M = 3.13, t(1,999) = 6.28, p < .001, p(3.09 \leq \mu \leq 3.16) = .95 \), with a standard deviation of .89. The reliability as estimated with both SIA and \( \alpha = .93 \).

The persuasiveness index was slightly skewed negatively, and was slightly leptokurtic, but approximated the normal distribution. The mean of the index was 3.46, which exceeded the midpoint of the scale, \( t(1,999) = 27.04, p < .001, p(3.43 \leq \mu \leq 3.50) = .95 \), the standard deviation was .76, \( \alpha = .91 \), and SIA = .92.

The health maven index was also slightly skewed negatively, and was slightly leptokurtic, but did not depart markedly from the normal distribution. The mean of the index, 3.26, exceeded slightly the midpoint of the scale, \( t(1,999) = 14.29, p < .001, p(3.23 \leq \mu \leq 3.30) = .95 \), with a standard deviation of .83. Both SIA and \( \alpha = .92 \).
Discussion
As in Studies 1 and 2, the data were very much consistent with the posited three-factor model. All factor loadings were ≥.77 and the errors in reproducing the obtained correlation matrix from the factor loadings and the structure of the model produced only minor deviations, as indicated by the fit indices.

Notably, the reliability coefficients for the three scales in Study 3 were slightly larger than in Study 1. Compared with Study 2, the connectivity measure had a higher reliability in Study 3, and the persuasiveness and health maven measures had only slightly lower reliability coefficients, despite having fewer items per measure. One explanation of this outcome is that, despite the use of 5-point rather than 8-point response scales (see Komorita & Graham, 1965 for a discussion of the impact of number of scale points on the reliability coefficient), this more diverse sample had the impact of increasing the variance of individual indicators and, thus, increasing the correlations among indicators of the same underlying latent variable. The reliability coefficient is a function of, among other things, the magnitude of these correlations. Specifically, as the correlations increase, the reliability coefficient increases as well, ceteris paribus, and consequently, the larger reliability coefficients resulted.

The distributional properties of the averaged scale scores were slightly different in Study 3 as well. Generally, the distributions more closely approximated the normal distribution, and mean scores differed less markedly from the midpoint of the scales. These outcomes likely result from the characteristics of the sample. Students may have more maven-like qualities, be more connected, and be more persuasive, than the U.S. adult population. Alternatively, they may not be so, but rather students may perceive themselves as having greater quantities of these attributes.

General Discussion
Highly influential people may be thought of as having one or more of three distinct characteristics: They may be well connected, very persuasive, highly expert, or have some combination of these attributes. The well-connected serve as weak-tie bridges between different people and groups. They link diverse populations, allowing information to move from one circle to another. The highly persuasive are skillful at convincing others; they enjoy discussing issues and are good at getting others to see matters their way without appearing aggressive or overbearing. Health mavens are very well informed regarding health topics broadly speaking, are considered health experts by their friends, and are sought after for advice on health issues. Those possessing an ample quantity of all three of these characteristics are very knowledgeable, very well connected, very convincing, and few in number. Superdiffusers were approximately 1–2% of the student samples in Studies 1 and 2; based on Study 3, they are projected to be about 5% of the U.S. adult population. Such persons have the potential to serve as powerful allies of those seeking to promote change. Thus, the connectivity, persuasiveness, and health maven indices have the potential to promote theory and research that examines the diffusion of health information by...
locating persons who might be employed to promote effectively healthy practices. However, it is important to be mindful of the fact that they also have the potential to provide a daunting obstacle should they be so inclined as to oppose proponents of change.

The data from these studies demonstrate that it is possible to identify such people employing standard self-report methods. The data demonstrate that influential members of social networks need not be viewed unidimensionally; indeed, it may be unprofitable to do so because different types of people fill different network functions. Moreover, these studies provide three scales with impressive psychometric properties, that is, reliability coefficients exceeding .90 and evidence consistent with hypotheses of content and construct validity, to help investigators identify connectivity, persuasiveness, and health mavens. These two contributions have the potential to enhance studies on social influence by refining the characteristics that make members of social networks influential and by allowing persons with these characteristics to be identified quickly and easily, without the complexity of sociometric methods or the cost of observational studies.

Despite these contributions, it is important to acknowledge the additional questions that are raised and that must be addressed in subsequent research. One high priority arises from a lacuna; namely, that none of the studies address the predictive validity of the measures, that is, experiments in which these measures associate as expected with behavioral criteria. For instance, if sociometric data indicate that those scoring high on the connectivity index occupy more pivotal connecting positions in social networks than those scoring low on the connectivity index, if those scoring high on the persuasiveness index are found to be more effective when engaged in social influence tasks than those scoring low on the persuasiveness index, and if those scoring high on the health maven index actually know more health information than those scoring low on the health maven index, then the confidence in the validity of these self-report measures would be enhanced substantially. If not, then to that extent their validity must be questioned.

Another question that is raised is the extent to which the maven concept can be extended to other contexts. From a theoretical perspective, such a possibility appears legitimate, although careful attention must be paid so that the breadth of the new context fits with the conceptual distinction between mavens and opinion leaders. Moreover, the existence of mavens in other areas would have to be examined empirically, with unique items generated to reflect the construct (i.e., replacing the word “health” in the health maven scale might not be sufficient).

An important test of the utility of these measures is the effectiveness of those identified as agents of behavioral change. Testing this possibility will entail identifying those who are expected to be highly influential, enlisting their cooperation in promoting behavioral change, and performing experiments to assess this strategy relative to standard strategies (e.g., communication campaigns). These three studies make progress toward addressing the first of these goals and are necessary, albeit insufficient, to begin addressing the remaining two.
Notes

1 Given the long histories of the phrases “opinion leader” and “opinion leadership,” they come with a considerable amount of ambiguity and unclarity. The term “superdiffuser” has neither the blessings nor the curses associated with a long history of use. In this article, it will be employed narrowly to refer to someone highly connected, highly persuasive, and highly maven-like.

2 This index is similar to the goodness-of-fit index. Predicted correlations were generated for each bivariate relationship in the correlation matrix. These values were then correlated with their respective obtained values to produce the measure of fit. To anticipate an objection, the centroid factor solution employed forces the regression line through the origin so that the index of fit is not affected by intercepts that depart markedly from zero and slopes that depart markedly from one. Put differently, the fit index is not in error by an additive or multiplicative constant.

3 We thank an anonymous reviewer for pointing out the possibility that the data could be second-order unidimensional, that is, that the three measures (connectivity, persuasion, and mavens) could be alternative indicators of a broader construct, such as opinion leadership. This model was tested but was found to be inconsistent with the data. The specific failure of the model occurred in tests of parallelism; the three constructs correlated in substantially different ways with other constructs in all three of the studies presented in this article. The interfactor correlations and the tests of second-order unidimensionality may be obtained from the first author.

4 All the reported model tests in Study 1 produce the same result when done with other statistical programs. For example, employing maximum likelihood estimation with SPSS Amos 17.0, the one-factor model for the three CPM measures fails, with a $\chi^2 = 747.46$, $df = 54$, $p < .001$, RMSEA = .26, and CFI = .38. The three-factor model for the CPM constructs is consistent with the data; $\chi^2 = 60.6$, $df = 51$, $p = .17$, RMSEA = .032, and CFI = .99. The six-factor model, combining the CPM constructs with the measures of social anxiety, argumentativeness, and value-relevant involvement, also fits well. The $\chi^2$ is statistically significant ($\chi^2 = 522.31$, $df = 390$, $p < .001$), but RMSEA = .042 and CFI = .95.

5 In Amos, the one-factor model fails as predicted, $\chi^2 = 10509.28$, $df = 90$, $p < .001$, RMSEA = .24, CFI = .53. Although the $\chi^2$ remained statistically significant for the three-factor solution ($\chi^2 = 694.40$, $df = 87$, $p < .001$), the RMSEA was modest (.059), and the CFI was ample (.97).

6 The function that maps dependent variable scores onto these three dimensions of individual differences might be additive or nonadditive and may be dependent on the specific criterion variable under scrutiny. Presently, both the theoretical and empirical knowledge required to be more precise for predicting any particular criterion variable is lacking.

7 In Amos, the one-factor model for the CPM measures failed, $\chi^2 = 2440.62$, $df = 405$, $p < .001$, RMSEA = .17, CFI = .45. The three-factor model fit well as predicted, $\chi^2 = 356.63$, $df = 186$, $p < .001$, RMSEA = .072, CFI = .93. The five-factor model, combining the CPM measures with the measures of opinion leadership and healthy lifestyle activism, also fit well, $\chi^2 = 706.05$, $df = 395$, $p < .001$, RMSEA = .067, CFI = .92.
References


论影响力的识别体系:
人际连通性指标,说服力指标,及专家影响力指标的发展与检验

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Kim Serota
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【摘要：】
传播推广活动，尤其是健康领域的传播推广，长期以来都将目标网络中具有影响力
的成员作为促成行为改变的重要手段。以三组数据为基础，三种影响力指标在该研
究中得以发展和证实。三种影响力指标的评估对象为社会人际网中具有高度信息散
播能力和影响力的个体（高度的人际连通性，较强的说服力和知识较丰富的个
体）。结果表明，研究数据与研究假设基本相符；影响力指标也具有一定的效度和
较高的信度。最后，本文进一步探讨了人际连通性，说服力，及健康专家对有效推
广并促成行为改变的潜在影响。

关键词：信息散布，舆论领袖，社会影响力，人际连通性，说服力，专家
Identifier l’influence : développement et validation des échelles de connectivité, de force de persuasion et d’expertise

Franklin J. Boster, Michael R. Kotowski, Kyle R. Andrews & Kim Serota

Mots clés : diffusion, leaders d’opinion, influence sociale, connectivité, force de persuasion et expertise

Le recours à des membres influents d’un réseau pour favoriser le changement comportemental a longtemps été un objectif des concepteurs de campagnes de communication, surtout dans les contextes de santé. Une série de trois études ont développé et validé des mesures de trois types de personnes influentes (les gens persuasifs, informés et ayant beaucoup de relations) jouant un rôle important dans la dissémination de l’information dans les réseaux sociaux. À travers toutes les études, les données étaient dans l’ensemble en accord avec les hypothèses, suggérant que ces indicateurs mesurent ce qu’ils sont censés mesurer et le font avec une grande exactitude. Le potentiel des construits de connectivité, de force de persuasion et d’experts de la santé à augmenter l’efficacité de la diffusion du changement comportemental est commenté.
Die Identifikation von Einfluss: Entwicklung und Validierung der Konnektivitäts-, Persuasivitäts- und Experten-Skalen

Franklin J. Boster, Michael R. Kotowski, Kyle R. Andrews & Kim Serota

Der Einsatz von einflussreichen Netzwerkmitgliedern zur Verstärkung von Verhaltensänderungsprozessen ist seit langem ein Ziel bei der Konzeption von Kommunikationskampagnen insbesondere im Gesundheitsbereich. In einer Serie von drei Studien werden Maße für drei Arten von einflussreichen Anderen (die hochgradig Vernetzten, Persuasiven und Informierten), die eine wichtige Rolle bei der Verbreitung von Informationen in sozialen Netzwerken spielen, entwickelt und validiert. In allen drei Studien waren die Ergebnisse prinzipiell konsistent mit den Hypothesen, was bedeutet, dass die Indices messen, was sie messen sollen und dies mit hoher Reliabilität tun. Wir diskutieren das Potential der Konstrukte Konnektivität, Persuasivität und Gesundheitsexperten, die Effektivität bei der Diffusion von Verhaltensänderungen zu steigern.

Schlüsselbegriffe: Diffusion, Meinungsführer, sozialer Einfluss, Konnektivität, Persuasivität, Experte
영향력의 동일화: 연계성, 설득 그리고 전문가 척도의 개발과 유용화

Franklin J. Boster 1, Michael R. Kotowski 2, Kyle R. Andrews 3, Kim Serota1,4

요약

행태적변화과정을 촉진하기 위하여 영향력있는 네트워크 구성원들을 사용하는 것은 오랜기간동안 커뮤니케이션 캠페인 디자이너들—특히 의료상황에서—의 주요 목적이었다. 3 가지의 연속적인 연구에서, 사회적 네트워크를 통해 정보의 분배에 있어 주요한 역할을 하는 영향력있는 타자들의 3 가지 형태의 측정들이 발전되었고 유용화되었다. 연구들에서 데이터들은 가정들과 일치하는 것으로 나타났는데, 이는 이러한 척도들은 그들이 측정하려고 목표했던 것들을 측정한다는 것을 보여주는 것이다. 연계성, 설득, 그리고 의료 전문가의 잠재력은 행태적 변화 분산의 효과를 증대시키는 것이라는 점이 논의되었다.
Identificando a la Influencia:
El Desarrollo y la Validez de la Conectividad, lo Persuasivo, y las Escalas de Expertos

Franklin J. Boster 1, Michael R. Kotowski 2, Kyle R. Andrews 3, Kim Serota 1,4

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Resumen

El uso de los miembros influenciales de la red que facilitan el proceso de cambio social ha sido largamente un objetivo de los diseñadores de campaña, particularmente en los contextos de la salud. En una serie de 3 estudios, las medidas de 3 tipos de miembros influenciales (aquellos que tienen alta conectividad, que son persuasivos, y que están bien informados) que juegan un rol importante en la diseminación de información a través de las redes sociales son desarrolladas y validadas. A través de los estudios los datos fueron, en general, consistentes con las hipótesis, sugiriendo que estos índices miden lo que se proponen medir y que lo hacen con una alta credibilidad. El potencial para la conectividad, el nivel de persuasión, y los constructos de expertos de la salud que incrementaron la efectividad de la difusión de cambio de comportamiento es discutido.