
Applying the Interpersonal Circumplex to Children's Behavior: Parent-Child Interactions and Risk Behaviors

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This article examined the applicability of the interpersonal circumplex (IC) to the observable social behaviors of children during parent-child interactions. In Study 1, the observational ratings of behaviors of 117 children (mean age = 9.88 years) were examined. Randomization tests of hypothesized order relations found that these behaviors tended to occur in the circular pattern predicted by the IC. To illustrate the applicability of the IC to children's behavior, Study 2 (n = 94) used the circular structure of children's behavior to longitudinally examine children's participation in two risk behaviors, smoking cigarettes and consuming alcohol. Results indicated that children who behaved in an arrogant-calculating manner were at risk for smoking cigarettes and children who behaved in an assured-dominate manner were at risk for drinking alcohol 1 year later. Implications of these results are discussed in terms of their relevance for helping researchers better understand and categorize children's interpersonal behaviors.

Keywords: *interpersonal; circumplex; children; risk behavior*

Imagine that a mother and her 10-year-old son are seated next to each other at a table in a psychology laboratory. The mother is attempting to cooperate with her son to complete a task assigned to them by a researcher. During their collaboration on this task, the child orientates himself in his chair to face away from his mother. When he speaks to his mother, he always uses a loud voice while looking down at the floor. When the mother speaks, the child often interrupts or else seems to ignore what she is saying. These and other observable behaviors provided by the child during this type of interaction are a

potentially rich source of data. By drawing on information obtained from these observed interpersonal behaviors, it is possible to make assumptions about various personality characteristics that this child might possess (e.g., the child is somewhat cold and dominating). Such implicit personality assumptions seem to occur automatically when observing a child interacting with a parent; we are able to observe a number of different behaviors, figure out what the manifestations of these many behaviors might tell us about a child, and then make some conclusion about a child's personality. As laypersons, we seem to have succeeded in creating an implicit model of children's behavior that allows us to accomplish these tasks. As researchers, it would be useful to create an explicit and empirically based model of children's interpersonal behaviors that can be used to better understand and categorize the behaviors children exhibit while interacting with their parents.

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An explicit model of children's interpersonal behaviors would benefit researchers' attempts to reduce the multitude of particular interpersonal behaviors exhibited by a child (e.g., body orientation, loudness of voice, eye contact, etc.) into categories that are more meaningful, reliable, and communicable (e.g., dominance, warmth, etc.). Such a model also has the potential to contribute to the prediction of other diverse and often consequential behaviors (e.g., participation in risky behaviors). This article will examine the observable social behaviors of 10-year-old children while they interact with their parents to identify an explicit model of children's interpersonal behavior. To illustrate how such a model can be used by researchers, the behavioral model will then be used to examine children's participation in health-compromising behaviors 1 year later.

Models of adults' interpersonal behaviors shed some light on the possible structure of children's behaviors in social interactions. Through systematic observations of adults in social interactions, researchers at the Kaiser Foundation (Freedman, Leary, Ossorio, & Coffey, 1951; Leary, 1957) concluded that interpersonal behaviors can be arranged on a circular continuum known as the interpersonal circumplex (IC). This circumplex structure asserts that interpersonal behaviors vary along a circular continuum and are orientated by the primary dimensions of dominant-submissive (i.e., dominance) behavior and hostile-friendly (i.e., warmth) behavior. Although the IC has gone through a number of slight revisions by various researchers (e.g., Kiesler, 1983; Strong et al., 1988; Wiggins, 1982), there tends to be agreement concerning its basic structure. Figure 1 displays the circular ordering of the eight-octant behaviors presented by Wiggins, Trapnell, and Phillips (1988). In this ordering, behaviors that fall close together are expected to be more positively related than behaviors that fall further apart, behaviors at right angles are unrelated, and behaviors at the opposite poles of a diameter are negatively related (see Wiggins, 1996, for a comprehensive history of the IC).

The IC presented in Figure 1 implies that the eight octants arranged around the circumplex represent different blends of the two dimensions of dominance and warmth. For example, extraversion is depicted as a blend of dominance and warmth, whereas arrogance is a blend of dominance and hostility (low warmth). By considering these dimensions together, the IC provides a potentially useful elaboration of two traits of the Five Factor model (FFM; Digman, 1990; Goldberg, 1990; McCrae & Costa, 1995). Specifically, the two primary dimensions of the IC seem to represent approximate 45° rotations of the FFM traits of extraversion and agreeableness (McCrae & Costa, 1989; see Figure 1). Previous studies suggest these two traits are useful for accurately describ-

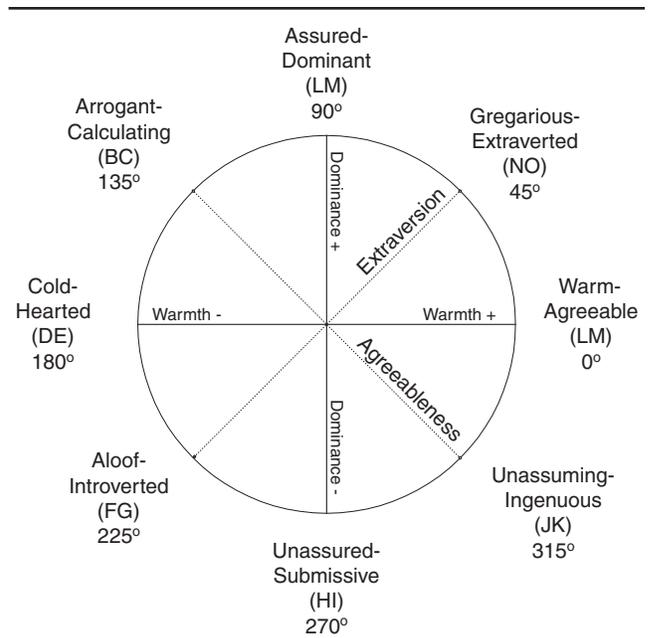


Figure 1 Wiggins, Trapnell, and Phillips's (1988) interpersonal circumplex.

ing children's personalities (P. M. Markey, Markey, & Tinsley, 2002; Parker & Stumpf, 1998) and are associated with a variety of psychosocial and health outcomes during childhood (e.g., Huey & Weisz, 1997; Jensen-Campbell et al., 2002; John, Caspi, Robins, Moffitt, & Stouthamer-Loeber, 1994; C. N. Markey, Erickson, Markey, & Tinsley, 2001; Persegani et al., 2002). Such findings suggest that although the two-dimensional IC has traditionally been used to examine the behavior of adults, it seems probable that its circular structure might also be applicable to children.

To examine the generalizability of the IC to a younger population, pioneering research by Becker and Krug (1964) and Schaefer (1961, 1997) used questionnaires to demonstrate that both teacher and parent ratings of children's behavior tended to occur in a manner predicted by the IC. Although these teacher and parent reports of children's behavior suggest that the IC could be useful for describing children's behavior, such research is methodologically limited. Questionnaire studies using well-acquainted raters are potentially susceptible to idiosyncratic and systematic errors including enhancement, deception, and halo effects (Kenny, 1994). It is also important to determine if the circular structure found in these studies reflects the true structure of children's behavior or simply reflects a preexisting cognitive structure maintained by adults (Shweder & D'Andrade, 1979). As a result of such concerns, it is difficult to determine if the relations found in these studies are primarily due to response biases or if they reflect how children actually behave. These concerns could be

greatly reduced by having unacquainted judges code observable interpersonal behaviors of children during videotaped interactions.

To the authors' knowledge, no studies have previously attempted to determine the extent to which interpersonal behaviors displayed by children during videotaped interactions conform to the IC. However, several studies examining the behaviors of adults confirmed the conclusions of the Kaiser Foundation: Observed interpersonal behaviors occur in a manner predicted by the IC (Gifford, 1991, 1994; Gifford & O'Connor, 1987; Strong et al., 1988; Tracey, 1994). For example, P. M. Markey, Funder, and Ozer (2003) used unacquainted judges to code the videotaped behaviors of college students as they interacted for 5 minutes with a peer. Analyses of these ratings revealed that the observed interpersonal behaviors of college students tended to occur in the circular pattern predicted by the IC. This research extends past findings by providing evidence that the circumplex structure is not merely due to response biases but is a valid representation of the manner in which interpersonal behaviors are actually related. The current study uses a similar behavioral methodology to determine the extent to which the IC can be applied to children's observed behaviors.

The remainder of this article presents both a methodological technique for measuring children's behavior during parent-child interactions using the framework provided by the IC and an example of how this model can be used by researchers. Study 1 will examine the extent to which the circular structure of interpersonal behaviors presented in Figure 1 can be geometrically and statistically modeled using unacquainted judges as the raters of children's behaviors. Study 2 will illustrate how this model of interpersonal behavior can be applied by researchers to longitudinally examine children's participation in the risk behaviors of smoking and alcohol consumption. Such findings will not only help demonstrate the validity of the IC as a measurement model of children's behavior during parental interactions but also its potential utility for predicting children's participation in health-compromising behaviors.

STUDY 1

Assessing Children's Behavior During Parental Interactions With the Interpersonal Circumplex

To gain insight into the structure of children's interpersonal behavior, judges will rate the observed interpersonal behavior of children during videotaped interactions with their parents. By examining these behavioral ratings at the level of the eight octants presented in Figure 1, it is hypothesized that these behavioral observations will occur in a manner predicted by

the IC. In addition, the circumplex model suggests that these octant behavioral ratings can be used simultaneously to compute dimensional scores for warmth and dominance. Dimensional scores can be computed using the following geometric formulas (Wiggins & Broughton, 1991):

$$\begin{aligned} \text{Dominance Dimension} &= (.3) \sum Z_i \sin\theta_i \\ \text{Warmth Dimension} &= (.3) \sum Z_i \cos\theta_i \end{aligned}$$

where Z_i represents the standardized score of the i th octant, and θ_i is the angle of the i th octant. Using the circular structure of the octants in this manner increases the number of behavioral items used to estimate the dimensional scores, thereby increasing the overall reliability of the behavioral observations and creating a more powerful measurement of children's interpersonal behavior than if these behaviors were examined separately.

Method

PARTICIPANTS AND PROCEDURES

In Study 1, 117 preadolescent children participated when they were in the fourth grade ($M = 9.88$ years of age). Approximately half of the children were female (52 females, 44%) and half were male (65 males, 56%). Both mothers and fathers were invited to participate in the study with their child, and at least one parent was required to participate in the study. In 64 (55%) families, both parents participated, and in 53 (45%) families, only the children's mothers participated. Participants in the current sample were either of Euro-American (72%) or Mexican American ethnicity (28%).

Family interactions. Each child participated in an interaction task with his or her parent(s) when the child was in the fourth grade. These interactions lasted approximately 15 minutes each and were videotaped with the participants' knowledge. During these interactions, families were instructed to use the supplies provided (pens, paper, ruler, etc.) to create a "health graph" that documented some of the life experiences of the child participating in the project. Family members were instructed to work together to record experiences in the child's life (e.g., beginning to walk, starting school, coping with a broken bone, etc.). Families were provided with an imaginary child's graph that served as an example, helped prompt conversation, and facilitated completion of this task. This task was designed to be open ended and proved to evoke widely varied behaviors from children, mothers, and fathers.¹

Behavioral coding. A personality psychologist and a developmental psychologist independently watched the first 5 minutes of each videotaped interaction and rated the children's behavior using a modified version of the

Riverside Behavioral Q-Sort (RBQ; Funder, Furr, & Colvin, 2000). Behavioral codes provided by the RBQ have been successfully used in the past to examine behavioral manifestations of various psychological characteristics (e.g., Creed & Funder, 1998; Funder & Colvin, 1991; Furr & Funder, 1998), to code the behavior of children (P. M. Markey, Markey, & Tinsley, 2004), and to study the circular structure of adult interpersonal behaviors (P. M. Markey et al., 2003). The 64-item RBQ consists of items designed to measure behaviors at a midlevel of generality between narrowly defined motor activities and more abstract styles of behavior. Because the RBQ was originally created to code the behaviors of individuals interacting with unrelated partners, the wording of several items was modified to indicate that children were interacting with “parent(s)” instead of “partner(s)” (e.g., “Seeks reassurance from *partner*” was changed to “Seeks reassurance from *parent[s]*”). Each item was written on a card, and after watching a videotaped interaction, judges separately described their general impressions of each behavior by ordering these cards into a forced choice, quasi-normal distribution. Each card was placed in one of nine categories indicating the degree to which the item was characteristic of the child’s behavior. Cards placed in Category 1 indicated behaviors that were extremely uncharacteristic of the child, those placed in Category 5 were behaviors that were neither characteristic nor uncharacteristic of the child, and behaviors placed in Category 9 indicated those behaviors that were extremely characteristic of the child.

The RBQ was originally designed to measure both interpersonal behaviors (e.g., “Exhibits condescending behavior”) and intrapersonal behaviors (e.g., “Aware of being on camera or in experiment”). Therefore, not all RBQ behaviors were clearly relevant to children’s interpersonal behaviors. To examine the behaviors that would likely be related to the IC, three RBQ items were selected that seemed to best represent each octant of the circumplex as defined by Wiggins et al. (1988; see Figure 1). These three items were then used to create a composite score for each octant (see Table 1). These same items have been used previously to successfully demonstrate that the interpersonal behaviors of adults occur in a manner predicted by the IC (P. M. Markey et al., 2003).

Results and Discussion

RELIABILITY AND INTERJUDGE AGREEMENT OF THE INTERPERSONAL CIRCUMPLEX

Because three behavioral items were selected to measure each octant, it was expected that the reliability of any single octant would be modest. As anticipated, the average three-item composite reliability of the octants was .76 for Judge 1 and .71 for Judge 2 (see Table 2). However, by applying the geometric formulas discussed

TABLE 1: Items Used to Define Each Riverside Behavioral Q-Sort (RBQ) Octant Scale

(PA) Assured-dominant	57. Speaks in a loud voice
	5. Tries to control the interaction
	6. Dominates the interaction
(BC) Arrogant-calculating	18. Talks at rather than with parent (e.g., conducts a monologue, ignores what parent says)
	28. Exhibits condescending behavior (acts as if self is superior to parent)
	55. Emphasizes accomplishments of self, family, or housemates
(DE) Coldhearted	61. Seems detached from the interaction
	20. Expresses criticism (of anybody or anything)
	35. Expresses hostility (to anyone or anything)
(FG) Aloof-introverted	14. Exhibits an awkward interpersonal style (e.g., mumbles, has difficulty knowing what to say)
	23. Shows physical signs of tension or anxiety (e.g., fidgets nervously, voice wavers)
	37. Behaves in a fearful or timid manner
(HI) Unassured-submissive	51. Gives up when faced with obstacles
	22. Expresses insecurity (e.g., seems touchy or overly sensitive)
	27. Seeks reassurance from parent (e.g., asks for agreement, fishes for praise)
(JK) Unassuming-ingenuous	4. Is interested in what parent has to say
	19. Expresses agreement frequently
	30. Seeks advice from parent
(LM) Warm-agreeable	8. Exhibits social skills
	33. Expresses warmth (to anyone)
	29. Seems likeable
(NO) Gregarious-extraverted	16. Shows high enthusiasm and high energy levels
	21. Is talkative
	63. Acts playful

earlier, it is possible to concurrently use the octant scales to compute dimensional scores for warmth and dominance. Combining these scales increases the number of behavioral items used to measure each dimensional score, permitting the calculation of more reliable assessments of children’s behavior than when the octant scales are examined separately.

Because the octant scales are expected to be related to each other in a circular manner rather than linearly, traditional methods for computing reliability are not applicable. However, the reliability of these dimensional scores can be calculated with the following formula (Nunnally & Bernstein, 1994):

$$r_{yy} = \frac{\sum b_i^2 - \sum b_i^2 r_{ii}}{\sigma_y^2}$$

where r_{yy} is the reliability of dimension y , b_i is the weight of the i th octant when used to compute dimension y , r_{ii} is

TABLE 2: Reliabilities and Interjudge Agreement of Each Riverside Behavioral Q-Sort (RBQ) Octant Scale and Dimensional Score

	<i>Reliability</i>		<i>Agreement (r)</i>
	<i>Judge 1</i>	<i>Judge 2</i>	
Assured-dominant (PA)	.81	.75	.78
Arrogant-calculating (BC)	.69	.71	.78
Coldhearted (DE)	.69	.69	.70
Aloof-introverted (FG)	.79	.80	.84
Unassured-submissive (HI)	.68	.71	.67
Unassuming-ingenuous (JK)	.77	.65	.74
Warm-agreeable (LM)	.86	.75	.80
Gregarious-extraverted (NO)	.73	.65	.70
Warmth dimension	.93	.91	.89
Dominance dimension	.92	.90	.85

the reliability of the i th octant, and σ_y^2 is the variance of the sum of the weighted octants for dimension y . As seen in Table 2, when the aforementioned formula is applied to judges' ratings, the dimensional reliabilities for warmth and dominance were high for both Judge 1 (.93 and .92, respectively) and Judge 2 (.91 and .90, respectively).

The model of behavior provided by the IC allows behavioral observations to be combined, thereby increasing the overall reliability of behavioral assessments. This advantage is reflected in the interjudge agreement. The average judge agreement at the level of a single behavior was $r = .55$. However, when behaviors were aggregated at the level of the octant, the average agreement increased to $r = .75$. At the level of the dimensional scores, this agreement increased even further; judges' agreement for warmth was $r = .89$ and for dominance was $r = .85$. It is important to note that this level of agreement was obtained by judges who were unacquainted with the targets and watched only 5 minutes of videotaped parent-child interactions. Thus, the IC provides a taxonomy for aggregating children's interpersonal behaviors into octants, a model that hypothesizes the extent to which these octants are related, and a means of increasing the reliability of judges' behavioral ratings and interjudge agreement.

CONFIRMATION OF THE CIRCULAR STRUCTURE OF CHILDREN'S INTERPERSONAL BEHAVIORS

If the behaviors exhibited by children failed to conform to the circular structure suggested in Figure 1, the aforementioned analyses concerning reliability and interjudge agreement would be inconsequential. Due to the sufficiently high judge agreement, the remainder of the analyses aggregated judges' ratings at the level of the octants. If the eight octants conform to the circular structure suggested by the IC, the dimensional scores of warmth and dominance calculated from these octants

should be orthogonal. To examine this assumption, dimensional scores were computed for each child using the geometric formulas presented earlier. As expected, the relation between the dimensions of warmth and dominance was extremely low ($r = .03$, $p = .77$).

A more precise way to assess the extent to which the octants conform to a circular structure is to examine whether the eight-octant scales are related to each other in a manner predicted by the IC. Implicit in the circular ordering of the eight behavioral octants presented in Figure 1 are predictions of the manner in which these octants are correlated. Specifically, correlations of octants more proximal on the circle are predicted to be greater than the correlations of octants more distal. The correlations for the octants separated by 45° (e.g., PA and BC, BC and DE, DE and FG, etc.) should be greater than the correlations for the octants separated by 90° (e.g., PA and DE, BC and FG, DE and HI, etc.), creating a total of 64 order predictions; the correlations for the octants separated by 90° should be greater than the correlations for the octants separated by 135° (e.g., PA and FG, BC and HI, DE and JK, etc.), yielding 64 predictions; and the correlations for the octants separated by 135° should be greater than the correlations for the octants separated by 180° (e.g., PA and HI, BC and JK, DE and LM, etc.), creating another 32 order predictions. By implication, the circular structure also suggests that the correlations of octants separated by 45° will be greater than those separated by 135° (creating 64 predictions) and those separated by 180° (creating 32 predictions); and the correlations of the octants separated by 90° will be greater than the octants separated by 180° (creating 32 predictions). Therefore, the circular structure implied in Figure 1 generates a total of 288 order predictions.

To evaluate the fit of the circular model presented earlier to the observed correlation matrix, the confirmation or violation of the 288 order predictions was examined using the randomization test of hypothesized order relations (Hubert & Arabie, 1987; Rounds, Tracey, & Hubert, 1992). This test yields an exact probability of obtaining the predicted order among the correlations in the observed data matrix under the null hypothesis that the eight-octant scales are relabeled at random; no assumptions about the independence of the order predictions are made. The probability associated with the randomization test corresponds to the proportion of predictions met by the correlation matrix displayed in Table 3 versus the number of predictions met with random labeling. In a correlation matrix with eight variables, there are a total of $8!$ (40,320) possible random matrices that can be compared to the original data matrix. The fit of these random matrices to the hypothesized order predictions serves as the comparison distribution for evaluating the fit of the original matrix. In the

current study, the randomization test was significant ($p = .0004$), with none of the random matrices fitting the predicted order relations better than the original matrix. Hubert and Arabie (1987) provided a correspondence index (CI) that serves as an index of fit of the original matrix with the order predictions. The CI is the number of agreements of the original matrix with the order predictions minus the number of disagreements divided by the total number of predictions made. The CI is a version of the Somers (1962) d statistic and can range from +1 (perfect fit) to -1 (no predictions were met), with a CI of 0.0 indicating that the number of predictions met is equal to the number violated. In the correlation matrix presented in Table 3, of the 288 order predictions, only 5 were not confirmed, resulting in a CI of .97. The randomization test and corresponding CI demonstrated that the observed interpersonal behaviors of these children occurred in a circular manner that was predicted by the IC.

Study 1 presented a methodological technique for assessing children's interpersonal behaviors and examined the extent to which these behaviors conform to the circular structure presented in Figure 1. With unacquainted judges coding the behaviors of children interacting with their parents, it was determined that the pattern of interpersonal behaviors displayed by these children during parental interactions was strongly (CI = .97) predicted by the IC. Both the taxonomy of the octants provided by the IC and the circular structure that predicts how these octants are related to each other provided some distinct psychometric advantages due to aggregation. Specifically, reliability tended to increase when moving from the level of the octant (average reliability = .73) to the level of the dimension (average reliability = .91), and interjudge agreement increased when moving from the level of the item (average $r = .55$), to the octant (average $r = .75$), to the dimension (average $r = .87$).

STUDY 2

Relating the Interpersonal Circumplex to Children's Risk Behaviors

Although determining the structure of children's interpersonal behaviors during parental interactions has important theoretical and measurement implications, this structure may also be used to examine important and potentially consequential behaviors occurring outside of social interactions with parents. Past research has demonstrated that brief behavioral observations, made even during a limited context, give insight into relatively stable characteristics of an individual's personality (Borkenau, Mauer, Riemann, Spinath, & Angleitner, 2004; Funder & Sneed, 1993; P. M. Markey et al., 2004).

Research also indicates that teachers, peers, and parents often agree with each other when describing the personality of a child (e.g., Barbaranelli, Caprara, Rabasca, & Pastorelli, 2003; Winsler & Wallace, 2002), suggesting that children behave in a relatively consistent manner across different situations. These findings imply that the behaviors exhibited by a child during interactions with parents can be useful indicators of a child's personality and may provide information about children's behavior in different contexts.

This second study examines the extent to which the IC, derived from the observable behaviors of 10-year-old children during a parental interaction, can be used to examine children's participation in the risk behaviors of cigarette smoking and alcohol consumption 1 year later. Identifying correlates of children's involvement in these risk behaviors is important for various reasons. Early alcohol consumption may have a direct negative impact on health and may precede patterns of alcohol misuse; alcohol consumption has been indirectly associated with violence, sexually transmitted disease, unintentional injuries, teen pregnancy, and school failure (U.S. Department of Health and Human Services, 2000). In addition to alcohol consumption, cigarette smoking is gaining increasing attention as one of the most health-compromising behaviors in which children participate (C. N. Markey, Markey, & Tinsley, 2003). Cigarette smoking is often referred to as the most common preventable cause of death in the United States (U.S. Department of Health and Human Services, 2000). Furthermore, research indicates that the earlier children begin smoking cigarettes, the greater the likelihood they will continue smoking throughout their lifetime (Everett et al., 1999).

Popular and scientific conceptions of young people's risk behaviors indicate that some children are more at risk for participating in risky behaviors than others (Jessor, 1998). Predictors of which children are most likely to participate in risk behaviors include a variety of social influences (e.g., low parental monitoring and association with deviant peers) (C. N. Markey et al., 2001; Tinsley, Markey, Ericksen, Kwasman, & Ortiz, 2002). Research also provides support for consistent relations between youths' personalities and participation in risk behaviors (e.g., John et al., 1994; C. N. Markey et al., 2001). Specifically, the FFM traits related to the IC (extraversion and agreeableness) have commonly been related to children's risky behaviors. Extraversion has been associated with externalizing behaviors and delinquency among youths (e.g., John et al., 1994), whereas agreeableness appears to be inversely associated with risky behaviors and delinquency among youths (John et al., 1994; C. N. Markey et al., 2001). Furthermore, at least one study (C. N. Markey et al., 2001) suggested that

TABLE 3: Intercorrelation Matrix of the Riverside Behavioral Q-Sort (RBQ) Octant Scales

	PA	BC	DE	FG	HI	JK	LM	NO
PA (Assured-dominant)	—							
BC (Arrogant-calculating)	.48*	—						
DE (Coldhearted)	-.03	.64*	—					
FG (Aloof-introverted)	-.45*	.10	.57*	—				
HI (Unassured-submissive)	-.63*	-.25*	.28*	.80*	—			
JK (Unassuming-ingenuous)	-.46*	-.78*	-.60*	-.06	.27*	—		
LM (Warm-agreeable)	-.28*	-.76*	-.76*	-.48*	-.14	.68*	—	
NO (Gregarious-extaverted)	.50*	-.11	-.60*	-.80*	-.74*	-.05	.31*	—

NOTE: $df = 115$.* $p < .05$.

the combined effects of personality and parenting behaviors may be important in determining youths' participation in risky behaviors; children who experience less parental monitoring than their peers and who possess personality qualities including extraversion and disagreeableness appear to be most at risk for experimenting with illicit substances.

The following study will expand on the aforementioned findings by examining the circular pattern of children's behaviors while interacting with their parents in relation to children's participation in the risk behaviors of smoking and alcohol consumption 1 year later. Because even brief behavioral observations seem to offer insight into individuals' personalities (Borkenau et al., 2004; Funder & Sneed, 1993; P. M. Markey et al., 2004), it seems likely that behavioral observations of children during parent-child interactions will provide information about the relatively stable characteristics of their personalities. Due to the relationship between the IC and the FFM traits of extraversion and agreeableness (McCrae & Costa, 1989) and past research linking these FFM traits to risky behavior (e.g., John et al., 1994; C. N. Markey et al., 2001), it is expected that children who behave in a manner consistent with top of the circumplex (i.e., the NO, PA, or BC octants; see Figure 1) will be more likely to later engage in risky behaviors than do children who do not behave in this manner.

Method

PARTICIPANTS AND PROCEDURE

Participants in the current study were the same participants from Study 1. One year after participating in the previous study, children were asked to complete the Risk Behavior Assessment (C. N. Markey et al., 2001); of the 117 children in Study 1, 94 completed the risk assessment ($M = 10.87$ years of age). Of interest in the current study were responses to two items focusing on the potentially health-compromising behaviors of smoking and alcohol consumption. For each of these items, children responded yes or no, indicating whether they had partic-

ipated in the behavior (coded 1 or 0, respectively). Data revealed that 9% of these 11-year-old children reported having smoked a cigarette and 22% reported consuming alcohol; only 3 children reported engaging in both risk behaviors.

Results and Discussion

In Study 1, the eight-octant scales measured by the RBQ were found to be interrelated in a manner predicted by the IC. This second study simultaneously used these eight-octant scales to predict participation 1 year later in cigarette smoking and alcohol consumption. By examining these scales simultaneously instead of separately, not only is there a substantial increase in reliability and interjudge agreement, there is also a decrease in the likelihood of Type I errors occurring. In addition, this model of behavior allows patterns of interpersonal behaviors related to these outcomes to be detected much more easily than if single behavioral items are examined separately. In an eight-octant circumplex, the pattern of correlations between the octants and each of the two risk behaviors should take on a sinusoidal form, as illustrated in the following formula (Gurtman, 1992):

$$r_i = e + a (\cos(\theta_i - \theta))$$

where r_i is the expected correlation of a risk behavior with octant I, e is the elevation of the curve, a is the amplitude of the curve, θ_i is the angle of octant I, and θ is the angular displacement of the curve.

The elevation of the curve represents the risk behavior's average correlation with the octant scores. In the current data, the elevation for smoking was .06 and .01 for alcohol consumption. The amplitude of the curve represents the highest positive correlation of each risk behavior with the eight-octant scores minus the elevation of the curve. The amplitude of a risk behavior can be calculated using the following formula (Wiggins & Broughton, 1991):

$$\text{amplitude} = [(r_{cv})^2 + (r_{av})^2]^{1/2}$$

where r_{cv} is the correlation between the dominance dimension and the risk behavior and r_{av} is the correlation between the warmth dimension and the risk behavior. Because the dimensions of dominance and warmth are theoretically orthogonal, it is possible to interpret the amplitude of a risk behavior in a manner similar to a multiple R . The correlations between the dimensional scores of dominance and warmth and the risk behaviors of alcohol consumption and smoking are presented in Table 4. Applying these correlations to the previous formula, the amplitude for smoking was .41, and the amplitude for alcohol consumption was .39. The sizes of these amplitudes are comparable to results traditionally obtained with questionnaire data (e.g., Wiggins & Broughton, 1991).

The angular displacement of the curve is the point at which each risk behavior has its highest positive correlations with the IC and represents the angular location of the risk behavior on the circumplex. The angular displacement of a risk behavior is calculated using the following formula (Wiggins & Broughton, 1991):

$$\text{angular displacement} = \arctan (r_{cv} / r_{av})$$

where r_{cv} is the correlation between the dominance dimension and the risk behavior and r_{av} is the correlation between the warmth dimension and the risk behavior.

Using the correlations presented in Table 4, the angular displacement for smoking was 139°, and the angular displacement for alcohol consumption was 91°. By applying these values to the sinusoidal formula presented earlier, it is possible to create a graphical representation of these results. The relations between the eight-octant scales and smoking and alcohol consumption are displayed in Figure 2. These behavioral profiles provide a graphic summary of the interpersonal behaviors displayed by children who later reported participating in a risk behavior. As shown in Figure 2, children who smoked cigarettes were likely to behave in an arrogant-calculating manner ($r = .47$) and consistent with the circumplex model, were unlikely to behave in an unassuming manner ($r = -.35$). Figure 2 also demonstrates that children who consumed alcohol tended to behave in an assured-dominant manner ($r = .40$) and were unlikely to have behaved in an unassured-submissive manner ($r = -.38$).

Results from these analyses indicated that unacquainted judge ratings of the interpersonal behaviors expressed by 10-year-olds in a very short period of time (5 minutes) were related to children's participation in the risk behaviors of smoking and alcohol consumption 1 year later. Although the IC predicted both these risk behaviors equally well (amplitudes = .39 and .41), how these risk behaviors were related to this model varied

TABLE 4: Angular Displacement and Amplitude of Smoking and Alcohol Consumption Based on the Correlations Between the Dimensional Scores of Warmth and Dominance and the Risk Behaviors of Smoking and Alcohol Consumption

	Warmth (r)	Dominance (r)	Amplitude	Angular Displacement
Smoking	-.31*	.27*	.41	139°
Alcohol	-.01	.39*	.39	91°

$df = 92$.

* $p < .05$.

slightly. Children who reported consuming alcohol tended to behave in a controlling manner while interacting with their parents. These children were likely to be loud and dominating but unlikely to express insecurity or seek reassurance from their parents (i.e., assured-dominant behavior; see Table 1). Similarly, children who smoked cigarettes also behaved in a dominating manner; however, this behavior was tempered with low levels of affectionate behavior. These children were likely to be condescending toward their parents while emphasizing their accomplishments and were unlikely to seek advice from or express agreement with their parents (i.e., arrogant-calculating behavior; see Table 1). These results are very similar to past research consistently linking the personality traits of extraversion and disagreeableness to children's risk behaviors (e.g., John et al., 1994; C. N. Markey et al., 2001).

These findings may have occurred if the behaviors of these children during the parent-child interactions were manifestations of their underlying personality. This seems probable given previous research linking behavioral observations in limited contexts to relatively stable characteristics of individuals' personalities (Borkenau et al., 2004; Funder & Sneed, 1993; P. M. Markey et al., 2004). However, it is also feasible that the results from the current study do not reflect a child's personality but instead provide unique information about the behaviors exhibited by children during parent-child interactions. For example, it is possible that children who behave in a dominant manner with their parents are not expressing a general tendency to behave in this fashion but rather are expressing a tendency to exhibit dominance only in relation to authority figures. It seems likely that such children, who may be apt to rebel against authority, would be the same children most likely to engage in activities that are primarily discouraged by these authorities (e.g., alcohol consumption and cigarette smoking). Although it is not possible to conclude the specific causal link between children's behavioral manifestations while interacting with their parents and children's subsequent engagement in risk behaviors from these data, future research building on these findings has the potential to further discern causal pathways.

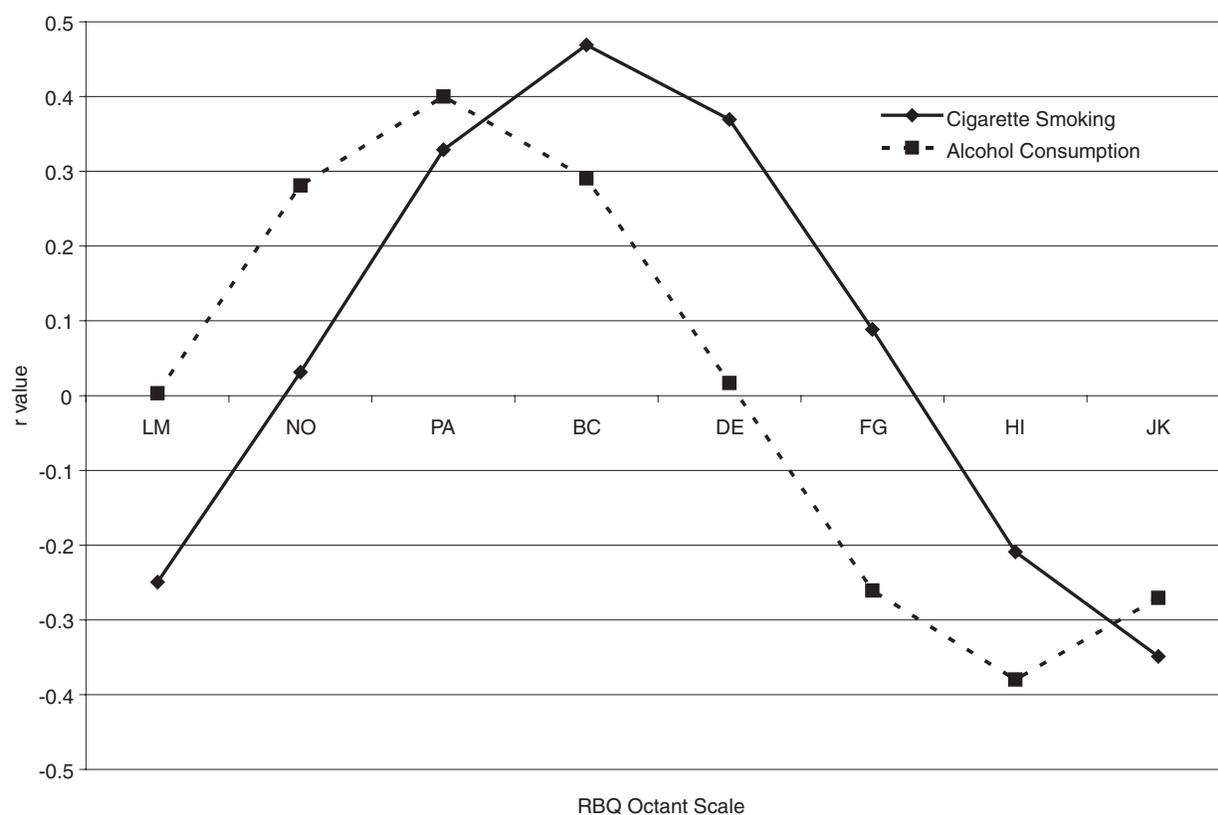


Figure 2 Relations between the interpersonal behaviors exhibited by children at age 10 and participation in the risk behaviors of smoking cigarettes and alcohol consumption at age 11.

NOTE: Graphic representation of the equation predicting smoking cigarettes $r = .06 + .41 (\cos(\text{Octant } \theta - 139))$ and the equation predicting alcohol consumption $r = .01 + .39 (\cos(\text{Octant } \theta - 91))$. LM = warm-agreeable; NO = gregarious-extraverted; PA = assured-dominant; BC = arrogant-calculating; DE = coldhearted; FG = aloof-introverted; HI = unassured-submissive; JK = unassuming-ingenuous; RBQ = Riverside Behavioral Q-Sort.

GENERAL DISCUSSION

In everyday interactions with children, it is possible to observe a variety of behaviors (e.g., speaking loud, acting playful, etc.), determine the extent to which behaviors are psychologically similar to each other (e.g., dominant behaviors, submissive behaviors, warm behaviors, etc.), and hypothesize about the extent to which these types of behaviors are related to other behaviors (e.g., a child who tends to express dominant behaviors is unlikely to express submissive behaviors). In short, it appears that we possess implicit models of children's behavior. The current article attempted to empirically present an explicit model of children's interpersonal behaviors that offers researchers the ability to reduce the multitude of interpersonal behaviors exhibited by a child during parental interactions into behavioral categories that are meaningful and have predictable relations to other behavioral categories. Specifically, this research examined the extent to which the IC, a model traditionally applied to adult behavior, would generalize to the behavioral manifestations of children during parent-child interactions.

Past research with parent and teacher reports of children's behavior suggests that children's interpersonal behaviors might occur in a manner predicted by the IC (Becker & Krug, 1964; Schaefer, 1961, 1997). The current study extended this research by using unacquainted judges to code observable interpersonal behaviors of children during videotaped interactions. By examining the behaviors exhibited by these children (in contrast to relying on questionnaire methods), the results obtained from this study may be less susceptible to various errors (e.g., enhancement, deception, halo effects, etc.; Kenny, 1994) and more easily generalized to "real-life" social interactions.

By coding observable behaviors, the current study confirmed that the behaviors exhibited by children during parent-child interactions occurred in a circular manner, consistent with predictions based on the IC. In general, behaviors that were located close together on the IC (see Figure 1) were more positively related than behaviors located further apart, and behaviors opposite of each other were negatively related. The effect size yielded in the current study quantifying the circular fit of

children's behavior to the circumplex model ($CI = .97$) is comparable to effect sizes found with adults using well-established self-report inventories. Tracey, Ryan, and Jaschik-Herman (2001) found that adult self-reports of trait adjectives using the Interpersonal Adjectives Scales fit a circular structure just as well (average $CI = .97$) as the observed behaviors of the children reported in this study. Furthermore, results from the current study indicate that the observed behaviors of children actually fit the IC slightly better than has past research employing the same methodology with adults (average $CI = .84$; P. M. Markey et al., 2003). It remains unclear if the circular structure of children's behavior found in the current study examining parent-child interactions would also generalize to other contexts that are not characterized by clearly defined roles (e.g., peer interactions). The applicability of the IC for modeling children's interpersonal behaviors across other types of social interactions could be the focus of future research.

Using this model of behavior, Study 2 demonstrated that the circular pattern of children's behavior was related to smoking and alcohol consumption 1 year later. Strong effect sizes (amplitudes = .39 and .41) found for the prediction of risk behaviors across judges (i.e., unacquainted judges' reports of behavior and children's reports of risk behavior), time (i.e., behaviors at age 10 and behaviors at age 11), and situations (i.e., behaviors exhibited with parents and risk behaviors that likely occur without parental supervision) (C. N. Markey et al., 2001) suggest the importance of children's interpersonal styles and the utility of the IC as a model of children's behaviors. Such findings are noteworthy considering that these predictions resulted from observations of children interacting with their parents for only 5 minutes. Perhaps more important, such findings suggest the potential utility of the IC for understanding children's behaviors. Thus far, the IC has proven to be an extremely useful tool for the prediction of various outcomes, including attachment styles, the complementarity of behaviors among adults, and adults' health-related behaviors (e.g., Bartholomew, 1990; Madison, 1997; P. M. Markey et al., 2003; Matano & Locke, 1995; Tracey et al., 2001; Wiggins & Pincus, 1989). The present study indicates that the IC may also prove to be a useful tool for predicting a variety of important psychosocial outcomes experienced by children.

NOTE

1. Although participants were free to discuss any topic, at no time during the interactions did either the children or the parents bring up the risk behaviors used as outcome variables in Study 2. Most of the health issues discussed during these interactions focused on developmental or health issues such as a broken bone or a lost tooth.

REFERENCES

- Barbaranelli, C., Caprara, G. V., Rabasca, A., & Pastorelli, C. (2003). A questionnaire for measuring the Big Five in late childhood. *Personality and Individual Differences, 34*, 645-664.
- Bartholomew, K. (1990). Avoidance of intimacy: An attachment perspective. *Journal of Social and Personal Relationships, 7*, 147-178.
- Becker, W. C., & Krug, R. S. (1964). A circumplex model for social behavior in children. *Child Development, 35*, 371-396.
- Borkenau, P., Mauer, N., Riemann, R., Spinath, F. M., & Angleitner, A. (2004). Thin slices of behavior as cues to personality and intelligence. *Journal of Personality and Social Psychology, 86*, 599-614.
- Creed, A. T., & Funder, D. C. (1998). Social anxiety: From the inside and outside. *Personality and Individual Differences, 25*, 19-33.
- Digman, J. M. (1990). Personality structure: Emergence of the Five-Factor model. *Annual Review of Psychology, 41*, 417-440.
- Everett, S. A., Warren, C. W., Sharp, D., Kann, L., Husten, C. G., & Crossets, L. S. (1999). Initiation of cigarette smoking and subsequent smoking behavior among U.S. high school students. *Preventive Medicine, 29*, 327-333.
- Freedman, M. B., Leary, T. F., Ossorio, A. G., & Coffey, H. S. (1951). The interpersonal dimension of personality. *Journal of Personality, 20*, 143-161.
- Funder, D. C., & Colvin, C. R. (1991). Explorations in behavioral consistency: Properties of persons, situations, and behaviors. *Journal of Personality and Social Psychology, 60*, 773-794.
- Funder, D. C., Furr, R. M., & Colvin, C. R. (2000). The Riverside Behavioral Q-sort: A tool for the description of social behavior. *Journal of Personality, 68*, 451-489.
- Funder, D. C., & Sneed, C. D. (1993). Behavioral manifestations of personality: An ecological approach to judgmental accuracy. *Journal of Personality and Social Psychology, 64*, 479-490.
- Furr, R. M., & Funder, D. C. (1998). A multimodal analysis of personal negativity. *Journal of Personality and Social Psychology, 74*, 1580-1591.
- Gifford, R. (1991). Mapping nonverbal behavior on the interpersonal circle. *Journal of Personality and Social Psychology, 61*, 279-288.
- Gifford, R. (1994). A lens-mapping framework for understanding the encoding and decoding of interpersonal dispositions in nonverbal behavior. *Journal of Personality and Social Psychology, 66*, 398-412.
- Gifford, R., & O'Connor, B. (1987). The interpersonal circumplex as a behavior map. *Journal of Personality and Social Psychology, 52*, 1019-1026.
- Goldberg, L. R. (1990). An alternative "description of personality": The Big Five factor structure. *Journal of Personality and Social Psychology, 59*, 1216-1229.
- Gurtman, M. B. (1992). Construct validity of interpersonal personality measures: The interpersonal circumplex as a nomological net. *Journal of Personality and Social Psychology, 63*, 105-118.
- Hubert, L., & Arabie, P. (1987). Evaluating order hypotheses within proximity matrices. *Psychological Bulletin, 102*, 172-178.
- Huey, S. J., & Weisz, J. R. (1997). Ego control, ego resiliency, and the five-factor model as predictors of behavioral and emotional problems in clinic-referred children and adolescents. *Journal of Abnormal Behavior, 106*, 404-415.
- Jensen-Campbell, L. A., Adams, R., Perry, D. G., Workman, K. A., Furdella, J. Q., & Egan, S. K. (2002). Agreeableness, extraversion, and peer relations in early adolescence: Winning friends and deflecting aggression. *Journal of Research in Personality, 36*, 224-251.
- Jessor, R. (1998). *New perspectives on adolescent risk behaviors*. New York: Cambridge University Press.
- John, O. P., Caspi, A., Robins, R. W., Moffitt, T. E., & Stouthamer-Loeber, L. M. (1994). The "little five": Exploring the nomological network of the five factor model of personality in adolescent boys. *Child Development, 65*, 160-178.
- Kenny, D. A. (1994). *Interpersonal perception: A social relations analysis*. New York: Guilford.
- Kiesler, D. J. (1983). The 1982 interpersonal circle: A taxonomy for complementarity in human transactions. *Psychological Review, 90*, 185-214.
- Leary, T. (1957). *The interpersonal diagnosis of personality*. New York: Ronald.

- Madison, J. K. (1997). Interpersonal assessment and therapy of eating disorders: A clinical application of a circumplex model. In R. Plutchik & H. R. Conte (Eds.), *Circumplex models of personality and emotions* (pp. 431-446). Washington, DC: American Psychological Association.
- Markey, C. N., Ericksen, A. J., Markey, P. M., & Tinsley, B. J. (2001). Personality and family determinants of preadolescents' participation in health-compromising and health-promoting behaviors. *Adolescent and Family Health, 2*, 83-90.
- Markey, C. N., Markey, P. M., & Tinsley, B. J. (2003). Personality, puberty, and preadolescent girls' risky behaviors: Examining the predictive value of the five-factor model of personality. *Journal of Research in Personality, 37*, 405-419.
- Markey, P. M., Funder, D. C., & Ozer, D. J. (2003). Complementarity of interpersonal behaviors in dyadic interactions. *Personality and Social Psychology Bulletin, 29*, 1082-1090.
- Markey, P. M., Markey, C. N., & Tinsley, B. J. (2002). A preliminary validation of preadolescents' self-reports using the five-factor model of personality. *Journal of Research in Personality, 36*, 171-181.
- Markey, P. M., Markey, C. N., & Tinsley, B. J. (2004). Children's behavioral manifestations of the five-factor model of personality. *Personality and Social Psychology Bulletin, 30*, 423-432.
- Matano, R. A., & Locke, K. D. (1995). Personality disorder scales as predictors of interpersonal problems of alcoholics. *Journal of Personality Disorders, 9*, 62-67.
- McCrae, R. R., & Costa, P. T. (1989). The structure of interpersonal traits: Wiggins's circumplex and the five-factor model. *Journal of Personality and Social Psychology, 56*, 586-595.
- McCrae, R. R., & Costa, P. T. (1995). Trait explanations in personality psychology. *European Journal of Personality, 9*, 231-252.
- Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). New York: McGraw-Hill.
- Parker, W. D., & Stumpf, H. (1998). A validation of the five-factor model of personality in academically talented youth across observers and instruments. *Personality and Individual Differences, 25*, 1005-1025.
- Persegani, C., Russo, P., Carucci, C., Nicolini, M., Papeschi, L., & Trimarchi, M. (2002). Television viewing and personality structure in children. *Personality and Individual Differences, 32*, 977-990.
- Rounds, J., Tracey, T. J., & Hubert, L. (1992). Methods for evaluating vocational interest structural hypotheses. *Journal of Vocational Behavior, 40*, 239-259.
- Schaefer, E. S. (1961). Converging conceptual models for maternal behavior and for child behavior. In J. C. Glidwell (Ed.), *Parental attitudes and child behavior* (pp. 124-146). Springfield, IL: Charles C Thomas.
- Schaefer, E. S. (1997). Integration of configurational and factorial models for family relationships and child behavior. In R. Plutchik & H. R. Conte (Eds.), *Circumplex models of personality and emotions* (pp. 133-153). Washington, DC: American Psychological Association.
- Shweder, R. A., & D'Andrade, R. G. (1979). Accurate reflection or systematic distortion? A reply to Block, Weiss, and Thorne. *Journal of Personality and Social Psychology, 37*, 1075-1084.
- Somers, R. H. (1962). A new asymmetric measure of association for ordinal variables. *American Sociological Review, 27*, 799-811.
- Strong, S. R., Hills, H., Kilmartin, C. T., DeVries, H., Lamer, K., Nelson, B. N., et al. (1988). The dynamic relations among interpersonal behaviors: A test of complementarity and anti-complementarity. *Journal of Personality and Social Psychology, 54*, 798-810.
- Tinsley, B. J., Markey, C. N., Ericksen, A. J., Kwasmann, A., & Ortiz, R. V. (2002). Health promotion for parents. In M. H. Bornstein (Ed.), *Handbook of parenting* (pp. 311-328). Hillsdale, NJ: Lawrence Erlbaum.
- Tracey, T. J. G. (1994). An examination of the complementarity of interpersonal behavior. *Journal of Personality and Social Psychology, 67*, 864-878.
- Tracey, T. J. G., Ryan, J. M., & Jaschik-Herman, B. (2001). Complementarity of interpersonal circumplex traits. *Personality and Social Psychology Bulletin, 27*, 786-797.
- U.S. Department of Health and Human Services. (2000). *Healthy People 2010* (Conference edition, in two volumes). Washington, DC: Government Printing Office.
- Wiggins, J. S. (1982). Circumplex models of interpersonal behavior in clinical psychology. In P. C. Kendall & J. N. Butcher (Eds.), *Handbook of research methods in clinical psychology* (pp. 183-221). New York: John Wiley.
- Wiggins, J. S. (1996). An informal history of the interpersonal circumplex tradition. *Journal of Personality Assessment, 66*, 217-233.
- Wiggins, J. S., & Broughton, R. (1991). A geometric taxonomy of personality scales. *European Journal of Personality, 5*, 343-365.
- Wiggins, J. S., & Pincus, A. L. (1989). Conceptions of personality disorders and dimensions of personality. *Psychological Assessment: Journal of Consulting and Counseling Psychology, 1*, 305-316.
- Wiggins, J. S., Trapnell, P., & Phillips, N. (1988). Psychometric and geometric characteristics of the Revised Interpersonal Adjective Scales (IAS-R). *Multivariate Behavioral Research, 23*, 517-530.
- Winsler, A., & Wallace, G. L. (2002). Behavior problems and social skills in preschool children: Parent-teacher agreement and relations with classroom observations. *Early Education and Development, 13*, 41-58.

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