Personality Traits Relate to Heading Frequency in Male Soccer Players

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Concussions in soccer are often coincident with the act of heading the ball, and some researchers have reported that soccer heading is associated with neurocognitive decrements. This study aimed to understand (a) the personality factors that may predict frequent soccer heading, and (b) how knowledge of players' personality traits might help sport counselors persuade neurologically at-risk players to moderate their heading behavior. Sixty elite male soccer players (ages 16-34) completed structured self-report interviews, the NEO-FFI personality inventory, and the Arnett Inventory of Sensation Seeking. Players who headed most had significantly higher extraversion scores than comparison athletes and soccer players who headed less. Physical height was the best predictor of heading frequency but was not correlated with extraversion, which was also a significant predictor. Players with the typical profile of the high heading group may be more resistant to suggestion that they alter their style of play for safety reasons.

Head injuries account for a significant percentage of all injuries that occur during soccer play, and concussion represents the predominant head injury that is seen (Boden, Kirkendall, & Garrett, 1998; Lindenfeld, Schmitt, Hendy, Mangine, & Noyes, 1994; Sandelin, Santavirta, & Kiviluoto, 1985; Tysvaer, 1992). Soccer-related head injuries occur in at least four ways that bear similarity to other contact sports: (a) direct head contact with another player (usually head, foot, or arm), (b) contact with the ground, (c) contact with stationary objects such as goal posts, and (d) body-to-body collisions between two players that cause rapid decelerations or rotations of the head (Tysvaer, 1992). Unique to soccer, intentional head contact with the ball (heading) also may play a role in head injuries (Matser, Kessels, Lezak, & Troost, 2001; Witol & Webbe, 2003), especially when two players leave their feet, jumping in a mutual attempt to head the ball (Fried & Lloyd, 1992; Rahnama, Reilly, & Lees, 2002).

While several studies have linked soccer heading to impaired neuro-cognitive performance (Matser, Kessels, Jordan, Lezak, & Troost, 1998; Matser et al., 2001; Webbe & Ochs, 2003; Witol & Webbe, 2003), the precise mechanism accounting for such impairment remains controversial. Possible causes include (a) accumulation of many subconcussive ball-to-head contacts, (b) occasional occurrence of an intense ball-to-head contact, and (c) occurrence of contact between head and

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another player's body or an inanimate object. Some researchers have concluded that known history of concussion is sufficient to account for all neuropsychological deficits that have been reported to occur within the context of soccer play (Abreu, Templer, Schuyler, & Hutchinson, 1990; Green & Jordan, 1998; Kirkendall, Jordan, & Garrett, 2001). Others have pointed to head-to-ball contacts as at least contributory if not causative (Abreu et al., 1990; Matser et al., 1998; Matser et al., 2001; Tysvaer & Lochen, 1991; Witol & Webbe, 2003). Critical to this debate about mechanism of injury is a player's tendency to put him or herself into a risky or dangerous position in order to head the ball. For example, when a corner kick is served into the goal area, attackers often leap into the air to deflect the ball into the net with the head. Defensive players may be making simultaneous leaps, and in addition to any ball-head contacts, another's head, an elbow, or the fists of the goalkeeper can easily make head contact. In response to a ball served low into the goal area, a player may run toward and then make a headfirst dive to the ball, putting his or her head perilously close to powerfully kicking feet. Clearly, the genesis of such risky heading behavior warrants study since collision while heading likely represents the single greatest risk factor for head injury in the sport (Barnes et al., 1998; Boden et al., 1998). Galambos and colleagues recently reported that disturbed mood and high stress scores provided significant predictive utility of injury status in a general sample of elite athletes (Galambos, Terry, Moyle, & Locke, 2005), yet their analysis did not include personality variables nor did it focus on head injury. Therefore, the present analysis examined which personality characteristics are related to this high-risk behavior.

Two measures were utilized to quantify key personality traits: the NEO-Five Factor Inventory (NEO-FFI; Costa & McCrae, 1992) and the Arnett Inventory of Sensation Seeking (AISS; Arnett, 1994). Both scales have been used previously to characterize athlete samples. Two advantages supported the use of the NEO-FFI. First, the NEO-FFI aims to describe characteristics of personality in healthy individuals as opposed to scales such as the MMPI-II that are geared to a clinical population. Second, it is a short measure that maintains strong reliability and validity characteristics. With the NEO-FFI, Kajihara and colleagues found that athletes tended to be more extraverted and conscientious, but less open to experience and agreeable than non-athletes (Kajihara, Mura, & Matsuda, 2001). Zarevski and colleagues reported that the AISS correctly identified athletes engaged in high-risk versus low-risk sports, with high-risk sport participants scoring higher on the intensity and novelty subscales (Zarevski, Marusic, Zolotic, Bunjevac, & Vukosav, 1998).

Sensation seeking is one dimension of personality that may be related to individual styles of soccer play. According to Zuckerman (1979), sensation seeking can be conceptualized as an individual's desire for novel, complex, and powerful experiences. Sensation seekers are more likely to engage in risky behavior, including taking both physical and social risks. Schroth investigated male athletes who participated in soccer, crew, rugby, and lacrosse and determined that male athletes scored higher on sensation seeking than male non-athletes (Schroth, 1995). He reported that rugby and lacrosse players scored higher on the Zuckerman Sensation Seeking Scale (SSS) than soccer and crew athletes did.

As described previously, the act of heading puts the player in positions known to increase risk of head injury (Fried & Lloyd, 1992; Rahnama & Reilly, 2002). Thus, it was accepted as a premise of this study that heading the ball may be considered a risky behavior. It was hypothesized that soccer players who are frequent

headers would demonstrate higher scores on measures of risk and sensation seeking, specifically the extraversion factor of the NEO-FFI and the Intensity subscale of the AISS than those who head the ball less frequently. Although openness to experience may seem like sensation seeking, the construct, as measured by the NEO-FFI, relates more to shifting interest, which we did not expect to be associated with heading. Discovery of a relationship between these personality factors and heading propensity could spur the development of targeted intervention strategies that are geared to specific motivations, attitudes, and behaviors.

Method

Participants

Sixty male soccer players from across central Florida (USA) volunteered to serve. The high school (2), college (3), premier development (1), and professional (1) teams for which these athletes played were considered elite within their respective leagues. The high school and college teams had each contended for or won their state or national association titles. The premier development team was a perennial contender for championship in the United Soccer Leagues, and the professional team was a franchise of Major League Soccer. Twenty currently active athletes with minimal experience in soccer, rugby, American football, and lacrosse served as a comparison group. The comparison athletes engaged mainly in running, cycling, basketball, and baseball. The two groups did not differ in age or education. For the soccer players, the participants' mean age was 21.09 ($SD = 4.31$), with a range from 16 to 34. The comparison athletes' average age was 21.20 ($SD = 4.35$), with a range from 16 to 34. Education for soccer players was 13.73 ($SD = 2.42$) years, and for comparison athletes was 14.00 ($SD = 2.43$) years. The two groups did not differ in age or education: $t(76) = -.24$, $p = .981$ and $t(76) = -.495$, $p = .622$, respectively.

The Florida Tech Institutional Review Board for Human Experimentation reviewed and approved all protocols for this study. Volunteers received study information and completed a consent form before participating in any data collection. Participants were excluded from the study, if they (a) admitted any current recreational use of illicit drugs, (b) admitted to present or past heavy use of alcohol, (c) had a history of serious head trauma from any source, or (d) had been diagnosed with a learning disability or attention deficit/hyperactivity disorder. Only six individuals were disqualified based upon exclusion criteria. Approximately 60 players whom we invited to participate declined. Invariably, they cited insufficient time in their schedules to accommodate the testing. All participants were tested without distraction in quiet, comfortable settings (either in the living room of their homes or in a testing laboratory that was furnished casually, similar to a home).

Measures

A structured interview was conducted first, in which the participants answered questions regarding personal, medical, and sports history. Each soccer player provided a subjective report of heading practices. The NEO-FFI and the Arnett Sensation Seeking Scale (AISS) then were administered.

The NEO-Five Factor Inventory is a 60-item version of Form S of the NEO-PI-R (Costa & McCrae, 1992). This personality inventory is a brief, comprehensive

questionnaire designed to assess five domains of personality (neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness) on a five-point scale. Completion of the instrument requires only 10 to 15 minutes. The NEO-FFI results presented here have been converted to T-scores for easiest interpretation. On each subscale, scores between 25-35 are considered very low, scores between 35-45 are considered low, scores between 45-55 are considered average, scores between 55-65 are considered high, and scores 65 and above are considered very high.

The Arnett Inventory of Sensation Seeking (AISS; Arnett, 1994) was used to assess the domain of sensation seeking. This scale divides sensation seeking into two subscales: novelty and intensity. The AISS is a 20-item scale in which the subject answers how descriptive the questions are of them (e.g., "I would like to travel to places that are strange and far away"). The subject's total item score is summed, and higher scores represent higher levels of sensation seeking. Total scores may vary from 20 to 80, and subscale scores from 10 to 40.

Four examiners were trained to follow identical administration procedures. The authors scored all tests. In addition to the personality testing and interview, players had also completed a neuropsychological test battery to assess cognitive and perceptual performance. Those results have been reported in detail elsewhere (Webbe & Ochs, 2003).

Similar to previous studies of soccer heading (Matser et al., 2001), participants were divided into four heading groups based upon self-report: comparison (#1; no heading; $n = 20$), low (#2; 0-5 times per game; $n = 19$), moderate (#3; 6-10 times per game; $n = 17$), and high (#4; more than 10 times per game; $n = 24$). In order to validate self-report measures, we also documented heading behavior during scheduled league games for 21 of the 60 players. Correlations of the estimates with the observations averaged about 0.50. Although this value seems low, it was similar to the correlations of observed headings between halves of a match or between matches for the same players. Team playing styles, weather conditions, score, and elapsed time of the game all contributed variance to the heading observations.

Results

Mean scores on the personality and sensation seeking measures were compared via *t*-tests for the soccer versus comparison athletes. Group means were in the average range and did not differ significantly (see Table 1). Next, soccer players were grouped according to their self-reported frequency of current heading behavior, and the means of the personality measures for these three obtained groups and the comparison group were compared via one-way ANOVA (a similar analysis was conducted using a lifetime cumulative measure). Since those outcomes were similar in all respects, we present only the analysis for the current heading behavior here. Mean scores were characterized best as falling in an average range. As shown in Table 2, a significant difference was found only on the NEO-E subscale. Post-hoc LSD tests confirmed that the high frequency heading group scored higher than the comparison ($d = 7.45$, $p = .010$) and the moderate heading groups ($d = 6.90$, $p = .023$). The profile of NEO-FFI standard scores for the groups is shown in Figure 1. This gives a visual representation that the soccer-heading and comparison groups

showed generally similar profiles, except for the elevated NEO-E scale and the somewhat depressed (though not significantly) NEO-O scale. It is important to note that the lines connecting data points are intended only to facilitate discrimination of the profile and do not imply systematic order or spacing of the domains.

In the rigor of conducting group statistical comparisons, it is easy to lose focus on the individual whose injury we treat or predict. For this reason, we conducted an analysis of the frequency distribution of individual NEO-FFI test scores. Extreme

Table 1   Means and Standard Deviations for Soccer Players and Comparison Athletes on the NEO-FFI and AISS

	Comparison (*n* = 20)		Soccer (*n* = 60)			
	M	*SD*	*M*	*SD*	*t*	*p*
NEO-FFI Subscales (T-scores)						
N	48.60	9.06	47.62	9.02	-.422	.674
E	55.80	10.36	60.25	9.30	1.801	.076
O	51.65	8.84	47.67	10.74	-1.497	.138
A	47.60	11.19	47.68	11.80	.028	.978
C	47.50	9.86	45.42	12.65	-.670	.505
AISS Subscales						
Int	29.15	3.66	29.08	4.22	-.063	.950
Nov	28.15	3.22	27.73	3.34	-.487	.628
Total	57.30	4.80	56.82	6.53	-.304	.762

Note. M = mean; SD = standard deviation

Table 2   Means and Standard Deviations for Soccer Heading Groups and Comparison Athletes on the NEO-FFI and AISS

	Comparison (*n* = 20)		Heading Group (*n* = 60)							
			Low		Moderate		High			
TEST	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*	*p*
NEO-FFI Subscales (T-scores)										
N	48.60	9.06	48.47	9.45	47.46	10.37	48.42	7.90	.221	.882
E	55.80	10.36	59.95	9.98	56.35	7.21	63.25	9.34	*2.937	.039
O	51.65	8.84	46.84	8.02	50.82	12.94	46.08	10.88	1.513	.218
A	47.60	11.19	49.42	13.69	50.12	9.26	44.58	11.59	.965	.414
C	47.50	9.86	46.21	10.69	47.24	10.72	43.50	15.33	.503	.681
AISS Subscales										
Int	29.15	3.66	28.68	3.76	28.35	4.33	29.92	4.51	.572	.635
Nov	28.15	3.22	27.47	2.76	27.88	3.94	27.83	3.45	.134	.940
Total	57.30	4.80	56.16	5.38	56.24	7.20	57.75	7.03	.333	.802

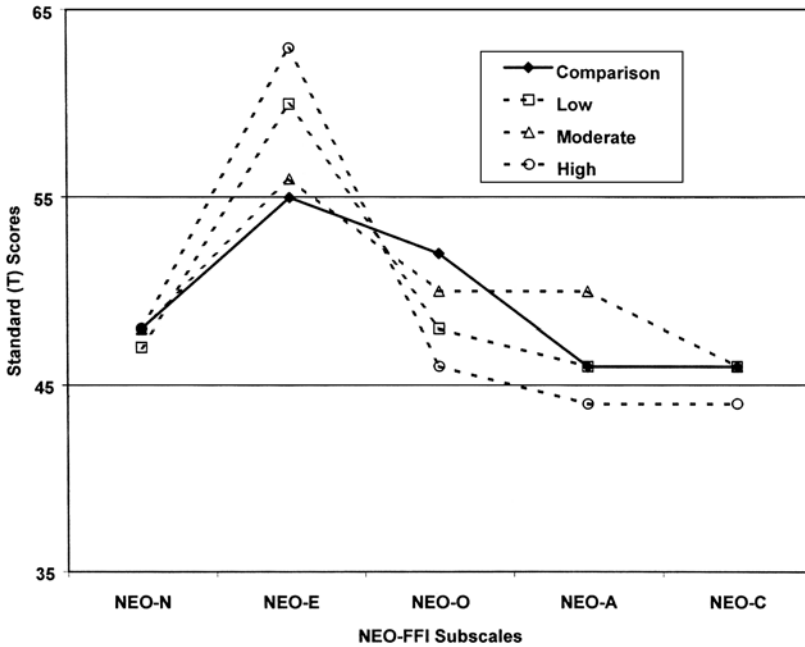*Note.* M = mean; SD = standard deviation

Figure 1 — Patterns of performance of the heading and comparison groups on the NEO-FFI. Scores between 45-55 are considered average.

scores were more common in the high heading group than in the other groups. For example, Figure 2 shows the percentage of players scoring in an extreme range (very high or very low) on the NEO-FFI subscales, based upon normative scores presented in the test manual (Costa & McCrae, 1992). Clearly, the high frequency headers were over-represented with extreme high NEO-E and low NEO-A scores compared to the other players and the comparison athletes.

Because the AISS is known to produce higher scores for an adolescent population (Arnett, 1996), and since some of the soccer and control athletes were older adolescents, ANCOVAs with age as the covariate were employed to test mean differences. Although age was a significant covariate, group means on the total AISS and on the Intensity subscale did not differ across heading groups (see Table 2). Analysis of extreme scores on the AISS revealed that three players in the high heading group and one in the moderate heading group produced scores that exceeded two standard deviations from the mean, that is, 68 or greater. No other players or comparison athletes scored this high.

In considering the personal variables for the heading groups, the high frequency heading players were the tallest ($M = 71.5$ in), and the low frequency headers were the shortest ($M = 69.2$ in), $F(2, 57) = 5.756$, $p = .005$. No other differences appeared. In considering potential differences in heading based upon field position played, athletes who self-identified as playing in the defensive third of the field were compared to those who played mostly in the offensive third. A significant
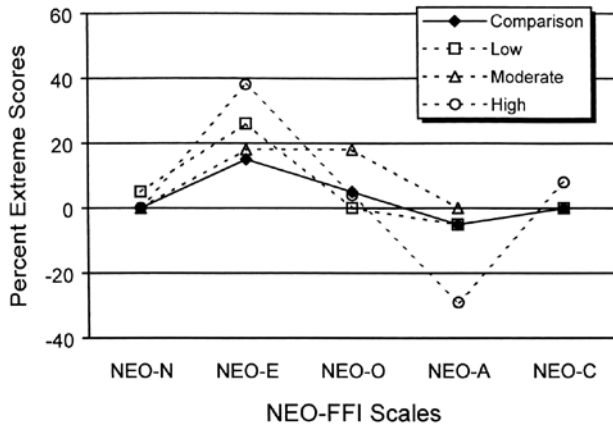
Figure 2 — Percentage of NEO-FFI scale scores in the very high (N, E, O, C) and very low (A) end of the distribution for the heading and comparison groups.

difference for self-reported heading frequency was obtained, $t(58) = 2.010$, $p = .04$, with defenders estimating higher frequencies than forwards did.

As shown in Table 3, a stepwise multiple regression of personal, demographic, and personality variables on estimated game heading showed that height was the most significant positive predictor of heading. Older age also contributed significantly to heading propensity. Among the personality factors, only the NEO-E added significantly to the regression model. Correlations among organismic and personality factors are shown in Table 4. Perhaps the most interesting note here was finding that NEO-E and height each correlated significantly with heading estimates but not with each other.

Player characteristics were compared across categories of play (high school vs. college vs. amateur vs. professional) to rule out categorical confounds that would confuse the interpretation of the personality analyses. The only significant difference (aside from the inherent ones of age and education) was body weight, which was less for the high school players ($M = 155$ lbs) than for the other categories ($M = 168$, 170, and 171 lbs, respectively), $F(3, 50) = 2.935$, $p = .040$.

Discussion

The present results affirm that some personality characteristics of soccer players correlate with their style of play. Specifically, high extraversion related to an increased likelihood of heading the ball. Of all the soccer players, the frequent headers had significantly higher extraversion (NEO-E) scores than the moderate headers or the comparison athletes, and the high-heading group had many more extreme scores than all other groups. Sensation seeking, as measured by the AISS, was not significantly different among the heading groups, although all four of the players who scored in a high/extreme range on the AISS were in the moderate or high frequency heading groups.

Table 3   Multiple Regression of Key Personality and Demographic Factors on Estimated Game Heading

	Mean	SD	Beta	ΔR^2	F	P
Height	70.43	2.34	.439	.228	16.556	.001
Age	21.09	4.31.298	.093	7.536	.008	
NEO-E	60.39	9.17.277	.077	6.878	.011	
NEO-A	47.11	11.74	-.191			
AISS-Intensity	29.22	4.24	.080			
Weight	165.74	16.63	.122			

Table 4   Correlations Among Personality Factors, Heading Estimate, and Physical Characteristics

	Hgt	Wgt	Age	NEO-E	NEO-O	NEO-A	NEO-C	NEO-N	AISS-I	AISS-N
Heading estimate	**.478	**.369	**.372	*.279	-.134	-.145	-.119	.057	.099	.012
Height		**.642	.147	-.020	-.106	-.102	-.118	.191	.045	-.034
Weight			.174	.109	-.026	-.063	.037	.035	.103	-.072
Age				.034	-.075	*.265	.173	-.198	-.250	-.135
NEO-E					.040	-.022	.008	-.248	*.315	.186
NEO-O						.078	**.340	-.069	.167	**.514
NEO-A							-.028	-.237	-.148	-.129
NEO-C								*-.278	-.177	**-.343
NEO-N									-.054	.019
AISS-Int										**.493

Note. $*p > .05$, $**p > .01$; two tailed

A player's height was the strongest predictor of heading of all factors. Indeed, just as greater than average height results in presumptions that an individual is or should be a basketball player, in soccer, height may predispose toward the expectation of heading. Moreover, taller players likely will be asked to head in key situations and to play positions where heading opportunities are frequent, and their behavior may be reinforced by successful outcomes. These are fairly obvious conclusions and certainly not novel, but understanding the genesis of heading for some players may be critical in later moderation of the behavior. Interestingly, although height correlated significantly with estimates of heading, it did not correlate with extraversion or other personality variables. This suggests that height and extraversion are relatively independent predictors of heading behavior. This may also help explain why mean differences in the AISS were not obtained. If heading propensity in this sample was controlled by both physical and personality factors and these are orthogonal to each other, then group differences due to either variable are downplayed.

Relationships were found among personality variables that theoretically should have related to each other. For example, the NEO-E, which measures outward seeking behaviors, correlated with the intensity subscale of the AISS, which measures stimulus seeking. The NEO-O, which measures a person's openness to obtaining

new experiences, correlated with the novelty subscale of the AISS. Although the NEO-C scale correlated significantly with the novelty scale of the AISS, there was no theoretical expectation or hypothetical explanation to account for this finding.

Limitations

The primary measure of heading used both here and previously relies upon players' estimates of their heading actions. As such, a level of error common to self-report information can be expected. Previous studies that have used this methodology to measure heading had not suggested the presence of systematic error (Jordan, Green, Galanty, Mandelbaum, & Jabour, 1996). Recently, though, Rutherford and Fernie (2005) reported that university players overestimated their actual heading frequencies. They also noted, however, that the estimates still put the players in the same general ranking relative to other players when headings were observed. Thus, although heading estimates may lack quantitative accuracy, the classification of players into low, moderate, and high heading groups relative to each other still appears valid. Our own limited observational data supported this conclusion as well. It was illuminating to discover that the correlations of players' observed game heading between halves of matches or between matches was no greater than the correlation between the self-report and averaged score of two matches. It appears that empirically obtained values for describing heading behavior should be based upon observation of many matches to overcome inherent variability over the short term.

Conclusion

The present results are sufficient to show that as a group, frequent headers of the ball score higher on extraversion. Players must make many split-second decisions. Heading the ball and placing the body in risky positions (e.g., a diving header near the goal) are among those decisions. As Anderson and colleagues have suggested, increase in self-knowledge of one's behavioral tendencies allows a player the opportunity to prepare better for such decisions and possibly to alter a style of play (Anderson, Tenga, Engebretsen, & Bahr, 2004). Our ability to understand a personality-playing style interaction allows us to alert players to personal propensity for on-the-field risk. For the purpose of prevention and intervention by health professionals, increased use of brief, user-friendly, and valid personality tests show promise to gain insight into a player's behavioral tendencies.

It can be predicted that players with higher NEO-E scores will be more likely to assume a leadership role on the team (Costa & McCrae, 1992). Their sense of worth as a player may be threatened if they are asked to tone down their play by reducing heading and other risk. For this reason, individuals who are most at risk for further concussion because of their style of play may also be the ones who are most resistant to change. Their style defines them as a player, and that definition and that style become integrally connected with their self-identity. The clinician must offer some remedy that will ameliorate the challenge to this on-field persona by presenting alternative styles of team contribution that are real and meaningful. In contrast, we might anticipate that players who head more by virtue of their

height may be more amenable to accepting recommendations regarding a change in playing style. Knowledge of personality factors and typical behaviors is a critical first step in establishing effective interventions.

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