Testing Theoretical Relationships and Non-Relationships of Genetically-Based Predictors: Getting Started with Communibiology

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Communibiology has emerged recently as a new paradigm for the study of communication. A model for the study of communibiology is advanced and two studies are presented which exemplify one method of beginning research under this paradigm. The results indicate how theories related to whether variables are or are not genetically based can be preliminarily tested.

Communication scholars predicting trends in interpersonal research anticipate that researchers will increase their biological emphasis by "paying more attention to the growing body of work by geneticists that addresses issues of behavior" (Knapp, Miller, & Fudge, 1994). In recent studies, communication researchers have indeed become interested in explicating communication traits in terms of biology, neurobiology, genetics, and heredity (Beatty, 1998; Beatty & McCroskey, 1998; Beatty, McCroskey, & Heisel, 1998; Horvath, 1995; 1998; McCroskey & Beatty, 1998).

Beatty and McCroskey (1998) coined the term "communibiology" to represent a research paradigm emphasizing the neurobiological foundations of human communication behaviors. The seminal work in communibiology draws largely from the research of personality theorists working under the rubric of "temperament." Bates (1989) defined temperament as "biologically rooted individual differences in behavioral tendencies that are present early in life and are relatively stable across various kinds of situations and over the course of time" (p. 4). Further, Bates (1989) points out that "there is general agreement that temperament is manifest largely in the context of social interaction" (p. 4).

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Over the past decade, biochemical signatures and neurological activity related to behavioral tendencies (typically termed traits) have become more defined. Importantly, much of this research suggests that these biologically-based traits exist in utero, and are usually detectable during the first few minutes of life (e.g., Bates, 1987; Buss, 1989; Buss & Plomin, 1984; Chess & Thomas, 1989; Fox, 1989; Gray, 1991; Kagan, Reznick, & Snidman, 1988; Kagan & Snidman, 1991; Nelson, 1994; Porter & Collins, 1982; Rothbart, 1989; Rothbart, Derryberry, & Posner, 1994; Strelau, 1994).

Personality Structure

In the past ten years, researchers in personality have been reducing the diversity of personality traits into the major structural dimensions of personality. While debate continues over the exact number, it is generally agreed that there are between three and eight dimensions of personality. A theory that has received much attention, in part because it is very parsimonious, is the three dimensional personality structure advanced by Eysenck. Using factor analytic techniques, Eysenck (1991) concluded that the cumbersome array of personality traits can be reduced to a tri-dimensional structure consisting of extraversion-introversion (E), neuroticism-emotional stability (N), and psychoticism- emotional control (P). In essence, these three dimensions embody the range in which individuals interact: cooperativeness and sociability (E), fearful avoidance (N), and hostility/aggression (P) (Eysenck, 1986).

An impressive amount of research indicates that the genetic component of each of these three dimensions is between 50% and 80% (Eaves & Eysenck, 1986; Eysenck, 1991; Eysenck & Eysenck, 1985; Stelmack, 1990; Stelmack & Geen, 1992; Zuckerman, 1995). In addition, other researchers exploring the components of E, N, and P have found similar results (e.g., Bouchard, 1993; Lykken & Tellegen, 1996; Horvath, 1995). Neurobiological research (mainly in psychobiology) has made significant progress in identifying the genetically inherited individual differences in neuroanatomical brain structures and their activation thresholds (Eysenck, 1991; Fowles, 1980; Gray, 1991; Nelson, 1994; Rothbart, Derryberry, & Posner, 1994; Steinmetz, 1994; Stelmack, 1990; Strelau, 1983).

Getting Started with Communibiology Research

Subsequent to the advancement of the basic communibiological paradigm, many individuals have indicated a desire to start doing research in this area. However, looking to the sophisticated efforts in neurobiology and psychobiology as potential models has been very intimidating to most. Most communication researchers are not yet ready to establish laboratories where sophisticated analyses of biological data can be analyzed. Nor are they in a position to establish long-range research programs with populations of identical and non-identical twins as research participants. While these methods are in fact the ways biological influences on human behavior can be conclusively demonstrated, that does not mean that short of such sophisticated work nothing else is possible or useful.

The first data-based paper generated within the communibiological paradigm was provided by Beatty, McCroskey, and Heisel (1998). In this research, communication apprehension was examined in relation to Eysenck's (1991) dimensions of E and N. Communication apprehension, as hypothesized, was found to be highly correlated with E (introversion) and N (neuroticism). Factor analysis and regression analyses depicted a strong relationship between communication apprehension and neurotic introversion. The implications of linking communication apprehension with E and N are to suggest there is a genetic component of communication apprehension (not to prove

that generalization conclusively). If the communibiological paradigm is correct in the logical chain (i.e., that the neurobiology associated with E, N, and P, is associated with communicative traits), then certain applications of this model should produce predictable results. This study provided the first model for communibiological research. The current work sought to expand on that model as an illustration of how communibiological research may get started.

The model used by Beatty, et al. (1998), and illustrated in the studies reported below, includes the following elements: 1) select (or create) a theory which posits an explanation for an element of human communication behavior; 2) relate that theory to specific biological elements and/or process in humans; 3) select (or create) a measure(s) related to those biological elements/processes; and 4) establish the relationship between those measures and relevant communication traits, behaviors, and/or processes. It must be stressed that this is foundational research. Firm conclusions about causation are not possible. However, this type of research can be very helpful in determining the potential viability of newly-advanced theoretical explanations of communication traits, behaviors, and/or processes. Two examples of this type of work are outlined below.

Examinations of Shyness and Teacher Immediacy

In this work we sought to demonstrate the usefulness of the communibiological approach to demonstrate the lack of association of biological systems with communication perceptions and/or behaviors as well as to demonstrate such associations. Good theories need to exclude as well as include biological systems as theoretical predictors of communication-related variables.

With regard to including biological systems as predictors (much as Beatty, et. al, 1998, illustrated previously) we reasoned that if communication apprehension is correlated negatively with extraversion, and positively with neuroticism, it is likely that related constructs are similarly associated. McCroskey and Richmond (1982) first outlined the theoretical relationship with and distinction between communication apprehension and shyness. Essentially, communication apprehension is the theoretical result of fear and/or anxiety, whereas shyness may result from these factors or a variety of other origins. McCroskey and Richmond (1982) conclude that the relationship between communication apprehension and shyness (defined as a reduced amount of communication behavior) is a general/specific distinction (with shyness being a broader construct and CA being one of the causes of shyness). Communication apprehension was correlated with self-reported shyness at r=.59. This suggests that the shyness construct should be similarly related to E and N, probably not P--unless P is substantially associated with some other biological system not yet isolated. The current research, of course, is not the first to examine possible genetic indicators of shyness. Although defined and measured differently than in the present work, researchers outside the field of communication have generated strong evidence for the genetic basis of shyness and related constructs (e.g., Bell, Amend, Kasniak, Schwartz, Peterson, Stini, Miller, & Selhub, 1995; Fones, Manfro, & Pollack, (1998), Fyer, 1993). Our purpose here is not to "break new ground," but rather to illustrate how initial investigations may be conducted to determine whether more sophisticated (and vastly more costly) investigations would be worth pursuing. Hence, we chose an area where we were virtually positive of the outcomes prior to conducting the study.

Study 1: Shyness. A survey of 216 students enrolled an introductory service course in communication studies at a large Eastern university was conducted. Participants were asked to complete measures of E, N, P (Eysenck, 1986; Eysenck & Eysenck, 1985) and the

McCroskey Shyness Scale (McCroskey & Richmond, 1982). This is a 14-item, Likert-type scale. The means, standard deviations, and reliabilities for each of the constructs are presented in Table 1.

TABLE 1
Means, Standard Deviations, and Reliabilities: Study 1

	Mean	S.D.	Alpha
E	37.75	6.05	.83
N	26.23	7.84	.86
P	25.31	5.58	.69
Shyness	40.35	11.05	.92

The results indicate, when corrected for attenuation, shyness correlated significantly with extraversion and neuroticism, but non-significantly with psychoticism (see Table 2). To further test these relationships, a regression analysis using E, N, and P to predict shyness accounted for 45 percent of the variance ($mr = .67$, $r^2 = .45$, $F = 148.96$; $df = 3/212$; $p < .01$). Both E and N accounted for unique variance in the model, P did not (E and N were significantly correlated and most of the variance predictable by N was collinear with that predicted by E). The results provide additional evidence to support the findings of Beatty, McCroskey, and Heisel (1998) and the communibiological theory upon which our hypotheses were based. Most importantly, they illustrate one approach to exploratory research which scholars may chose to follow in the early stages of communibiological research efforts.The results indicated, when corrected for attenuation, shyness correlated significantly with extraversion and neuroticism, but non-significantly with psychoticism (see Table 2).

TABLE 2
Correlations Between E, N, P, and Shyness**

	E	N	P
Shyness	-.67 (-.77)*	.24 (.27)*	.08 (.10)
E	-.30 (-.34)*	.20 (.23)	
N	.02 (.04)		

* $p < .01$
** Correlations in parentheses are corrected for attenuation.

Study 2: Student Perceptions of Teacher Immediacy. While there was a theoretical rationale and substantial solid data to justify our expectation that communication apprehension and shyness are related to the Eysenck dimensions, it would not be expected that these genetically-based predictors would be correlated with every imaginable variable. Hence, it is reasonable to ask, What is not related to E, N, and P? To address this question, we decided to investigate student perceptions of teacher nonverbal immediacy.

A large body of research has accumulated which indicates teachers who are perceived by their students as nonverbally immediate are much more successful in terms of student learning and report more positive student evaluations of that teacher. The operating assumption in this research is that the students' perceptions are (at least primarily) the product of the teachers' immediacy behaviors. If these perceptions were to be found to be largely a function of biological systems in the students (rather than those in the teachers) this would seriously challenge current theories related to teacher immediacy. We did not think such a link would exist with Eysenck's personality dimensions and their biological bases. Hence, no relationship should be expected to be found between E, N, or P and student perceptions of their teacher's nonverbal immediacy. This, of course, is not to suggest that perceptions of teacher nonverbal immediacy are totally unrelated to all neurobiological systems in students--just to the systems under study which are manifested in E, N, and P. It is very likely that biological systems relating to attention may impact the way students perceive immediate teachers, for example. At present, those systems have not been elucidated in immediacy theory. In advance of doing so, therefore, it would be useful to be able to exclude biological systems that show a weak likelihood of being relevant. The following study is an example of how that may be done.

A survey of 219 students (not including any participants in the previous study) enrolled in an introductory service course in communication studies at a large Eastern university was conducted. Students responded to Eysenck's measures of E, N, and P, and a measure of teacher immediacy for the teacher they had in a class previous to the one in which they were enrolled (a common method used to insure a wide variety of teachers being reported on in previous research). Alpha reliabilities, means, and standard deviations for the measures are presented in Table 3.

TABLE 3
Means, Standard Deviations, and Reliabilities: Study 2

	Mean	S.D.	Alpha
E	37.82	5.49	.80
N	25.33	7.63	.86
P	26.43	5.56	.68
Immediacy	28.57	6.89	.82

Raw correlations between teacher immediacy and E, N, and P ranged from -.13 to .08 (for raw correlations and those corrected for attenuation, see Table 4). Even when corrected for attenuation, these correlations suggested there is no meaningful relationship between E, N, or P (and their biological correlates) and perceptions of teacher immediacy. To further test the relationships, a regression analysis was conducted with E, N, and P predicting perceptions of teacher immediacy ($mr = .14$, $r^2 = .02$, $F = 1.37$; $df = 3/215$; $p = .37$). Not surprisingly, E, N, and P were all nonsignificant in the equation (power for observing small effects in these analyses was > .90). These findings suggest that there is little or no direct contribution of E, N, or P in predicting student perceptions of teacher immediacy.

TABLE 4
Correlations of E, N, P, and Teacher Immediacy**

	E	N	P
Immediacy	.08 (.10)	-.08 (-.10)	-.13 (-.17)
E	-.27 (-.33)*	-.07 (-.09)	
N	.10 (.13)		

* $p < .01$
** Correlations in parentheses are corrected for attenuation.

Implications for the Communibiological Paradigm

Clearly, there are limitations to the use of E, N, and P. Not every communication construct will be manifest in these three temperament constructs, nor will all behavioral tendencies be manifest in the Behavioral Activation System, Behavioral Inhibition System, or Fight or Flight System (thought to be the bases of E, N, & P). Rather, the communibiological paradigm emphasizes the necessity of explicating communication processes and constructs in terms of the related biological components and processes. Proponents of the communibiological perspective argue that communication is a biological process, thus viable communication theories must reflect the actual functioning of human biological systems (Beatty, et al., 1998). While not all current theories suggest what biological components and processes underlay their operation, those which do not must remain suspect until these relationships are delineated and tested. Such testing may ultimately involve very complex and expensive research efforts. Prior to undertaking such efforts, research such as the small studies reported here will be useful in determining where research seeking more conclusive efforts should be directed.

Future Directions of Communibiological Research

The model for communibiological research outlined above is an initial model for getting started with research in this new paradigm. It is not presumed to be the "only way" to do communibiological research. This research model has only been employed so far with one operationalization (Eysenck, 1991) of one approach to the neurobiology of temperament (Gray, 1982, 1987, 1990, 1991). Other operationalizations may be even more informative (e. g., McCrae & John, 1992). In addition, temperament is only one of the many aspects of human beings which may be related to communication, and it may not even be the most important aspect.

Communibiology represents a new vision and new direction for communication scholars. The paradigm offers an integrative approach to communication in a bio-social context. It makes little sense to separate the biological mechanisms from their behavioral manifestations. In order to truly understand communication behaviors and processes, it is necessary to understand the biological and biochemical antecedents and concomitants of these processes. While the communibiological paradigm is still in its infancy, the initial investigations offer compelling support for the value of the paradigm. Vastly more research is needed to determine the extent to which communication traits and processes are associated with specific biological processes. Getting to the level of the complex research needed to accomplish these ultimate objectives will be difficult. Small steps to get started, such as the ones described here, are important beginnings for the long distance we have to travel.

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