Dominant, cold, avoidant, and lonely: Basal testosterone as a biological marker for an interpersonal style

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ABSTRACT

We hypothesized that an interpersonal trait approach would improve our understanding of the behavioral manifestations of basal testosterone. Participants provided saliva samples for testosterone assays on two separate visits and completed the Interpersonal Adjective Scales, the Circumplex Scales of Interpersonal Values, and measures of attachment and loneliness. High testosterone was associated with a distinct interpersonal style that included: attachment-related avoidance, dominance, and disconnectedness. High testosterone was also associated with loneliness, and this relationship was mediated by attachment-related avoidance. These findings add to our understanding of the interrelationships between hormones, personality, and social behavior. The circumplex structure revealed by testosterone's associations provides evidence for its construct validity as a biological marker of an interpersonally dominant, cold, avoidant, and lonely interpersonal style.

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1. Introduction

Testosterone is a steroid sex hormone that plays a role in the development of male reproductive tissues and secondary masculine characteristics such as body hair. It also shapes affect, behavior, and cognitions related to competition and social status (Eisenegger, Haushofer, & Fehr, 2011). In an attempt to elucidate the physiological underpinnings of personality, researchers have long been interested in personality correlates of high and low basal testosterone levels. Early research examined associations between testosterone and existing personality measures largely without a theoretical model, and findings suggested that testosterone is not related to most broad personality traits commonly used in personality research (e.g., extraversion, agreeableness, neuroticism, persistence; Baucom, Besch, & Callahan, 1985; Dabbs, Hopper, & Jurkovic, 1990; Sellers, Mehl, & Josephs, 2007). One reason for this may be that broad personality traits like extraversion or agreeableness consist of several different lower-order facets that may show diverging associations with testosterone (DeYoung, Weisberg, Quilty, & Peterson, 2013). Recent attempts to link testosterone with personality have been more theory-driven (Maattanen et al., 2013; Sellers et al., 2007). The aim of the present study was to use an interpersonal theoretical model to examine the specific interpersonal style associated with basal testosterone.

Unlike most personality or trait studies on testosterone, many behavioral and experimental studies have tested predictions guided by theory, and examined the associations of basal levels or changes in testosterone with (usually state levels of) aggression, anti-social tendencies, and dominance (Eisenegger et al., 2011). An association between high testosterone and aggressive behaviors is well-established in animals. However, in humans this association is less clear (see Eisenegger et al., 2011), and may be more complex compared to animals (Carré, Gilchrist, Morrissey, & McCormick, 2010). Human studies on the association between testosterone and anti-social behaviors provided somewhat more reliable results (Dabs & Morris, 1990). Finally, findings on the association between testosterone and constructs related to competition in humans are strong and consistent (see Eisenegger et al., 2011). Recent research also suggests that testosterone can interact with the situation to affect theoretically relevant behaviors (Josephs, Sellers, Newman, & Mehta, 2006).

It remains unclear whether testosterone affects behavior, behavior affects testosterone, or there is a bidirectional effect between behavior and testosterone. However, there exists enough evidence indicating that basal levels of testosterone are stable within individuals (Mazur & Booth, 1998; Sellers et al., 2007). Previous personality research did not use an explicit and comprehensive *interpersonal* theoretical model to study personality traits associated with these relatively stable levels of basal testosterone.

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We argue that the behavioral manifestations of high and low basal testosterone levels can best be understood as an interpersonal construct—i.e., a cluster of stable personality traits concerning how people act, think, and feel in their relationships with others. The significance of studying testosterone within this construct is that ultimately, differences in testosterone levels are most meaningful and consequential during interactions with other human beings. In fact, as is the case for vasopressin and oxytocin, there is growing physiological evidence for testosterone as a "social hormone" (van Honk, Terburg, & Bos, 2011). Therefore, in this study we utilized measures based on the circumplex theory of interpersonal relationships (Horowitz et al., 2006; Wiggins, 1979) and other interpersonal constructs such as attachment-related avoidance and loneliness to better understand the precise interpersonal "signature" or phenotype associated with high basal testosterone.

What kind of an interpersonal constellation of traits do we expect individuals with high and low basal testosterone to show? As depicted in Fig. 1, according to the Interpersonal Circumplex Model of personality, all interpersonal traits can be organized around two main interpersonal dimensions: "Communion" (C: connecting with others; affiliation), and "Agency" (A: influencing others; dominance). Any interpersonal construct can be expressed as a blend or combination of these two bipolar dimensions. For example, arrogance is a blend of dominance (agency) and hostility (disconnectedness; unfriendliness), which corresponds to the $+A - C$ (Agentic and Disconnected) octant in Fig. 1. Circumplex measures assess each of the eight octants formed by the two bipolar dimensions of Agency and Communion (Horowitz, Turan, Wilson, & Zolotsev, 2008).

The circumplex method allows researchers to identify each interpersonal trait as belonging to an octant in the circumplex. What octant, then, would best represent the personality structure associated with high testosterone levels? In terms of the Agentic dimension, individuals with high testosterone should theoretically be more agentic and dominant (i.e., the three upper octants), since testosterone is thought to be related to dominance behavior. In terms of the Communal dimension, we hypothesize that testosterone is associated with low communion (unfriendliness; low interpersonal warmth). Our rationale for this hypothesis is

based on the argument raised by some researchers that the reason for smaller effect sizes in the association between testosterone and aggression in humans is that, unlike animals, humans generally use means other than overt physical aggression to establish dominance. These strategies include stares, verbal threats, belittling, and denigration (Eisenegger et al., 2011; Mazur & Booth, 1998; Mueller, 1998). We hypothesize that many of these strategies should decrease the degree of affiliation or interpersonal warmth that the person displays.

Therefore, we expect testosterone to be negatively correlated with interpersonal warmth. In fact, there is evidence that high testosterone is associated with different manifestations of low levels of affiliation (Bos, Terburg, & van Honk, 2010; van Honk et al., 2011; also see reviews by Eisenegger et al., 2011; Mehta & Josephs, 2010). This unique combination of high agency and low communion that we expect individuals with high testosterone levels to show corresponds to the upper left quadrant in Fig. 1 ($+A - C$ or the "Agentic and Disconnected" octant; see DeYoung et al., 2013 for a similar argument).

In order to be considered an interpersonal construct, a measure should not only show its highest correlation with the corresponding octant scale, it should also show an expected *pattern* of correlations with the other seven scales. That is, the construct should have its highest negative correlation with the diametrically opposite scale in the circumplex (Fig. 1). In the case of our theoretical formulation of testosterone as a blend of dominant and disconnected styles, the diametrically opposite scale in the circumplex corresponds to the $-A + C$ (Submissive and Communal) scale— low on dominance combined with high on communion. Therefore, we hypothesized that the $-A + C$ scale would show the lowest (i.e., the highest negative) correlation with testosterone. Furthermore, the two octants to each side of this $-A + C$ scale should yield slightly higher correlations (i.e., less negative correlations), and the two scales that are two octants away from this scale should yield yet higher correlations, and so on.

This pattern of correlations that a variable shows with the eight octant scales, when graphed, yields a cosine curve, similar to the one depicted in Fig. 2. In a perfect circumplex structure, the size of the correlation (the *y*-axis in Fig. 2) is a direct function of the scale's angular distance (see Fig. 1) from the scale with the lowest correlation. Obtaining such a cosine curve provides strong evidence for the construct validity for an interpersonal measure, because it confirms a good fit to the circumplex structure (Gurtman, 1993; Turan & Horowitz, 2010).

In this article, we report how basal testosterone is associated with the eight scales of the Interpersonal Adjective Scale (IAS-R;
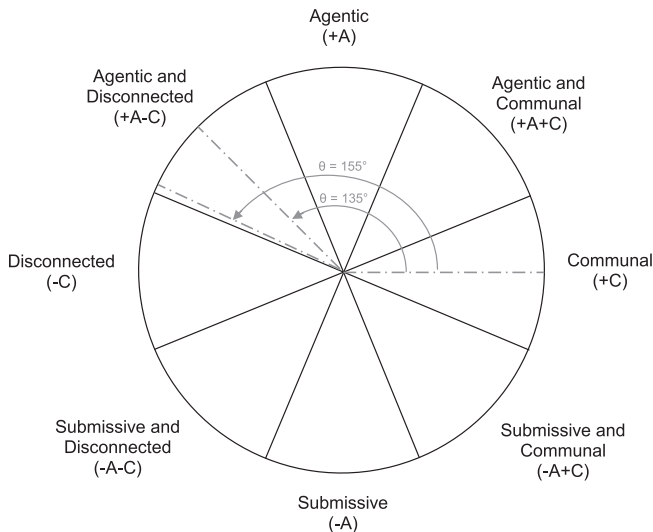
Fig. 1. The circumplex interpersonal structure. According to the model, all interpersonal traits can be organized around two main interpersonal dimensions: "Communion" (C: connecting with others; affiliation), and "Agency" (A: influencing others; dominance). $\theta = 135°$ and $\theta = 155°$ angles reflect the angular locations of basal testosterone empirically obtained based on the present data for IAS-R and CSIV, respectively (using the Structural Summary Method).
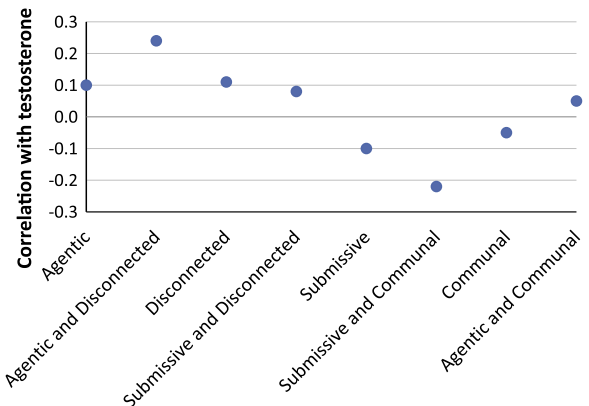
Fig. 2. Correlations between basal salivary testosterone levels and the eight Revised Interpersonal Adjective Scales (IAS-R) approximate the expected cosine curve. The *y*-axis shows the magnitude of the correlation coefficient with testosterone.