# Typological Measures of Shyness: Additive, Interactive, and Categorical

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A typological model of shyness as neurotic-introversion has been suggested but never evaluated. We compared the ability of two direct measures of trait-shyness (Revised Shyness scale, Social Anxiety scale) and two typological measures (additive and interactive versions of neurotic-introversion) to predict peer-rated shyness and talk-time in leaderless groups. One hundred and twenty participants, initially unacquainted, met in small weekly discussion groups. At weeks 2 and 7, participants rated their group members on current shyness and talk-time. The two direct-measures and the additive typological measure showed substantial validities at both points in time. Although not as effective, Introversion was predictive at both times but Neuroticism only at Time 2. Little support was found for either the interactive or categorical measure. © 1998 Academic Press

From the beginning, shyness researchers were confronted with the problem of discriminant validity: Is the concept sufficiently distinct from related personality constructs? For example, the S scale resulting from an early factor analysis of personality (Guilford & Guilford, 1936) was criticized for confounding shyness with several other traits (Eysenck, 1956). Guilford (1975), in turn, made the same accusation about Comrey's (1970) Shyness scale. Later, Cheek and Buss (1981) went to some effort to distinguish ''shy'' from its lexical cousin ''unsociable.'' In the most recent review, Leary (1991) warned against equating shyness with ''social anxiety,'' recommending the latter term be reserved for the subjective-distress component. Noting this advice, we opted for the broader term ''shyness'' in this report because our measures tap both behavioral and affective aspects.

Perhaps the most cited reason for questioning the construct validity of shyness scales is their empirical overlap with Eysenck's two major axes of

personality, extraversion and neuroticism. Not long after he developed measures of those axes, Eysenck (1953) found that available shyness measures showed substantial positive correlations with Neuroticism and substantial negative correlations with Extraversion.[1] Similar results have been found with more recent shyness measures (e.g., Jones, Briggs, & Smith, 1986; Krug & Johns, 1986; Pilkonis, 1977a,b). Given the importance of Introversion and Neuroticism (long touted by Eysenck and recently acknowledged by their inclusion in the ''Big Five''), it is tempting to define shyness as a derivative thereof: Why postulate a separate construct if ''neurotic introversion'' captures the concept?

*Combination types.* The term ''type'' is often used to describe a unique combination, mixture, or blend of traits. The idea that shyness is a distinct trait combining aspects of introversion and neuroticism was first reviewed by Crozier (1979). Later, Geen specifically defined shyness as neurotic-introversion (Geen, 1986, p. 274). Gilmartin (1987, p. 41) also used the term, neurotic-introvert, but in reference to the narrower construct of ''love-shyness.'' Most recently, Buss (1995) used the term ''blend'' to describe how neuroticism and introversion combine to yield shyness (p. 334). To summarize this conception, we define *combinatory shyness* as the social inhibition resulting from some combination of neuroticism and introversion.

*Categorical types.* Apart from its meaning as a combination of traits, the term ''typology'' is sometimes used in the sense of a distributional discontinuity or taxon (Meehl, 1992): We will use the term *categorical,* when the typology involves discontinuous groups. In arguing for a categorical view, Kagan (1994) claimed that roughly 15% of children show a ''shy, timid, fearful profile'' (p. 265). He argued further that this category is biological in origin, appearing early in life and remaining stable with age.

Kagan's (1994) conclusions were based on his finding that categorical analyses (i.e., $t$ tests and ANOVAs) yielded clear and consistent differences between shy and nonshy groups. In contrast, when analyzed as continuous dimensions (with correlation and regression), these results were not as clear or consistent over time (Kagan, Reznick, & Snidman, 1988).

*Primary conceptions.* In contrast to typological conceptions, other researchers argue that shyness is a continuous unitary trait with primary status (e.g., Briggs, 1989; Comrey & Jamison, 1966). Apart from the fact that the word ''shy'' is among the most-used traits in free descriptions of personality, it often emerges as an independent factor in factor analyses (for a review see Crozier, 1979). Not surprisingly, then, a number of reputable personality inventories, the 16PF, for example, treat shyness (vs. boldness) as a distinct

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[1] Because correlations of shyness with Extraversion are always negative, we will henceforth refer to positive correlations with its opposite pole, Introversion.

trait[2], albeit correlated with both introversion and neuroticism (Krug & Johns, 1986). To evaluate whether shyness is primary, Briggs (1988) conducted an item-by-item analysis of four shyness scales. He found that all four scales (and the majority of items) correlated approximately equally with Introversion and Neuroticism. At the same time, the shyness scales showed strong internal consistency. He concluded that shyness is a univocal primary factor distinct from, but lying between, the two superfactors. Since then, Briggs (1989) has elaborated further arguments for measuring personality at the primary level, that is, at a level more specific than the Big Five superfactors.

## Measuring Primary and Typological Conceptions

The established questionnaire measures were developed under the assumption that shyness has primary status. These questionnaires are *direct measures* in that the items focus specifically on manifestations of social shyness (e.g., ''I feel inhibited in social situations''; ''I feel tense when I'm with people I don't know well''). As a rule, shyness scales display exceptional psychometric properties, in particular, excellent homogeneity and stability over time (Briggs & Smith, 1986). Although some commentators have worried that shyness is a phenomenological variable that might not show convergence across methods (Harris, 1984; Ozer, 1989), the major shyness scales have been firmly validated with a combination of peer-ratings and behavioral criteria (Cheek & Briggs, 1990; Jones & Carpenter, 1986; Leary, 1991; Paulhus & Morgan, 1997).

In operationalizing combinatory shyness, we had to consider two methods of combining the components, namely, *additive measures* and *interactive measures.* Additive measures entail a simple sum of the two components. The implication is that the component elements are interchangeable in contributing to the outcome construct. Interactive methods require computation of the partialed product (Cohen, 1978). Here the theoretical implication is that the components combine synergistically (Carver, 1989). Put another way, the interactive model stipulates multiple necessary causes for an emergent attribute to appear (Lykken, McGue, Tellegen, & Bouchard, 1992).

An example of debate over a typological model is provided in the literature on androgyny measurement. Bem (1974) had touted the psychological benefits of androgyny, that is, scoring high on both the orthogonal dimensions of Masculinity and Femininity. To test whether androgyny actually provided synergistic benefits for mental health, Lubinski, Tellegen, and Butcher (1981) regressed several health outcome measures on M, F, and $M \times F$. The interaction term, after controlling for M and F, failed to predict any health

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[2] Moreover, predictive validity increases with use of primary traits compared with a smaller number of second-order factors (Mershon & Gorsuch, 1988).

outcome. Spence (1983) countered that an additive model was a more appropriate measure of androgyny. A contrasting example where the interactive model has proved more successful is the two-factor model of psychopathy (Harpur & Hare, 1991): Violent crime outcomes were best predicted by an interactive, rather than an additive, function of the two psychopathy factors.

In the case of shyness, the additive model implies that introverted and neurotic qualities are interchangeable in bringing about manifest shyness. For example, a nervous demeanor may be weighted equally with quietness when observers are rating others' shyness. Eysenck (1956) seems to prefer this conception in noting two motivations for shyness: ''. . . the introvert does not care to be with other people; the neurotic is afraid of being with other people'' (p. 108). In defining shyness as an avoidance of being with other people, then, it matters not which motivation was ultimately responsible.

In contrast, the interactive model implies that shyness emerges only when an individual possesses a high degree of both neuroticism and introversion. For example, individuals at a party may be tagged as shy only if they are both quiet and nervous (Leary, 1986). This definition is consistent with Kagan's (1994) research on children and adult evidence that extraversion is an emergent rather than an additive variable (Lykken *et al.,* 1992).

Finally, for all three operationalizations (direct, additive, interactive), we may also test the possibility that shyness is *categorical* rather than *continuous.* The 20-year research program summarized in Kagan (1994) suggests a breakdown of shy (15–20%), moderate (40–45%), and nonshy (40%). Although Kagan has yet to follow these children into adulthood, his percentage estimate for shys is consistent with adult epidemiological studies (e.g., Kessler, McGonagle, Zhao, Nelson, Hughes, Eschlemann, Wittchen, & Kendler, 1994). Based on these norms, we will use the 20–40–40 breakdown as our best estimate of the size of shy, moderate, and nonshy categories in our college-age sample.

## THE PRESENT STUDY

Our goal was to specify several typological measures of shyness and examine their validity in comparison with (a) two direct measures of shyness and (b) measures of the components, introversion and neuroticism. Both of the direct measures have been widely used—one in the shyness literature, the Cheek–Buss Revised Shyness scale (Cheek, 1983), and one in the social anxiety literature, the Social Anxiety scale (Fenigstein, Scheier, & Buss, 1975). Despite the difference in labels, both are considered broad enough to span behavioral as well as subjective aspects of shyness (Leary, 1991).

Manifestations of shyness are most evident in meetings with strangers (Pilkonis, 1977a), in group situations (Zimbardo, 1977), and within unstructured guidelines (Crozier, 1986). We chose to collect our data in a situation

combining all three elements, namely, groups of strangers meeting in small leaderless discussion groups. Groups of 4–5 met weekly for a total of seven weeks. Prior to group assignment, participants completed a personality inventory that included Neuroticism, Introversion, and two direct measures of shyness. After two of the meetings (sessions 2 and 7), participants rated each other with respect to current level of shyness and talk-time.

The mean peer ratings of each participant's shyness and talk-time constituted our two criterion variables. Including both variables permitted an evaluation of the McCroskey and Beatty (1986) hypothesis that shyness is equivalent to quietness. The longitudinal design allowed us to evaluate possible changes in the relative efficacy of direct vs. typological measures over the course of increasing acquaintanceship.

## Method

### Subjects

Participants were 120 students, 51 male and 69 female, enrolled in third-year psychology courses at the University of British Columbia. After the course was completed, they were asked if their data could be analyzed for research purposes: All agreed. Part of these data overlap with Study 1 of Paulhus and Morgan (1997), but in that report the dependent variables of interest (perceived intelligence, creativity, and wisdom) were entirely different.

### Instruments

*Self-report measures.* To measure the Big Five trait domains, the 60-item NEO Five Factor Inventory (NEO-FFI) was used: The validity and reliability of each factor have been well established (Costa & McCrae, 1989). Two of the Big Five, Extraversion and Neuroticism, were used to construct the typological measures of shyness. The other three, Agreeableness, Conscientiousness, and Openness, were included to demonstrate discriminant validity. All responses were collected on 5-point scales.

Two direct shyness measures were included. The Cheek–Buss Revised Shyness Scale (Cheek, 1983), a 13-item revision of their earlier Shyness Scale (Cheek & Buss, 1981), was designed to assess both the behavioral and subjective aspects of shyness. Participants also completed the 6-item Social Anxiety subscale of the Self-Consciousness Scale (Fenigstein *et al.,* 1975). Although very short, this measure is also viewed as broad enough to cover both behavioral and subjective aspects of shyness (Leary, 1991). All responses to the shyness items were collected on 7-point Likert scales.

*Peer ratings.* After sessions 2 and 7, participants were asked to rate their group members ''as they behaved in that session'' on a set of bipolar scales. Embedded in this set at both times were two critical items: One was a 15-point scale anchored by *shy* and *nonshy.* Use of this single item has been found to be a valid indicator of shyness (Pilkonis, 1977a). The second was a 15-point scale anchored by *talked little* (=1) and *talked a lot* (=15).

### Procedure

Prior to being assigned to groups, all participants completed a package of self-report questionnaires. A total of 26 discussion groups were organized: 16 of the groups had five members, the remaining 10 groups were composed of four members. Group assignments were random with the constraint of heterogeneity with regard to gender and ethnicity. The groups met

TABLE 1
Reliabilities and Intercorrelations of Self-Report Questionnaires

| Questionnaire | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 1. Introversion | (.88) | .05 | −.08 | .28 | −.20 | .40 | .42 | .46 |
| 2. Agreeableness | | (.80) | .16 | −.25 | .05 | .02 | .07 | .05 |
| 3. Conscientiousness | | | (.89) | −.32 | .19 | −.26 | −.30 | −.29 |
| 4. Neuroticism | | | | (.86) | −.30 | .45 | .42 | .45 |
| 5. Openness | | | | | (.85) | −.19 | −.17 | −.18 |
| 6. Revised Shyness scale | | | | | | − | (.83) | .75 | .96 |
| 7. Social Anxiety scale | | | | | | | (.80) | .96 |
| 8. Direct Index[a] | | | | | | | | (.90) |

*Note.* N = 114. Correlations exceeding .25 are significant at $p < .01$, two-tailed test.

[a] The Direct Index of shyness is a composite of standardized scores on the two shyness questionnaires (Revised Shyness and Social Anxiety scales).

weekly for 20 minutes during class-time for seven consecutive weeks. Participants were requested to avoid interaction with fellow group members outside of official meetings. No instructions were given regarding leadership within the groups, but weekly instructions required that each individual was to participate in the meeting.

Each week a discussion topic or task was assigned. Topics were selected to encourage interaction with class readings and lecture topics and to provide opportunity for a variety of personality dimensions to be brought into play. The topics were, in chronological order: descriptions of family's/friend's personality, verbal and quantitative problem-solving, positive and negative qualities of the self, worries and concerns, creative and absorbing experiences, social issues, and Allport's characteristics of well-adjusted persons.

After completion of each group meeting, participants were given a rating sheet in an envelope and asked to return the completed sheet (sealed in the envelope) to the instructor at the next class session. The sheets asked the participant to rate the other members of his/her discussion group on a set of bipolar adjectives (including shyness and talk-time) with 15-point rating scales. No ties were allowed: That is, no two members were to be assigned the same number on any one scale.

## Results[3]

### *Self-Report Measures of Personality*

Table 1 provides the intercorrelations among the self-report questionnaires. The pattern of intercorrelations among the Big Five dimensions is similar to that reported in the FFI manual (Costa & McCrae, 1989). In addition, the α reliabilities for each measure are included along the diagonal: They appear to be satisfactory.

Note also that the two direct measures of shyness—the Revised Shyness Scale and the Social Anxiety Scale—correlate similarly and substantially with Extraversion (−.42 and −.40), and with Neuroticism (.45 and .42). The

[3] The possibility of gender effects was examined for our major results but they were found to be minimal.

TABLE 2
Intercorrelations of Five Shyness Predictors

| Questionnaire | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1. Direct Index | – | .46 | .45 | .62 | −.20 |
| 2. Introversion | | – | .28 | .80 | .00 |
| 3. Neuroticism | | | – | .80 | .00 |
| 4. Additive Index | | | | – | .00 |
| 5. Interactive Index | | | | | – |

*Note.* $N = 114$. The Direct Index is a composite of standardized versions of the two shyness questionnaires. The Additive Index is the sum of standardized Introversion and Neuroticism. The Interactive Index is the residual of the product $(I \times N)$ regressed on standardized versions of Introversion and Neuroticism. Correlations exceeding .25 are significant at $p < .01$, two-tailed test.

two direct measures also correlate comparably with the other three Big Five measures. Along with their high intercorrelation ($r = .75$), this pattern of evidence suggests that the two direct shyness measures tap the same trait construct. Therefore, a composite termed the *Direct Index* of shyness was created by standardizing and summing the two direct self-report shyness measures.

### Five Self-Report Measures of Shyness

In addition to the Direct Index, four other variables were evaluated as self-report measures of shyness. To create the Additive Index, Introversion and Neuroticism scores were standardized and summed. The Interactive Index was operationalized as the product of standardized Introversion and Neuroticism after controlling for their main effects. To create this term, the product, Introversion $\times$ Neuroticism, was regressed on its two constituent variables and the residual score for each subject was generated. This residualized product was then treated as a separate variable labeled the Interactive Index. Correlations with this residual are identical to partial correlations of the product controlled for I and N. Nonetheless, we chose to isolate the residual for use as a separate index parallel to the four other predictors. Table 2 provides the intercorrelations among all five measures derived from self-reports.

The table reveals that the Additive Index intercorrelates highly with the Direct Index. In contrast, the Interactive Index shows little association with any of the other predictors. Of course, its independence from Introversion and Neuroticism was compelled by partialing out those variables.

### Predictive Validity

We then examined the relative ability of the five self-report measures to predict shyness as perceived by group peers. To evaluate continuous versions

TABLE 3
Correlations of Five Self-Report Predictors with
Peer-Rated Shyness

|                   | Time 1 | Time 2 |
|-------------------|--------|--------|
| Direct Index      | .49    | .45    |
| Introversion      | .43    | .38    |
| Neuroticism       | .22    | .36    |
| Additive Index    | .38    | .42    |
| Interactive Index | .09    | −.11   |

*Note.* $N = 114$. The Direct Index is a composite
of two shyness questionnaires. The Additive Index
is the composite of Introversion and Neuroticism.
The Interactive Index is the residualized product of
Introversion $\times$ Neuroticism. Correlations exceeding
.23 are significant at $p < .01$, one-tailed test.

of these predictors, we used moderated regression techniques (Aiken &
West, 1991; Bissonnette, Ickes, Bernstein, & Knowles, 1990; Chaplin, 1991;
Cohen, 1978). To test the categorical versions, we used the traditional
ANOVA approach (SPSS unique effects option).

*Peer-Rated Shyness*

For use as the criterion, peer-ratings were aggregated across the 3–5 group
members rating each target at Time 1 ($M = 7.7$; $SD = 2.1$) and Time 2 ($M = 7.3$; $SD = 2.0$). Reliabilities of the aggregate were estimated by intraclass
correlations (ICCs) based on the Shrout and Fleiss (1979) formulas. Both
Type I and Type II ICCs were computed because our data format falls some-
where between the situation of different raters for each target (Type I) and
the same raters for all targets (Type II). The values were .66 and .88, respec-
tively, for Time 1 and .74 and .90, respectively, for Time 2. The temporal
stability, computed as the correlation of the aggregated scores across Time
1 and 2, was also high, ($r = .83$).

*Regression-correlation.* We calculated Pearson correlations between each
of the five predictors and peer-rated shyness. Note from Table 3 that the
Direct Index (the composite of the two shyness questionnaires) demonstrated
a substantial validity at both Time 1 (.49) and Time 2 (.45). Not tabled is
the fact that the validities were only slightly lower for the individual direct
measures: Revised Shyness Scale (.42, .40) and Social Anxiety Scale (.37, .40).

The predictive value of the Additive Index at Time 1 ($r = .38$) and Time
2 ($r = .42$) was not significantly worse than the performance of the Direct
Index (both $t$'s $< 1.6$, n.s.). Even the components of the Additive Index,
Introversion and Neuroticism, performed decently on their own. On the other
hand, the Interactive Index showed no predictive power whatsoever.

*ANOVAs.* First, we divided subjects at the median on the Direct Index. A *t* test showed that the shy group received significantly higher shyness ratings than the nonshy group both at Time 1, $t(116) = 3.06$, $p < .01$, and Time 2, $t(114) = 2.93$, $p < .01$ (both tests two-tailed). The effect sizes for these group comparisons (.53, .48), were converted to correlations (see Rosenthal & Rosnow, 1984, p. 446). The resulting values (.26, .25) are noticeably lower at both times than the raw correlations of the Direct Index with peer-rated shyness (.49, .45). These results provide no support for a categorical model.

*Kagan categories.* Such reductions in effect size are to be expected when a continuous variable is categorized (Cohen, 1983). Kagan (1994), however, claimed that categorization actually increases the power of shyness measures if his recommended cutpoints are used. Accordingly, we approximated his categories using Direct Index cutpoints that allotted 20% of the sample to the shy group and 40% to the nonshy group. Compared to the effect sizes obtained with median splits (.53, .48), this categorization produced larger effect sizes (.96, .87) but similar significance levels for the *t* test at both Time 1, $t(70) = 3.02$, $p < .005$, and Time 2, $t(70) = 3.11$, $p < .005$, two-tailed. Apparently the larger effect sizes due to greater separation of the group means were offset by the reduction in sample size.

The observed increase in effect size via his categorization (.43, .39) would support Kagan to the extent that it exceeded the increase expected from the removal of the central observations. The latter values (.44, .49) were calculated from formulas provided by Alf and Abramson (1975) are comparable to the observed increases. Again, no support ensues for the categorical model.

Finally, to achieve comparable shyness splits derived from the Eysenck axes, we divided subjects on Introversion and Neuroticism with cutoffs designed to yield shy and nonshy groups of roughly 20 and 40%. This goal required forming a high–high group (higher than the 60 percentile on both) and a low–low group (lower than the 40th percentile on both). A subsequent $2 \times 2$ ANOVA on shyness ratings yielded weak main effects for Introversion and Neuroticism ($Fs < 4$) but nonsignificant interactions at both Time 1 and Time 2.

This failure of the Kagan categorization system to surpass the predictive power of the continuous measure of shyness is a blow to the categorical model. Apparently, the power drop due to decreased sample size outweighed the power gain due to the fact that deletion of moderate scorers tends to increase artifactually the linear associations of that variable with other variables (Thorndike, 1982).

## Talk-Time

When aggregated across the available raters, talk-time ratings showed extremely high intraclass correlations. Even when the more stringent Type II formula was used, the values were .93 and .95 at Times 1 and 2, respectively.

TABLE 4
Correlations of Five Predictors with Peer-Rated
Talk-Time

|  | Time 1 | Time 2 |
|---|---|---|
| Direct Index | .56 | .49 |
| Introversion | .44 | .45 |
| Neuroticism | .15 | .14 |
| Additive Index | .41 | .38 |
| Interactive Index | −.13 | .19 |

*Note. N* = 114. The Direct Index is a composite
of two shyness questionnaires. The Additive Index
is the composite of Introversion and Neuroticism.
The Interactive Index is the residualized product of
Introversion × Neuroticism. Correlations exceeding
.23 are significant at $p < .01$, one-tailed test.

In other words, there was virtually no disagreement about which participants talked the most.

*Correlation/regression.* Table 4 provides the correlations of aggregated talk-time with Introversion, Neuroticism, and the four shyness measures. As with the shyness ratings, three of the five predictors showed consistent prediction of talk-time: Once again, the Interactive Index failed to reach significance. Unlike with shyness ratings, the association of Neuroticism with talk-time did not increase over time.

*ANOVAs.* A median split of the Direct Index again showed a significant *t* test at both points in time (both $p$'s $< .01$). And again the use of Kagan splits improved the effect sizes. Using median splits on Introversion and Neuroticism, we again performed 2 × 2 ANOVAs on talk-time. At both Time 1 and Time 2, results yielded main effects for Introversion and Neuroticism, but neither interaction approached significance.

In sum, both our regression and ANOVA results supported the utility of the direct and additive measures of shyness, but not the interactive measure. Nor did categorization improve the power of our predictors.

### Predictive Efficacy of Introversion and Neuroticism Over Time

Another finding of particular interest from Table 3 was the change over time in the pattern of correlations of Introversion and Neuroticism with peer-rated shyness. The predictive power of Neuroticism increased significantly ($t = 2.52, p < .01$) from .22 at Time 1 to .36 at Time 2, whereas the predictive power of Introversion did not change (.43 vs. .41, n.s.). But with talk-time the criterion (Table 4), neither Introversion nor Neuroticism changed over time: Introversion predicted significantly better than Neuroticism at both times (both *t*'s $> 2.5, p < .01$).

The pattern suggests that shyness ratings are completely determined by talk-time at Time 1, but that Neuroticism-related cues are engaged at Time 2. This possibility was tested by partialing Talk-Time from the correlations of Introversion and Neuroticism with shyness ratings. This partialing process reduced the predictive power of Introversion to a partial correlation of .17 (n.s.) at Time 1 and .09 (n.s) at Time 2. Neuroticism, with a partial correlation of .31, $p < .05$, however, remained a significant predictor of shyness ratings at Time 2 (recall that it never was a significant predictor at Time 1).

## DISCUSSION

The two direct self-report measures performed equally well in predicting our two shyness criteria. Although comprising only 13 and 6 items, respectively, the Revised Shyness scale and the Social Anxiety scale were able to predict, weeks in advance, the shyness and talk-time ratings provided by discussion group members. And despite the rather different labels, the two direct measures appear to be empirically equivalent[4]—at least within the normal range of personality studied here.

The validity of the direct measures was impressive even at Time 1, that is, after only 40 minutes of contact time. This rapid recognition of others' shyness is consistent with the strong minimal-acquaintance validities typically found for Extraversion (e.g., Kenrick & Stringfield, 1980; Paulhus & Reynolds, 1995) but inconsistent with the weak minimal-acquaintance validities typically found for Neuroticism (e.g., Paulhus & Bruce, 1992). The dynamics of these two validities were clarified by an examination of their time course over the seven weeks covered by our data: The ability of the Introversion scale to predict rated shyness was evident immediately. In contrast, prediction from the Neuroticism scale was initially modest but improved over time. The pattern for prediction of talk-time was more consistent, with Introversion remaining a better predictor at both points in time.

This pattern suggests that the cues used to attribute shyness shift over time from sheer silence to include cues related more to neuroticism. The nature is of these cues is speculative, but it seems safe to say that they are either behavioral or informational. Behavioral cues could include fidgeting and avoidance of eye contact (Garcia, Stinson, Ickes, Bissonnette, & Briggs, 1991). But why weren't these cues recognized earlier? Perhaps they lack the ''salience of silence.'' Moreover, some cues (e.g., verbal disfluencies) simply cannot arise during silence: They can only operate later in the acquaintance process when the few nonsilent samples of shy behavior have accumulated or when shy individuals have become comfortable enough to speak. Confirmation that most quiet individuals do belong in the shy category is

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[4] Interestingly, both measures originated in the 1970s from the University of Texas research team of Arnold Buss and students.

likely to be partially offset by the disconfirmation of others. After breaking their silence, some may speak with such confidence and eloquence that they are reassigned to the nonshy category (see Paulhus & Morgan, 1997).

Informational cues, that is, public declarations of shyness to the group, will help pinpoint the shy types who are more neurotic than quiet. Yet a declaration such as ''Because I talk so much, you may not realize that I'm shy'' is likely to be taken with a grain of salt by peers (Amabile & Kabat, 1982). But the embarrassment of disclosing one's social anxiety has been shown to be overwhelmed by strong self-verification processes (e.g., Swann, Stein-Steroussi, & Giesler, 1992). This insistence on self-verification (by public declaration or more subtle means) should eventually admit the neurotically shy into the group identified as shy, and the association of Neuroticism with perceived shyness should increase correspondingly.

This fluctuation in availability of cues in long-term groups may also be responsible for the lack of improvement in judges' accuracy over time (as indexed by the self-peer correlations). Our previous work suggested that the accumulation of evidence about which members are shy is counteracted by the tendency for them to behave less shy over time (Paulhus & Morgan, 1997).

*Shyness vs. talk-time.* Consensus among peers was even higher for the talk-time ratings than for the shyness ratings. The intercorrelation of the two criteria ($r = .63$) was sizable but well below the reliabilities of the two measures. Moreover, the pattern of correlations with Introversion and Neuroticism differed noticeably. Again the pattern suggests that observers' shyness ratings were based substantially, but not solely, on a participant's level of talking (see Paulhus & Morgan, 1997). Therefore, we must dispute the McCroskey and Beatty (1986) argument that shyness can be equated with quietness. In fact, shy social behavior has a variety of observable manifestations (see Jones & Carpenter, 1986; Garcia *et al.,* 1991), but, as far as we know, the relative impact of each cue on shyness perceptions has not been systematically evaluated. A comparison of on-line behavioral coding with self- and observer ratings over time would be ideal (see Gosling, John, Craik, & Robins, in press).

*Additive vs. interactive measures.* The primary purpose of this report was to evaluate the validity of a combinatory conception of shyness, namely, the neurotic-introvert. Clearly, our interactive operationalization of this combination was ineffective: We found no reason to believe that shy behavior emerges from the unique marriage of Introversion with Neuroticism. Interactive measures seldom are effective, partly because interactions require excessive power to detect (Cohen, 1978). As Chaplin (1991) and others have argued, we get more return on our psychometric investments if we concentrate on direct, rather than interactive, predictors.

Before giving up entirely on this approach, we must note some possible

limitations of our operationalizing the emergent effect as the residualized product of Introversion $\times$ Neuroticism, that is, the portion of the product remaining after partialing out the two main effects. Do our analyses apply if the emergent effect were conceived as the raw product (including the main effects) rather than the residualized product? In a word, yes: In either case, the residual must be significant to support the model (Aiken & West, 1991; Carver, 1989, p. 582).

One might also worry that the residualized measure is inherently flawed because the partialing process could yield a bizarre score distribution or at least, could reduce the variance. We argue, on the contrary, that the residualized product is the method of choice for measuring interaction effects. The interaction product, equivalent to partial correlations, is far more powerful than the corresponding ANOVA interaction effect (Chaplin, 1991). Moreover, our examination of the distribution of residuals showed it to be remarkably normal. Finally, we checked the possibility of a curvilinear effect of the Interactive Index by plotting it against the dependent variable, rated shyness. No curvilinear trend was apparent.

In contrast to the interactive measure, our additive measure of shyness, Introversion plus Neuroticism, *was* effective. In fact, this composite of two orthogonal domain scores performed almost as well as the direct composite. Thus our findings do lend some support to the utility of measuring shyness as neurotic introversion[5]. It is comforting to know that, were a direct measure unavailable, a researcher could assemble a valid proxy measure of shyness from the Eysenck Personality Inventory (Eysenck & Eysenck, 1975) or, indeed, from a standard Big Five inventory (e.g., Costa & McCrae, 1989; John, Donahue, & Kentle, 1991). The clear drawback is inefficiency: The additive measure (24 items) required two to four times as many items to approach the predictive power of the direct measures.

*Categorical typologies.* We found little evidence for categories in any of our analyses. We categorized all the independent variables and tested them with ANOVAs. Whether we categorized with traditional median-splits or Kagan's 20–40–40 split, the categorical version was always far less powerful than its continuous counterpart. This finding is consistent with earlier evidence that Jungian categories are not sustained under empirical scrutiny (Stricker & Ross, 1964).

The one piece of evidence favoring a categorical conception was a bimodal (but not trimodal) distribution on one of our dependent variables, talk-time. Rather than guaranteeing biological categories, such bimodality could have alternative explanations. For example, participants might self-ascribe a role

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[5] An alternative combinatory model of shyness was proposed by Buss (1986) and evaluated by Asendorpf (1989). Socially inhibited behavior is said to result from either stranger-fear or self-consciousness.

as either a talker or a listener in this specific situation (academic discussions). Self-definition and social pressure might then act to reify such categories.

Nonetheless, we don't consider our null results for categories to be a refutation of Kagan's conception of shyness. First, Kagan has not made strong claims about how his childhood categories would play out in adulthood. Second, all of our variables involved ratings rather than objective behavior. Kagan argued that rating scales tend to mask categories. Consistent with his argument, the one multimodal distribution that we observed was on the most objective variable, talk-time. Clearly, behavioral measures are a prerequisite for pursuing the value of categorical measures.

*Additive or distinct components?* Construction of a measure from two orthogonal subscales, as with our additive typological measure, always raises psychometric and theoretical problems (Carver, 1989). The fact that Neuroticism and Introversion made independent contributions to peer-ratings suggests that two distinct categories of behavioral cues are used to attribute shyness (see Pilkonis, 1977a, b). Observers may attribute shyness to nervous people as well as to quiet people. Note that these categories closely resemble discomfort and inhibition, a distinction made by several writers (Buss, 1995; Leary, 1986; Jones *et al.,* 1986).

In fact, the independent contributions of Introversion and Neuroticism to perceived shyness may appear to support Eysenck's belief in two independent forms of shyness. Thus, the application of the same term ''shyness'' to two well-known traits might simply be a semantic mistake. In our opinion, there are a number of reasons to reject this conjecture and conceive shyness as a univocal, primary factor.

*Shyness as a primary factor.* Note first that the contributions of Introversion and Neuroticism are necessarily independent because they are orthogonal. But each superfactor may be catching an edge of a primary factor falling between them. This interpretation is supported by Briggs's (1988) item-by-item analyses of shyness scales. Although items falling closest to Neuroticism concern distress and those falling closest to Introversion concern inhibition, nonetheless, the two groups of shyness items were highly intercorrelated.

Our data support the distinctiveness of shyness in that our direct measures equaled or surpassed the predictive punch of the Eysenckian superfactors or their composite. Metaphorically speaking, the lean, Davidian shyness scales stood toe-to-toe with Goliathan superfactors. The ''leanness'' (specificity) of the Revised Shyness and Social Anxiety scales is evidenced by their high inter-item correlations ($M = .33$ compared to .25 for Introversion and Neuroticism, in our data). The optimal specificity of shyness scales more than compensates for the small number of items.

An indisputable advantage of direct measures is that they minimize false

positives in predicting who is shy. Although we have shown that our additive typological measure can predict shy behavior, this sum of superfactors yields such a broad-band self-report measure that it will also predict a large range of nonshyness behaviors. For example, a sample of high scorers will include some pure introverts and some pure neurotics. Thus, when cautious interpretation of correlates, rather than prediction, is critical, the specificity of primary measures is a clear advantage.

In sum, direct measures of shyness are superior to additive typological measures for reasons of face-validity and emphasis on fidelity to a primary factor rather than broad bandwidth. For these reasons, we believe that direct measures (such as the Revised Shyness and Social Anxiety scales) remain the instruments of choice for assessing shyness via self-report.

## CONCLUSIONS

Using perceived shyness and talk-time as the dependent variables, we found no support for two of the typological approaches to Eysenckian shyness, namely, the interactive and categorical conceptions. And the 24-item additive measure could not outperform the short and direct measures of shyness as a primary trait. Nonetheless, we concede the difficulty of ever demonstrating the superiority of primary over additive conceptions of shyness. After all, any vector can be fully represented by linear combinations of other vectors. Therefore, any psychological variable can be always be measured by a variety of appropriate combinations of other variables.

The discovery of an interactive effect would have made a strong case for primary status. That is, peer-perceived shyness could be argued to be such a fundamental phenotype that the specific combination of traits producing it must be considered to constitute a trait on its own. And there may be other dependent variables that are both fundamental to shyness and show emergenic properties. Heritabilities of objective behavior are likely to be the most convincing. Nonetheless, even indexes of objective behavior will be subject to the lesson learned here and elsewhere (Garcia *et al.,* 1991; Gough & Thorne, 1986; Paulhus and Morgan, 1997): The shy person is a moving target whose manifestations evolve, albeit systematically, over time and audience.

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