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## Is Skater's Cramp a Task-Specific Dystonia?

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# Personality in Speed Skaters with Skater's Cramp

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## Abstract

### Objective

Skater's cramp is a debilitating disorder in expert speedskaters and recent evidence from muscle and movement studies nominate it is a task-specific dystonia (TSD). Building on these studies we investigated clinical features and personality in skater's cramp, hypothesizing that similar to other TSDs, trait emotionality would be higher in affected skaters.

### Methods

We employed the HEXACO inventory to examine the personality of a cohort of skaters with skater's cramp (n=26) compared to a age, sex and experience-matched controls (n=28). Affected skaters were selected based on relevant clinical features important to the diagnosis of TSD.

### Results

Sentimentality (a sub-factor of emotionality) was higher in affected skaters, but only in the male population. Extraversion was lower in skaters with skater's cramp. Clinical findings resembled other forms of TSD.

### Discussion

Higher sentimentality is in line with previous studies in TSD . Lower Extraversion in affected skaters was an unexpected finding that be may a new feature of skater's cramp and possibly TSD, but findings remain tentative. This study represents a first step in further research on personality in skater's cramp.

**Keywords:** Task-Specific Dystonia, Speed Skating, Personality, HEXACO

## Introduction

Dystonia is a movement disorder generally described by “sustained or intermittent muscle contractions causing abnormal, often repetitive, movements and postures”(1). A subsection of this disorder is task-specific, ergo task-specific dystonia (TSD), and has been defined as “a collection of movement disorders that present with persistent muscular incoordination or loss of motor control during skilled movements”(2). TSD is known to affect a host of occupational skills including hairdressers, tailors, watchmakers or weavers (3–5). It is also common in musicians and athletes with one percent of professional musicians affected (6), and higher estimates for golfers, reporting a tentative 20% (7,8). Clinically, TSD has a sudden onset after many years of unaffected practice and progresses insidiously over a course of weeks or months (9). The exact pathophysiology of TSD is unknown, but research indicates it may arise as a result of corruption in the formation of highly specific motor engrams. Skilled practice is thought to produce longer motor engrams for longer sequences of movement (10), which replace intermediate motor control representations and reduce motor adaptability. In turn, this may increase susceptibility to forming task-specific errors resulting in jerking, over-activation and co-activation (11). Triggers for forming these errors include over-practicing, stress, injury, equipment change and genetics (6,11).

Skater's cramp is a mysterious movement disorder in professional and highly dedicated amateur speed skaters. It was first nationally recognized as a movement disorder when a high profile Olympic speeds skater from the Netherlands prematurely ended his career as a consequence of developing this disorder. Skater's cramp was first described as an endo- or exo- rotation of a speed skater's foot, occurring right before placing their skate on the ice after a completed stroke (12). Subsequently it was hypothesized to be TSD (13), and quantitative studies have supported this hypothesis finding features of movement and muscle activity (14), and inter-muscular coherence (15) that match this diagnosis.

In addition to muscle and movement features, non-motor differences have also been described in TSD. In dystonia generally, higher anxiety has been found in adult-onset isolated focal dystonia (16) and functional dystonia (17). In TSD specifically, sensitivity to negative emotion in the form of higher baseline anxiety has been described in musician's dystonia (18). Another study using the well validated NEO Five-Factor Inventory (NEO-FFI) (19) showed the trait neuroticism (sensitivity to negative affect) was higher in affected musicians (20). Two later studies found no significance using the NEO-FFI, but did identify differences in other anxiety related factors not only in musicians (21), but also in other TSDs in sports like golf (22) and baseball (23).

Building upon the existing evidence that movement and muscle features of skater's cramp resemble a TSD, we aimed to test whether personality features described in other TSDs were also present in skater's cramp. Specifically, we hypothesized that skaters with skater's cramp would have a different personality profile from healthy skaters and particularly have higher neuroticism (i.e., negative emotionality). We further explored differences in other personality traits (honesty, extraversion, agreeableness, conscientiousness, openness) without directional predictions. To improve accuracy despite the limitations of a small sample size (due to the rarity of skater's cramp) we controlled for natural population variance by matching affected skaters with a control group for age and sex, as well as experience and dedication to speedskating.

## Methods:

### 1.1 Population

Participants with skaters cramp filled out an online survey. We recruited participants by email and telephone request directed at various Dutch speed skating clubs across the country with the help of coaches (convenience sampling). Control participants were recruited from the same speed skating clubs. All other participants were admitted to the control group by answering "no" to the question: *Do you think you have, or think you have had skater's cramp?* Additionally we invited the affected cohort from a previous study of skaters with skater's cramp (n=14) to participate via email. In the previous study these participants had undergone a physical examination by a neurologist (MT). Both previously recruited and newly recruited participants were selected for the affected group by answering "yes" to the question: *Do you think you have, or think you have had skater's cramp?* and additionally answering "yes" to two further inclusion criteria (self-report) questions: *"Have you ever been unable to control one of your skates during skate placement?"*, and *"Do you notice cramping or jerking of your skate during skate placement?"*. Control participants were recruited from the same skating clubs as the newly recruited participants to increase the likelihood they would be matched for various confounds including sex, age, hours of practice per week (prior to developing the condition), and years of skating. To insure they were matched we compared these factors statistically (see analysis section). All participants were over the age of 18, volunteered for this study and gave their informed consent. Participants were informed they could retract their data and participation in the study at any time. The Medical Ethical committee of the University Medical Center Groningen approved the study (M119.241754).

## 1.2 Measurement Tools

All participants newly recruited and from the previous cohort filled out a bespoke survey. The bespoke survey was based on an edited version of a survey employed in an initial case study of skaters with skater's cramp (14). We collected demographic and clinical details of skaters important to the diagnosis of movement disorders like TSD. Questions included detailed information on 1) skating career: experience level, years spent skating, and dedication 2) medical history: pre-existing conditions, injury, or mental/physical pathology 3) skater's cramp: rate of onset, task-specificity, pain level, and possible contributing factors. The survey collected additional basic information i.e. age, sex.

To investigate the personality profile of skaters we employed the validated HEXACO personality inventory(24) consisting of 6 personality factors: Honesty-Humility (avoid manipulating others), Emotionality (high sensitivity to emotions and stress), eXtraversion (high social confidence and self-esteem), Agreeableness (high forgiveness of others), Conscientiousness (high perfectionism and organization), Openness to Experience (high imaginativeness and curiosity for the unusual). For each factor there are 4 facets that are highly internally correlated to the major factors (24). HEXACO is an extension of the original well established lexical strategy for the investigation of personality called the five factor model or "big five" (19). The big five consists of Neuroticism (N) (also referred to as neuroticism), Extraversion (X), Agreeableness (A), Conscientiousness (C), and Openness to Experience (O) (NXACO). HEXACO has been shown to accurately model these same 5 factors consistently (emotionality has replaced neuroticism, but represents the same factor) (25,26), while adding an additional factor Honesty-Humility (H). The extent to which Honesty-Humility is factorially distinctive from the remaining 5 is still under investigation (27), however many studies support a 6 factor model (26). To investigate these personality difference in the Netherlands, we employed a validated Dutch translation of the HEXACO (28), consisting of 96 questions, 16 questions for each of the six HEXACO factors (4 questions per facet).

## 1.3 Analysis

An a priori power analysis was conducted using G\*Power (psychologie.hhu.de/) (29) that revealed 56 participants would suffice in a factorial between group ANOVA with two fixed factors, group (affected vs controls) and sex (male vs female) to detect a small to medium size effect (partial  $\eta^2$  of 0.12) assuming a power equaling 0.8 and an alpha of 0.05. Our conservative estimate of possible effect sizes was assumed appropriate, based on findings from previous similar studies (22,30). In light of the rarity of this condition in the general population, a larger sample size is not feasible.

All analyses were performed using SPSS statistics (IBM.com). Multiple tests were used to confirm that the affected skaters and control skaters were correctly matched. Chi-squared

test and Mann-Whitney test were applied to measure whether the affected and control cohorts were matched for sex and age respectively. We used Mann-Whitney test as well to confirm that the affected and control groups were matched for hours of practice and years of skating.

Analysis of variance (ANOVA) was applied to compare the affected group and control group for the 6 major factors and 20 facets of HEXACO. The dependent variable was the personality factor or facet (e.g. Extraversion), and the two independent fixed factors were TSD (affected skaters vs control skaters), and sex (male vs female). Authors took care to define the fixed factor sex in accordance with guidelines for Sex and Gender Equity in Research (31). The reason to include sex as an independent factor is acknowledging the natural sex difference in personality – specifically emotionality (32). In cases of an interaction effect between factors: TSD and sex, we conducted further post-hoc pairwise comparisons, comparing the affected skaters to the control skaters for males and female groups separately employing Bonferroni correction. For both factor and facet ANOVA analyses, assumptions of homogeneity variance were tested with Levene's test, and assumptions of multivariate normality were tested with the Shapiro-Wilk test, skewness and kurtosis and QQ plots.

## Results

### 1.1 Population

Of an initial 81 speed skating respondents, 65 completed the survey. Of the 14 participants invited from the affected cohort from a previous study of skater's cramp, 5 participants responded and 5 were included. Of the remaining newly recruited respondents 11 were excluded who answered positively to having skater's cramp, but negatively to one or both of the additional inclusion criteria questions. Twenty-six participants answered yes to both questions and comprised the affected group (Male  $n = 17$ ,  $M_{age} = 53.71$ ,  $SD = 9.5$ ; Female  $n = 9$ ,  $M_{age} = 44.1$ ,  $SD = 9.56$ ). Twenty-eight participants answered "no" to having skater's cramp and comprised the control group (Male  $n = 19$ ,  $M_{age} = 48.79$ ,  $SD = 13.8$ ; Female  $n = 9$ ,  $M_{age} = 41.5$ ,  $SD = 13.86$ ). The affected and control groups did not differ in the ratio of men to women, their age, their hours of practice per week (prior to developing the condition), and years of skating. The results and statistical tests used to match groups are depicted in Table 1.



**Table 1.** Sample population Skater's Cramp (n=26) Control (n=28)

	Skater's Cramp	Control	p-Value	Effect Size
Age median (IQR)	51 (13.75)	50.5 (19.75)	.63 <sup>†</sup>	.01 <sup>a</sup>
Sex n (%)				
Woman	9	9		
Men	17	19	.85 <sup>†</sup>	.03 <sup>b</sup>
Years of Skating mean ± SD	31.57 ±14.88	30.36 ±14.71	.76 <sup>‡</sup>	.082 <sup>c</sup>
Practice Hours a Week mean ± SD	5.61±4.07 <sup>*</sup>	5.67±4.25	.96 <sup>‡</sup>	-.015 <sup>c</sup>

N = number of participants, p= probability value, IQR = interquartile range, SD = standard deviation, <sup>†</sup>Mann-Whitney, <sup>a</sup>Rank-Biserial Correlation, <sup>‡</sup>Chi-Squared Test, <sup>b</sup>Cramer's V, <sup>‡</sup>Independent t-test, <sup>c</sup>Cohen's d, <sup>\*</sup>Practice hours prior to developing skater's cramp.

## 1.2 Skater's Cramp Clinical Characteristics

Skater's cramp was painless and task-specific with a sudden onset. In the survey all skaters reported no pre-existing injuries or medical conditions associated with the disorder. In participants selected from the previous study of skater's cramp (n=14) who underwent an examination by a neurologist (MT), there were no abnormalities reported. Most affected skaters had received some form of medical diagnosis (81%), but none had received a successful treatment of any kind and the rate of recovery was zero. Self-reported triggering factors varied, where a fall/injury or over-exertion were most commonly reported. In Appendix A, a table depicts key clinical characteristics of the group with skater's cramp.

## 1.3 HEXACO: Major Factors and Facets

### 1.3.1 Sentimentality

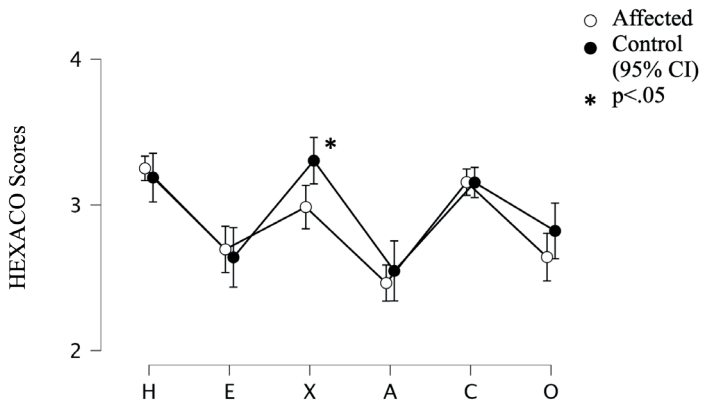
The main effect of TSD on the facet Sentimentality (a facet of the factor Emotionality) was non-significant,  $F(1,50) = .2, p=.65$ , partial  $\eta^2 = .004$ , however there was a significant TDS × Sex interaction effect,  $F(1,50) = 6.68, p=.01$ , partial  $\eta^2 = .12$ . Post-hoc analysis revealed that affected male skaters (Mean±SD: 3.09±.56) had higher sentimentality than control male skaters (Mean±SD: 2.58±.79),  $F(1,50) = 5.34, p=.024$ , partial  $\eta^2 = .1$  (figure 2). Affected female skaters (Mean±SD: 2.94±.72) did not appear to show a significant difference with control female skaters (Mean±SD: 3.42±.41),  $F(1,50) = 2.32, p=.13$ , partial  $\eta^2 = .04$ . Though, due to the low sample size (n=9) of females in the affected group, we could not draw any meaningful conclusion from the post-hoc pairwise analysis comparing affected female skaters vs control female skaters.

### 1.3.2 Extraversion

Extraversion was lower in affected skaters (Mean±SD: 2.99±.39) compared to controls (Mean±SD: 3.3±.4),  $F(1,50) = 7.4, p=.009$ , partial  $\eta^2 = .13$  (figure 1). Within the individual facets of the factor Extraversion, scores for the facet Sociability were lower in the affected skating group (Mean±SD: 2.69±.41) compared to controls (Mean±SD: 3.12±.6),  $F(1,50) =$

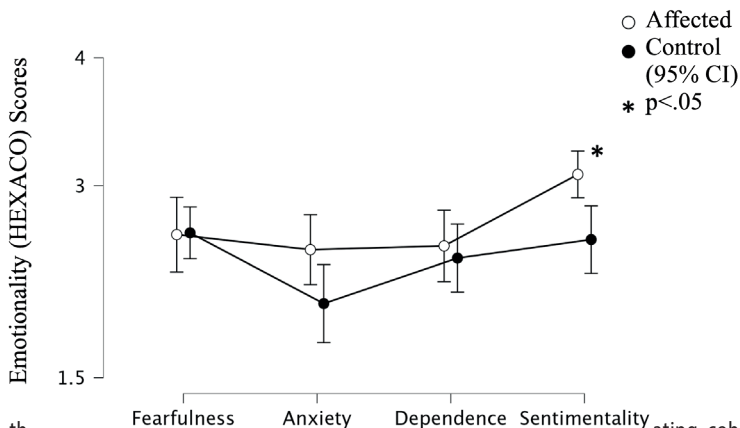
8.75,  $p=.005$ , partial  $\eta^2 = .15$ . Consult Table 2 for all significant results, for the complete output consult Appendix B.

**Figure 1.** HEXACO: Skater’s Cramp vs Control



Depicted are the average HEXACO factor scores for the affected and the control skating cohorts. Whiskers represent the 95% confidence interval.

**Figure 2.** Facets: Emotionality (Only Male)



Depicted are the average HEXACO facet scores for emotionality and the control skating cohorts. Whiskers represent the 95% confidence interval.

### 1.4 Assumptions

Assumptions of homogeneity of variance were equal for the 6 major factors and 20 facets of HEXACO (Levene’s test:  $p<.05$ ). Major factors and facets of HEXACO were normally distributed (Shapiro-Wilk test:  $p>.05$ ). Skewness and kurtosis values were not deviant for any of these facets ( $\pm 2$  and  $\pm 7$  respectively) (33,34) and QQ plots appeared normal.

**Table 2.** ANOVA: Factors/Facets of HEXACO with Independent Factors: Affected vs Control and Males vs Females

Factor/Facet	Sex	Group Affected		Group Control		ANOVA F(1,50)								
		Mean±SD	Mean±SD	p	F	η <sup>2</sup>	p	F	η <sup>2</sup>	p	F	η <sup>2</sup>	p	SE
Extraversion (Factor)	**Total:	2.99±.39	3.3±.4	.009	7.4	.13	.12	2.53	.05	.85	.04	.00		
Sociability (Facet Ext.)	**Total:	2.69±.41	3.12±.6	.005	8.75	.15	.4	.72	.01	.6	.28	.01		
Sentimentality (Facet Emot.)	Total:	3.04±.61	2.85±.79	.92	.01	>.01	.07	3.34	.06	.01	6.68	.12		
	* Male:	3.09±.56	2.58±.79										.02	.22
	Female:	2.94±.72	3.42±.41										.13	.31

SD = Standard Deviation, Ext. = Extraversion, Emot. = Emotionality, p: probability, \*\* = p > .01, \* = p > .05, F = F value, η<sup>2</sup>: partial eta squared, SE = standard error.

## Discussion

Our study aimed to compare the personality of skater's affected with skater's cramp to age-, sex- and skating experience-matched controls. We found affected skaters were higher in sentimentality (a facet of emotionality) only in the male population. Furthermore, the group with TSD was lower in extraversion. Clinical features of skaters with skater's cramp were comparable with TSD with a similar age of onset, rate of onset, rate of recovery (35), level of task-specificity, absence of pain, and ratio of men to women (9,36,37). Higher sentimentality in males and lower extraversion in general may relate to a new feature of personality that is distinctive to skater's cramp and possibly also a feature of TSD (a field of study in its infancy).

### 1.1 High Sentimentality

Higher sentimentality in males of our study (comprising the majority of our cohort) resembled similar results in TSD in musicians and athletes (20,23). Anxiety appeared marginally higher in males compared to the control population as well, but did not reach significance ( $p=.07$ ) (table 2). The results of the male skater's cramp group are comparable with the broader literature around emotionality and other forms of TSD (20). It is not exactly known why emotionality appears higher in TSD, but a shared neurological mechanism for developing anxiety and movement disorders has been proposed (38). Studies show that decreased inhibition in cortical and subcortical networks underlying TSD (39,40), are also involved in anxiety sensitivity (41). Specifically, motor loops involving the basal ganglia and frontal cortex are thought to negatively influence limbic loops relying on similar brain regions (17,20). It is possible that our tentative result of higher sentimentality, albeit only in the male sub-population, is an indicator of a common dysregulation between motor and limbic loops, as posited in other forms of TSD (38). Although highly preliminary, higher sentimentality may indicate another link between TSD and skater's cramp, and supports future research on personality in TSD.

Importantly, our findings were limited to a male sub-population. Due to too few participating females ( $n=9$ ), we draw no firm conclusions for that group separately, and only propose the male group ( $n=17$ ) may be higher in sentimentality based on the interaction and pairwise results. Previous studies of TSD and personality have had the same limitation, with too few female participants for subgroup analysis in the study, 4/24, (16%) (21), 4/20 (20%) (18), 15/64 (27%) (22), and 0/19 (0%) (23). Therefore, it is still an open question whether sex is a determinant of differences in emotionality both in skater's cramp and in TSD generally. Despite these limitations, we deemed it justified to report our sex-specific findings, arguing that the known higher emotionality in healthy females (32) and the known higher prevalence of TSD in males at 4:1 (37) suggests a possible interaction effect that justifies looking at female and male groups separately.

## 1.2 Low Extraversion

The entire group of affected skaters scored lower on the major factor extraversion, specifically lower on the facet Sociability. This finding is not supported by the literature as no examples of higher extraversion have been found in TSDs. One explanation unrelated to skater's cramp is that we inadvertently selected for a more social control group. Meanwhile affected participants may have been more motivated by a need to understand their disorder, resulting in a disparity in social engagement scores.

Alternatively, lower extraversion may indeed relate to skater's cramp, and not to our selection procedure. Supporting this notion extraversion scores for the control group were not higher than an average Dutch population (42) (skaters: Mean±SD: 3.3±.4 compared to average Dutch: Mean±SD: 3.32±.45). If extraversion was indeed lower in affected skaters, it may relate to higher emotionality in TSD through a common dopaminergic mechanism. Anxiety sensitivity has been shown to correlate not only with higher emotionality, but also lower extraversion(43). This is partly because both tendencies downregulate dopamine (44). Importantly, insufficient dopamine in striatal pathways is also involved in the development of TSD (45). Therefore, maladaptive downregulation of dopamine between basal ganglia and frontal cortex may be the shared mechanism that causes higher emotionality, lower extraversion, and a higher risk of TSD. Experiments with larger cohorts conducted on different forms of TSD are needed to investigate the possible multidimensional relationship between emotionality/extraversion, dopamine and TSD.

## 1.3 Limitations

This study had limitations, primarily it remains challenging to clearly capture differences in personality with a 6 (HEXACO) or 5 (NEO-PI) factor model when constricted by the small sample sizes available when studying TSD. For example of the 5 studies employing NEO-PI who found higher anxiety in those with TSD, only three found a direct difference in NEO-PI (20,23,46), the other two required more complex statistics and other psychometric tests to find similar results(21,22). Despite these limitations, we employed methods to improve the validity of our findings. In conducting this study, we adhered the same thresholds for population size and statistical power that have previously been used in other studies of personality and TSD. Furthermore, we employed a very strict matching of affected and healthy participants to control for covariant factors that influence personality like age (47), sex (32), and dedication to sports (48).

## 1.4 Conclusion

In other TSDs in sports and music, higher emotionality has been found. We further supported the link between a TSD and sentimentality showing that sentimentality (a facet of emotionality) was higher in skaters cramp but only in males. Additionally we found that Extraversion was lower in the whole group of affected skaters . This may be a new

feature of personality in skater's cramp specifically, or in TSD more generally. Due to a small sample size and the underrepresentation of female participants in our group and in TSD and personality research in general, our results are a tentative further step in examining personality difference in skater's cramp and TSD.

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## Appendix A

**Table 2.** Population Characteristics Skater's Cramp (n=26)

Onset Time (weeks) median (IQR)	1.5 (5.75)
Task Specificity of Skater's Cramp n(%)	
Symptoms at Rest	1 (4%)
While Running	4 (15%)
Only While Skating	22(85%)
Self-Reported Trigger Factors n (%)	
Injury/Fall	7(27%)
Equipment Change	2(8%)
Technique Change	3(12%)
Over-Training	5(19%)
Nothing Reported	9 (35%)
Pre-existing injury/medical condition n (%)	4 (15%) (none movement related)
Recovery n (%)	0 (0%)
Pain n (%)	0 (0%)
Unilateral (one leg) n (%)	24 (92%)
Joint Pain n (%)	4 (15%) unrelated to affected limb
Quit Due to Symptoms n (%)	17 (65%)
Received a Diagnoses n (%)	21 (81%)(not TSD)
Attempted Treatment	9 (35%)
Successful Treatment	0 (0%)

## Appendix B

### Full Results of ANOVA

Here are the full set of result for the ANOVA comparing affected group and control group for the 6 major factors and 20 facets of HEXACO. The **dependent variable** was personality factor or facet (e.g. Extraversion), and **fixed factors** was TSD (affected skaters vs control skaters), and sex (male vs female). Table one describes between subjects effects, and table two describes post-hoc pairwise comparisons using Bonferroni correction. Significant results are reported **in bold**.

		Tests of Between-Subjects Effects					
Dependent Variable		Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Subjects	Emotionality	.037	1	.037	.204	.654	.004
	Fearfulness	.005	1	.005	.038	.847	.001
	Anxiety	5.765E-5	1	5.765E-5	.000	.991	.000
	Dependence	.798	1	.798	1.714	.196	.033
	Sentimentality	.004	1	.004	.010	.923	.000
	HonestyHumility	.044	1	.044	.296	.589	.006
	Sincerity	.239	1	.239	.807	.373	.016
	Fairness	.124	1	.124	.474	.494	.009
	GreedAvoidance	.011	1	.011	.022	.882	.000
	Modesty	.009	1	.009	.036	.850	.001
	<b>Extraversion</b>	<b>1.127</b>	<b>1</b>	<b>1.127</b>	<b>7.363</b>	<b>.009</b>	<b>.128</b>
	SocialSelfEsteem	.636	1	.636	3.340	.074	.063
	SocialBoldness	.916	1	.916	2.089	.155	.040
	<b>Sociability</b>	<b>2.399</b>	<b>1</b>	<b>2.399</b>	<b>8.753</b>	<b>.005</b>	<b>.149</b>
	Liveliness	.867	1	.867	2.644	.110	.050
	Agreeableness	.041	1	.041	.230	.633	.005
	Forgiveness	.807	1	.807	1.957	.168	.038
	Gentleness	.027	1	.027	.081	.777	.002
	Flexibility	.350	1	.350	1.038	.313	.020
	Patience	.116	1	.116	.240	.626	.005
Conscientiousness	.001	1	.001	.012	.912	.000	
Organization	6.951E-5	1	6.951E-5	.000	.986	.000	
Diligence	.075	1	.075	.348	.558	.007	
Perfectionism	.016	1	.016	.032	.860	.001	
Prudence	.079	1	.079	.645	.426	.013	
OpennesstoExperience	.302	1	.302	1.198	.279	.023	
AestheticAppreciation	1.178	1	1.178	2.047	.159	.039	
Inquisitiveness	.013	1	.013	.060	.807	.001	
Creativity	.970	1	.970	1.361	.249	.026	
Unconventionality	.000	1	.000	.000	.986	.000	

SEX								
SEX	<b>Emotionality</b>	<b>1.363</b>	<b>1</b>	<b>1.363</b>	<b>7.571</b>	<b>.008</b>	<b>.132</b>	
	Fearfulness	.392	1	.392	2.858	.097	.054	
	<b>Anxiety</b>	<b>3.367</b>	<b>1</b>	<b>3.367</b>	<b>7.179</b>	<b>.010</b>	<b>.126</b>	
	Dependence	1.050	1	1.050	2.256	.139	.043	
	Sentimentality	1.443	1	1.443	3.341	.074	.063	
	HonestyHumility	.057	1	.057	.381	.540	.008	
	Sincerity	.082	1	.082	.277	.601	.006	
	Fairness	.069	1	.069	.262	.611	.005	
	GreedAvoidance	.950	1	.950	1.973	.166	.038	
	Modesty	2.873E-5	1	2.873E-5	.000	.992	.000	
	Extraversion	.388	1	.388	2.534	.118	.048	
	<b>SocialSelfEsteem</b>	<b>1.071</b>	<b>1</b>	<b>1.071</b>	<b>5.627</b>	<b>.022</b>	<b>.101</b>	
	SocialBoldness	.576	1	.576	1.314	.257	.026	
	Sociability	.199	1	.199	.725	.399	.014	
	Liveliness	.069	1	.069	.212	.647	.004	
	<b>Agreeableness</b>	<b>1.035</b>	<b>1</b>	<b>1.035</b>	<b>5.803</b>	<b>.020</b>	<b>.104</b>	
	Forgiveness	1.190	1	1.190	2.885	.096	.055	
	Gentleness	.574	1	.574	1.740	.193	.034	
	Flexibility	1.866	1	1.866	5.538	.023	.100	
	Patience	.731	1	.731	1.520	.223	.030	
	Conscientiousness	.050	1	.050	.621	.435	.012	
	Organization	.019	1	.019	.085	.772	.002	
	Diligence	.164	1	.164	.762	.387	.015	
	Perfectionism	1.043	1	1.043	2.028	.161	.039	
	Prudence	.154	1	.154	1.258	.267	.025	
	OpennesstoExperience	.007	1	.007	.026	.872	.001	
	AestheticAppreciation	.076	1	.076	.133	.717	.003	
	Inquisitiveness	.586	1	.586	2.666	.109	.051	
	Creativity	.076	1	.076	.107	.745	.002	
	Unconventionality	.195	1	.195	.475	.494	.009	
	Subjects*SEX	<b>Emotionality</b>	<b>1.121</b>	<b>1</b>	<b>1.121</b>	<b>6.225</b>	<b>.016</b>	<b>.111</b>
		Fearfulness	.014	1	.014	.105	.747	.002
<b>Anxiety</b>		<b>2.103</b>	<b>1</b>	<b>2.103</b>	<b>4.484</b>	<b>.039</b>	<b>.082</b>	
Dependence		1.495	1	1.495	3.212	.079	.060	
<b>Sentimentality</b>		<b>2.887</b>	<b>1</b>	<b>2.887</b>	<b>6.684</b>	<b>.013</b>	<b>.118</b>	
HonestyHumility		9.389E-5	1	9.389E-5	.001	.980	.000	
Sincerity		.088	1	.088	.297	.588	.006	
Fairness		.297	1	.297	1.135	.292	.022	
GreedAvoidance		.088	1	.088	.182	.672	.004	
Modesty		8.866E-8	1	8.866E-8	.000	1.00	.000	
Extraversion		.006	1	.006	.037	.847	.001	
SocialSelfEsteem		.001	1	.001	.004	.949	.000	
SocialBoldness		.081	1	.081	.184	.670	.004	
Sociability		.078	1	.078	.283	.597	.006	
Liveliness		.066	1	.066	.203	.654	.004	
Agreeableness		.032	1	.032	.179	.674	.004	

Forgiveness	.124	1	.124	.300	.586	.006
Gentleness	.067	1	.067	.205	.653	.004
Flexibility	.012	1	.012	.036	.850	.001
Patience	.841	1	.841	1.749	.192	.034
Conscientiousness	.008	1	.008	.097	.757	.002
Organization	.040	1	.040	.179	.674	.004
Diligence	.217	1	.217	1.008	.320	.020
Perfectionism	.102	1	.102	.199	.658	.004
Prudence	5.765E-5	1	5.765E-5	.000	.983	.000
OpennesstoExperience	.045	1	.045	.180	.674	.004
AestheticAppreciation	.048	1	.048	.084	.773	.002
Inquisitiveness	.000	1	.000	.002	.968	.000
Creativity	.097	1	.097	.136	.713	.003
Unconventionality	.090	1	.090	.219	.642	.004
Error						
Emotionality	9.004	50	.180			
Fearfulness	6.866	50	.137			
Anxiety	23.451	50	.469			
Dependence	23.271	50	.465			
Sentimentality	21.596	50	.432			
HonestyHumility	7.454	50	.149			
Sincerity	14.794	50	.296			
Fairness	13.099	50	.262			
GreedAvoidance	24.080	50	.482			
Modesty	12.680	50	.254			
Extraversion	7.652	50	.153			
SocialSelfEsteem	9.518	50	.190			
SocialBoldness	21.922	50	.438			
Sociability	13.702	50	.274			
Liveliness	16.393	50	.328			
Agreeableness	8.917	50	.178			
Forgiveness	20.624	50	.412			
Gentleness	16.498	50	.330			
Flexibility	16.846	50	.337			
Patience	24.031	50	.481			
Conscientiousness	4.042	50	.081			
Organization	11.266	50	.225			
Diligence	10.771	50	.215			
Perfectionism	25.730	50	.515			
Prudence	6.118	50	.122			
OpennesstoExperience	12.583	50	.252			
AestheticAppreciation	28.772	50	.575			
Inquisitiveness	10.994	50	.220			
Creativity	35.658	50	.713			
Unconventionality	20.511	50	.410			

Total	Emotionality	395.487	54
	Fearfulness	396.625	54
	Anxiety	355.688	54
	Dependence	385.188	54
	Sentimentality	493.188	54
	HonestyHumility	566.756	54
	Sincerity	464.563	54
	Fairness	684.361	54
	GreedAvoidance	512.688	54
	Modesty	659.111	54
	Extraversion	545.334	54
	SocialSelfEsteem	676.375	54
	SocialBoldness	457.375	54
	Sociability	474.313	54
	Liveliness	623.278	54
	Agreeableness	349.461	54
	Forgiveness	290.438	54
	Gentleness	449.313	54
	Flexibility	278.063	54
	Patience	444.188	54
	Conscientiousness	541.648	54
	Organization	479.500	54
	Diligence	719.125	54
	Perfectionism	557.438	54
	Prudence	467.188	54
	OpennesstoExperience	416.988	54
	AestheticAppreciation	427.875	54
	Inquisitiveness	523.438	54
	Creativity	419.813	54
	Unconventionality	354.563	54

## Pairwise Comparisons

Dependent Variable	sex	(I) Subjects	(J) Subjects	Mean Difference	Std. Error	Sig. <sup>b</sup>	95% Confidence Interval for Difference <sup>b</sup>	
							Lower Bound	Upper Bound
Emotionality	0	Affected	Control	-.361	.200	.077	-.763	.041
	1	Affected	Control	.250	.142	.083	-.034	.535
Fearfulness	0	Affected	Control	.056	.175	.752	-.295	.406
	1	Affected	Control	-.014	.124	.911	-.262	.235
Anxiety	0	Affected	Control	-.417	.323	.203	-1.065	.232
	1	Affected	Control	.421	.229	.071	-.038	.880
Dependence	0	Affected	Control	-.611	.322	.063	-1.257	.035
	1	Affected	Control	.095	.228	.678	-.362	.553
Sentimentality	0	Affected	Control	-.472	.310	.134	-1.095	.150
	1	<b>Affected</b>	<b>Control</b>	<b>.509</b>	<b>.219</b>	<b>.024</b>	.069	.950
HonestyHumility	0	Affected	Control	.058	.182	.752	-.308	.423
	1	Affected	Control	.063	.129	.625	-.195	.322
Sincerity	0	Affected	Control	.056	.256	.829	-.459	.571
	1	Affected	Control	.227	.182	.218	-.138	.592
Fairness	0	Affected	Control	.259	.241	.288	-.225	.744
	1	Affected	Control	-.056	.171	.746	-.399	.287
GreedAvoidance	0	Affected	Control	-.056	.327	.866	-.713	.602
	1	Affected	Control	.115	.232	.621	-.350	.581
Modesty	0	Affected	Control	-.028	.237	.907	-.505	.449
	1	Affected	Control	-.028	.168	.870	-.365	.310
Extraversion	0	Affected	Control	-.285	.184	.129	-.655	.086
	1	<b>Affected</b>	<b>Control</b>	<b>-.328</b>	<b>.131</b>	<b>.015</b>	<b>-.591</b>	<b>-.066</b>
SocialSelfEsteem	0	Affected	Control	-.222	.206	.285	-.635	.191
	1	Affected	Control	-.238	.146	.108	-.531	.054
SocialBoldness	0	Affected	Control	-.194	.312	.536	-.821	.433
	1	Affected	Control	-.358	.221	.111	-.802	.086
Sociability	0	Affected	Control	-.528	.247	.037	-1.023	-.032
	1	Affected	Control	-.367	.175	.041	-.718	-.016
Liveliness	0	Affected	Control	-.194	.270	.475	-.737	.348
	1	Affected	Control	-.343	.191	.078	-.727	.041
Agreeableness	0	Affected	Control	-.007	.199	.972	-.407	.393
	1	Affected	Control	-.110	.141	.439	-.393	.173
Forgiveness	0	Affected	Control	-.361	.303	.239	-.969	.247
	1	Affected	Control	-.158	.214	.465	-.589	.273
Gentleness	0	Affected	Control	.028	.271	.919	-.516	.572
	1	Affected	Control	-.122	.192	.527	-.507	.263
Flexibility	0	Affected	Control	.139	.274	.614	-.411	.688
	1	Affected	Control	.203	.194	.300	-.186	.592
Patience	0	Affected	Control	.167	.327	.612	-.490	.823
	1	Affected	Control	-.363	.231	.123	-.828	.102

Conscientiousness	0	Affected	Control	.035	.134	.797	-.234	.304
	1	Affected	Control	-.016	.095	.863	-.207	.174
Organization	0	Affected	Control	.056	.224	.805	-.394	.505
	1	Affected	Control	-.060	.158	.705	-.379	.258
Diligence	0	Affected	Control	.056	.219	.801	-.384	.495
	1	Affected	Control	-.214	.155	.174	-.525	.098
Perfectionism	0	Affected	Control	-.056	.338	.870	-.735	.624
	1	Affected	Control	.129	.239	.592	-.352	.610
Prudence	0	Affected	Control	.083	.165	.616	-.248	.415
	1	Affected	Control	.079	.117	.502	-.156	.314
OpennesstoExperience	0	Affected	Control	-.097	.236	.683	-.572	.378
	1	Affected	Control	-.220	.167	.195	-.556	.116
AestheticAppreciation	0	Affected	Control	-.250	.358	.488	-.968	.468
	1	Affected	Control	-.377	.253	.143	-.886	.132
Inquisitiveness	0	Affected	Control	-.028	.221	.900	-.472	.416
	1	Affected	Control	-.039	.157	.806	-.353	.276
Creativity	0	Affected	Control	-.194	.398	.627	-.994	.605
	1	Affected	Control	-.375	.282	.190	-.941	.192
Unconventionality	0	Affected	Control	.083	.302	.784	-.523	.690
	1	Affected	Control	-.090	.214	.676	-.519	.340

Based on estimated marginal means

b. Adjustment for multiple comparisons: Bonferroni.