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EXPLORATION OF THE BENEFITS OF AN ACTIVITY-SPECIFIC TEST OF TEMPERAMENT[1, 2]

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Summary.—The Structure of Temperament Questionnaire (STQ) was proposed by Rusalov in 1989 and subsequently tested in five languages. The questionnaire assesses four temperamental traits (Ergonicity, Plasticity, Tempo, and Emotionality) in three separate areas of activity: physical, verbal-social, and intellectual. The scales are all activity-specific. In 775 Canadian subjects, two temperament tests were compared, both developed on the basis of Pavlovian studies of the nervous system: the activity-specific approach (STQ) and the nonspecific Pavlovian Temperamental Survey (PTS). More significant sex differences were found on activity-specific scales of the STQ than on the nonspecific PTS scales. The pattern of correlations between the STQ scales and the time taken on an experimental task requiring a prolonged and intense word-assessment activity showed stronger correlations with the specific scales of the STQ measuring the dynamic aspects of social-verbal activity, and not with the PTS Strength of Excitation scale, which is based on a "general arousal" concept. The results supported the separation of temperament traits related to three different types of activities and opposed to "general arousal" theories of temperament.

Many researchers consider temperament to comprise the content-free, formal dimensions of behaviour, whereas personality is considered a sociopsychological construct comprising the content characteristics of human behaviour (Eysenck & Eysenck, 1968; Nebylitsyn, 1972; Gray, 1982; Rusalov, 1989; Strelau & Angleitner, 1991). As Strelau and Angleitner (1991, p. 6) pointed out in their review, "most temperament researchers agree that temperament, whatever the traits and structure to which this concept refers, has a strong biological determination." This assumption has its roots in the facts that temperament characteristics can be observed from the first weeks of life and individual differences in temperamental traits have a strong genetic determination." The European tradition in analysis of temperament (Kant, 1798/1974; Stern, 1900, cited from Lamiell, 2003; Heymans, 1929; Pavlov, 1941; Eysenck & Eysenck, 1968) described

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two basic components of temperament, Activity characteristics and Emotionality characteristics.

A two-component model of temperament was developed further in the Russian psychological school, which studied the types and properties of the nervous system as the basis of the most consistent personality traits. Since Pavlov's time at the beginning of the 20th century, extensive experimental work with human participants has been conducted in the laboratories of Teplov and Nebylitsyn (see the review of Gray, 1964) and Rusalov (1979). These experiments showed that the strength of excitation or inhibition in the central nervous system (CNS) is expressed as how long the individual can sustain activation or inhibition of activation. The mobility of the CNS processes is indicated as the plasticity of behaviour, how easily the individual can start or stop activity, and how flexible and adaptive the individual is to new circumstances or instructions. The balance between excitation and inhibition was thought to be the basis of emotionality, impulsivity, or detachment behaviour. The British psychologist Jeffrey Gray, who conducted most of the work on the translation and analysis of Pavlov's "types of CNS" (Gray, 1964), found a strong parallel between the concept of arousal and the Pavlovian concept of the strength of a nervous system. Elucidating the relationships between various brain structures, Gray proposed a model that explains both the four classical temperamental types and Pavlov's types in terms of the relationship between approach and withdrawal systems (Gray, 1982).

Vladimir Rusalov, who, after Nebylitsyn, inherited the Laboratory of Differential Psychology and Differential Psychophysiology in the Institute of Psychology under the Russian Academy of Sciences, started in the 1970s a large experimental project analyzing types of EEG activity, strength, and mobility of nervous processes in various modalities, performance by humans in deterministic and probabilistic conditions, tempo of reading and motor tasks, verbal activity, performance on tests of intelligence, and behavioral particularities associated with the various temperamental traits. Based on this work, Rusalov concluded that temperamental traits are activity-specific: energetic level or tempo of performance might be different for a given individual in physical, social, or intellectual activities, therefore the aspects of the performance of these activities should be assessed and analysed separately.

Based on his experiments, Rusalov proposed the Structure of Temperament theory and developed his Structure of Temperament Questionnaire. The first version of the English version of the Structure of Temperament Questionnaire (STQ; Rusalov, 1989) had four scales: Ergonicity (endurance, the ability to keep intensive work), Plasticity (or flexibility, the ability to effectively switch between tasks or to change the way of per-

formance), Tempo, Emotionality separately in physical-motor (Motor) activity, and social activity (such as reading, writing, speaking, or communication). Estimates of internal reliability for the scales have ranged from .70 to .81. Then, a third set of four scales was added to measure aspects of intellectual activity, with the development of adult, teenage, middle school, and preschool Extended versions of the STQ (Rusalov, 1997, 2004). The Extended STQ has a 4-point Likert scale format; see Appendix A, p. •••, for examples of items. A summary of the validation of the Structure of Temperament Questionnaire is provided in Appendix B, p. •••.

The benefits of the Rusalov Structure of Temperament Questionnaire were that it used the activity-specific model of temperament in which the scales were grouped in factors by the types of activity (for example, Social Ergonicity, Social Plasticity, and Social Tempo) and not by dynamic aspects of activity. The previous models of temperament and personality did not distinguish among areas of activity, considering, for example, arousal in motor and social activity (Extraversion or Strength of the nervous system) as a nonspecific general activation of the nervous system (Pavlov, 1941; Eysenck & Eysenck, 1968; Nebylitsyn, 1972; Gray, 1982; Costa & McCrae, 1992; Strelau, 1999).

The theoretical rationale of the present study was to explore the benefits of analysis of temperament traits separately in physical, social-verbal, and intellectual activities. Many models of temperament and personality continue to follow the so-called "general arousal" approach, considering that only one general trait is related to the energetic component of behaviour, namely "strength of excitation" (Pavlov, 1941; Strelau, 1999), "liveliness" (Cattell, 1965), "extraversion" (Eysenck & Eysenck, 1968; Rothbart, 1988; Big Five model, including Costa & McCrae, 1992), "activity" (Behavioural Approach System of Gray, 1982; Buss & Plomin, 1984; Windle & Lerner, 1986), "drive persistence" (Carver & White, 1994; Cloninger, Przybeck, Svrakic, & Wetzel, 1994), or just "arousal" (Mehrabian & Bank, 1978). The same is true for mobility (i.e., how easily the activity can be started and carried out). Previous studies using the STQ showed that the arousal-related traits of temperament correlate with the personality traits in a discriminatory manner. For example, high correlations of Extraversion, as measured by the Eysenck Personality Questionnaire, are found with the Social Ergonicity (*r*s = .68–.74), Social Plasiticity (*r*s = .43–.65), and Social Tempo (*r*s = .39–.51) scales of the STQ (Rusalov, 1989; Brebner & Stough, 1993; Dumenci, 1995; Zin'ko, 2006), but not with the scales of Motor or Intellectual Ergonicity. Similarly, high correlations of Extraversion, as measured by the Big Five, are found with the Social Ergonicity (*r* = .29) and Social Tempo (*r* = .29) scales, while the correlations with the Motor Ergonicity and Motor Tempo scales were not significant (Dumenci, 1995).

In this study, a test measuring temperament traits separately in three areas of activity (i.e., Structure of Temperament Questionnaire) was expected to yield more knowledge about biologically based individual differences than a nonspecific test of temperament. Sex is one of the main biological factors related to individual differences, often associated with particular temperaments. Previous studies using the STQ have shown that separation of temperament traits related to verbal-social and physical activities provides important information about sex differences (Vasyura, 2008; Trofimova, 2009). The second main factor universally listed as a temperament dimension is arousal within the nervous system, helping an individual to stay active on a task. If there is a "general arousal" factor (described as "strength of excitation" or "extraversion" or "activity" or "drive persistence" or just "arousal") and if there is no need for the separation of arousal by type of activity, then performance on any task requiring constant activation would show nonspecific correlations with temperament scales measuring arousal. On the other hand, if the specific task affected the pattern of correlations between specific temperament traits and speed of performance on this task, then that would demonstrate the need to use temperament scales designed to measure the dynamic aspects of activity separately in physical, social-verbal, and intellectual areas. For this study, a task requiring a prolonged semantic estimation of the abstract words (i.e., requiring arousal in verbal and intellectual activities) was performed under time pressure. This task was chosen over other social activities to measure the ability to sustain prolonged repetitive activity associated with verbal material based upon its duration and intensity. The use of other social activities would bring unnecessary variance to the data and also might be more stimulating for some subjects, potentially biasing the results.

In summary, the goals of the present study were (a) to assess the benefits of an activity-specific test of temperament (STQ) in the analysis of sex differences, (b) to investigate the differential power of two temperament tests developed within the Pavlovian tradition (the activity-specific STQ and the nonspecific Pavlovian Temperament Survey; PTS) using an experimental task requiring intense and fast verbal intellectual activity, and (c) to compare these two tests by finding the correlations between their scales. The corresponding hypotheses were that (a) significant differences would be observed between the scores of men and women on the scales of the STQ when the scales assess dynamic properties separately in three different types of activities; (b) among these two temperament tests developed within the Pavlovian tradition, the activity-specific test of temperament would have stronger correlations with the time required to complete a prolonged word-assessment task than a nonspecific test of

temperament—specifically, the duration of this task would correlate negatively mostly with the dynamic aspects of verbal-social and possibly intellectual activity, but not with the aspects of physical activity; and (c) STQ scales measuring the arousal aspects of activity (i.e., Ergonicity) would correlate positively with the PTS scale of Strength of Excitation, while the STQ scales of Plasticity and Tempo would correlate positively with the PTS Mobility scale, and the STQ scale of Intellectual Ergonicity would correlate positively with the PTS scale of Strength of Inhibition.

Method

Participants

Canadian participants ($N = 966$; 233 men, 733 women) ages 17 to 35 years ($M = 20.2$, $SD = 3.3$), of whom 171 were volunteers and 743 were psychology students at McMaster University and 52 were psychology students at Brock University (both universities are located in Southern Ontario, Canada) took part in this study in 1999 to 2006. Of these, 775 of 966 participants, 175 men and 600 women (M age = 19.8 yr., $SD = 3.0$), 63 volunteers (8%) and 712 students, completed all measures; 74 student participants (M age = 20.1 yr., $SD = 3.2$) completed the experimental task and the STQ, and 117 volunteers completed the STQ only (they were not invited to participate in the experiment).

Measures

Participants ($N = 775$) completed the extended English version of Rusalov's Structure of Temperament Questionnaire (Rusalov & Trofimova, 2007), and the English version of the Pavlovian Temperament Survey (Strelau, 1999).

Structure of Temperament Questionnaire (Rusalov, 1989; Rusalov & Trofimova, 2007).— This questionnaire has 150 statements to be answered using a 4-point Likert-type scale with labels 1: Strongly disagree, 2: Disagree, 3: Agree, and 4: Strongly agree. Six items are assigned to a validity scale, and 144 items to 12 temperamental scales (12 items each) measuring the four traits of Ergonicity, Plasticity, Tempo, and Emotionality in each of three areas of activity (motor-physical, social-verbal, and intellectual-mental). The Cronbach alpha reliability coefficient for the STQ scales ranged from .70 to .84 (Rusalov & Trofimova, 2007).

Pavlovian Temperament Survey (Strelau, 1999).—This survey has 66 statements to be answered on a 4-point Likert-type scale with labels 1: Strongly disagree, 2: Disagree, 3: Agree, and 4: Strongly agree. There are three scales, Strength of Excitation, Strength of Inhibition, and Mobility (22 items each), for which Cronbach coefficients alpha were reported to range from .81 to .84.

Semantic task.—To complete this task, participants rated 30 abstract concepts (words) on 60 7-point bipolar scales (i.e., warm vs cold, soft vs hard, interesting vs uninteresting, etc.). Each concept was presented as a word on a computer monitor along with each of the bipolar scales.

Procedure

Participants were debriefed about the duration and nature of the experiment. They were instructed to work as fast as possible, and their time on this task was recorded. The computer program Expan (provided by HR-Laboratory Human Technologies)[3] detected whether a participant was giving random or inconsistent answers. The procedure took 1 to 3 hours depending on the speed of the participant's performance. All participants signed an informed consent form before testing and participation in the experiment. Afterward, university students received the practicum credit for their participation. All subjects were fluent in English.

Results and Discussion

Table 1 shows means, standard deviations, and confidence intervals for the applied measures. Each STQ scale had a normal distribution of scores with a range of 12 to 48. The sex differences in the scores on STQ scales were much stronger than on PTS scales, supporting the first hypothesis. Analysis of sex differences using one-way ANOVA showed that women performed the Semantic Task significantly faster than men, which was consistent with significantly higher scores for women than men on Social Ergonicity and Social Tempo scales (Table 1). Men had higher scores on Motor Ergonicity, Plasticity, Tempo, and Emotionality scales, and also on Intellectual Plasticity and Tempo scales. Sex differences in PTS scores were found to be statistically significant only for the Mobility scale ($p < .01$). These results are in line with findings from studies showing that men have higher physical activity than women, especially in activities requiring upper body strength (Thomas & French, 1985; Eaton & Enns, 1986), and that on the average men perform better than women on tests of visual-spatial abilities but more poorly than women on verbal tests (Hyde & Linn, 1988; Halpern, 2000).

Contrary to the common view of women being more emotional than men, the results showed that while women had higher scores on Social and Intellectual Emotionality scales, it was men who had significantly higher scores on the scales of Motor Emotionality, i.e., male subjects reported being more sensitive to success or failure in physical activities than did women. This result supports the idea of separation of two definitions of emotionality, expression of an emotion or experience of an emotion. Several studies have found previously that the sex differences were statis-

[3]http://www.ht.ru/about/index_eng.php.

TABLE 1

MEANS, STANDARD DEVIATIONS, 95% CONFIDENCE INTERVALS, AND *F* VALUES OF ONE-WAY ANALYSES OF VARAINCE FOR SEX FOR EACH MEASURE

Measure	*M*	*SD*	95%*CI*	*M*	*SD*	95%*CI*	*F*
		Men, $n=202$			Women, $n=647$		$df=1, 847$
Time on Semantic Task, min.	84.5	25.5	80.9–88.0	75.7	20.4	74.1–77.3	24.80‡
PTS scales		Men, $n=175$			Women, $n=600$		$df=1, 773$
Strength of Excitation	58.4	7.5	57.2–59.5	57.4	6.9	56.9–58.0	2.45
Strength of Inhibition	58.7	6.4	57.7–59.6	58.3	6.4	57.8–58.8	0.41
Mobility	58.4	6.7	57.4–59.4	56.8	6.8	56.3–57.4	6.83†
STQ scales		Men, $n=233$			Women, $n=733$		$df=1, 964$
Motor Ergonicity	33.5	7.4	32.5–34.4	30.9	7.0	30.4–31.4	22.72‡
Intellectual Ergonicity	31.4	5.5	30.7–32.1	30.8	5.6	30.4–31.2	1.69
Social Ergonicity	34.4	7.1	33.5–35.4	36.0	6.7	35.5–36.4	8.76‡
Motor Plasticity	32.2	5.7	31.5–32.9	30.7	5.5	30.3–31.1	12.05‡
Intellectual Plasticity	30.7	5.4	30.0–31.4	29.2	5.2	28.8–29.6	14.61‡
Social Plasticity	29.6	6.3	28.8–30.4	28.8	6.6	28.3–29.3	2.51
Motor Tempo	33.7	6.0	33.0–34.5	32.8	5.3	32.4–33.2	4.78*
Intellectual Tempo	34.4	5.6	33.7–35.2	32.1	5.3	31.7–32.5	34.16‡
Social Tempo	33.6	5.9	32.8–34.3	36.5	5.5	36.1–36.9	47.58‡
Motor Emotionality	26.9	5.7	26.1–27.6	25.4	6.0	25.0–25.8	10.96‡
Intellectual Emotionality	29.6	5.7	28.8–30.3	30.8	6.0	30.4–31.3	8.16‡
Social Emotionality	28.1	6.1	27.3–28.8	29.6	5.7	29.2–30.0	11.85‡

*$p<.05$. †$p<.01$. ‡$p>.001$.

tically significant when situational factors modeled underlying sex stereotypes: women reported more intense emotional experiences than men in situations which involved interpersonal rather than impersonal emotion elicitors (LaFrance & Banaji, 1992; Fischer, 1993). In this sense, sensitivity to failure in relations and social activities might be greater for women, and sensitivity to failure in physical activity might be greater for individuals who are expected in society to be stronger or more physically fit, i.e., in general men. Interestingly, there was a significant negative correlation ($p < .001$) between the PTS Strength of Inhibition and Social Emotionality scales (Table 2). It is possible that men consider behavior related to social emotionality as disinhibited and inappropriate for their sex.

Sex differences among correlations of the temperament scales with duration on the Semantic Task were not dramatic, but significant (Table 2). The temperament traits associated in men with faster performance on the Semantic Task were different from those for faster performance among women. The duration of this task for women showed significant correlations with all three Tempo scales, Intellectual Plasticity, and Motor Ergonicity scales; these were not observed for men. The duration of the Semantic Task for men had the strongest correlation with the STQ Social Plasticity scale, which assesses how easily an individual generates, stops, or switches between verbal-social actions. It is possible that the size of the male sample was a factor contributing to these differences. It is also possible, however, that men and women used different abilities to perform the task and so had different styles of working on it. If women indeed are more accustomed to working with words, then for them the Semantic Task is a matter of speed in doing rather automatic, well-known work. If men on average report lower speed and endurance in verbal-social activities than women (as noted above), then men might compensate through higher flexibility in the "switches" required in such activities and use their verbal-social plasticity to succeed on the Semantic Task.

Among all applied temperament scales, significant correlations ($p < .001$) of performance times on the semantic task were found with the scales measuring dynamic aspects of social-verbal activity, i.e., Social Ergonicity, Social Plasticity, and Social Tempo, and much less with other scales. Higher scores on these scales were associated with faster performance on the task, which involves rating of abstract concepts. The correlations of other scales with the time required to complete the Semantic Task were not consistent across sexes (Table 2) and not as often significant. The three scales of the STQ related to verbal-social activity (Social Ergonicity, Social Plasticity, and Social Tempo) must reflect the ability for intense and fast verbal activity much better than do the scales of intellectual and motor activity. The semantic task required a prolonged, intense activation of nervous processes related to verbal activity and the inhibition of unrelated behav-

TABLE 2

Correlations Between the Structure of Temperament Questionnaire (STQ) Scales, Duration of Semantic Task (min.) (n = 849), and Pavlovian Temperament Survey (PTS) Scales (n = 775)

Scales	Time on STQ			PTS–E Total	PTS–M Total	PTS–I		
	Total	Men	Women			Total	Men	Women
Structure of Temperament Questionnaire								
Motor Ergonicity	–.05	.00	–.11†	.38‡	.22‡	.04	–.04	.06
Intellectual Ergonicity	.01	–.01	.00	.33‡	.23‡	.15‡	.16*	.15‡
Social Ergonicity	–.18‡	–.14*	–.18‡	.33‡	.31‡	–.09*	–.09	–.09*
Motor Plasticity	.03	–.02	.01	.35‡	.38‡	.12‡	.09	.13‡
Intellectual Plasticity	–.06	–.07	–.09*	.41‡	.45‡	.02	.09	–.01
Social Plasticity	–.14‡	–.18†	–.14‡	.37‡	.39‡	–.27‡	–.28‡	–.28‡
Motor Tempo	–.10†	–.08	–.13†	.43‡	.33‡	.05	–.06	.09*
Intellectual Tempo	–.08*	–.13	–.11†	.40‡	.34‡	.02	.07	.00
Social Tempo	–.20‡	–.14*	–.18‡	.40‡	.32‡	–.09*	–.11	–.09*
Motor Emotionality	.02	.04	–.01	–.01	–.01	–.05	–.06	–.05
Intellectual Emotionality	–.02	–.11	.04	–.09*	–.11†	.00	–.03	.01
Social Emotionality	.00	.06	.01	–.21‡	–.14‡	–.07	–.16‡	–.04
Pavlovian Temperament Survey								
Strength of Excitation (n = 722)	–.08*	–.06	–.10*		.52‡			
Strength of Inhibition (n = 722)	.05	–.01	.06	.09*	.13‡			
Mobility (n = 722)	–.05	–.07	–.07					

Note.—PTS–E = PTS Strength of Excitation scale; PTS–I = Strength of Inhibition scale; PTS–M = Mobility scale. *p < .05. †p < .01. ‡p < .001.

iors in order to stay focused; however, there were no significant correlations consistent in either group by sex, between the PTS Strength of Excitation or Strength of Inhibition scales and the duration of performance on the semantic task. There was only one negative correlation of small effect size ($p < .05$) between the PTS Strength of Excitation scale and the duration of the Semantic Task in the women, which affected the correlation between the same in the whole sample. The PTS Mobility scale did not show significant correlation with the duration of the Semantic Task, in spite of the fact that the task required flexibility of performance in switching from one concept to another.

Such a selective pattern of correlations supports the second hypothesis, showing that the STQ scales, designed to measure dynamic aspects of specific activities, have stronger correlations with the speed of performance in corresponding activities than the nonspecific PTS scales. Overall, the selectivity of correlations of temperament scales with the duration of the semantic task and the findings on sex differences show the benefits of separation of temperamental aspects according to the type of activity in the analysis of biological individual differences.

Correlations between the STQ and PTS scales were in accord with the third hypothesis: there were significant positive correlations between the STQ Ergonicity scales and the PTS scale of Strength of Excitation, between the STQ Plasticity and Tempo scales and the PTS Mobility scale, and between the STQ Intellectual Ergonicity scale and the PTS Strength of Inhibition scale (Table 2). The significance of correlations between STQ scales and the PTS scales of Strength of Excitation and Mobility was identical for men and women, so only "all sample" correlations are given on these two PTS scales. Overall patterns of correlations between of STQ and PTS scales, however, were nonspecific and were similar to those reported by Strelau (1999) for Polish and German samples, and by Ruch, Angleitner, and Strelau (1991) for a German sample. All STQ scales measuring characteristics of activity (i.e., Ergonicity, Plasticity, Tempo) in all three areas of activity (motor, social, intellectual) had statistically significant ($p < .001$) positive correlations of various magnitudes with the PTS scales of Strength of Excitation and Mobility. Such a pattern of correlations indicates that almost all STQ scales measure arousal and mobility aspects of activity, but PTS scales do not differentiate between aspects of arousal or types of activity.

The scales of Emotionality in Social and Intellectual activities (which measure sensitivity of a person to failure or success) had significant negative correlations with the Strength of Excitation and Mobility scales of the PTS. Such correlation suggests that people with low arousal (i.e., with the low ability to sustain intense or prolonged work) and low mobility of behavior might have frequent expectations of failure, increased neuroticism in social settings, and overall problems in social adaptation. Significant

negative correlation consistent for both sexes was also found between the scores on the STQ Social Plasticity scale and the PTS Strength of Inhibition scale, which suggests that inhibitory behavior as measured by PTS relates to hesitancy in social activity as measured by the STQ or that the content of the STQ Social Plasticity scale to a large extent describes disinhibited behavior and should be examined further.

In conclusion, STQ and PTS both emerge from the Pavlovian tradition of experimental study of properties of nervous systems and share the tenet that these properties have a biological basis and appear as dynamic aspects of human behaviour: energetic, mobility, and regulatory aspects. The results illustrate the importance of separation of such dynamic aspects into three main types of activity—physical, verbal, and intellectual—as such separation provides more sensitive and detailed analysis of biologically based individual differences.

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APPENDIX A

Examples of the Items of the Extended Structure of Temperament Questionnaire (STQ)

STQ Scale	Item
Motor Ergonicity	4. I get pleasure from doing physical work in my free time.
	32. It is easy for me to do hard physical work.
Intellectual Ergonicity	17. I get tired of prolonged mental work.
	82. I carry out my mental activities with pleasure.
Social Ergonicity	33. I would feel uncomfortable if I didn't communicate with people for a long time.
	98. I'm silent even among my friends.
Motor Plasticity	11. I quickly move into high gear.
	40. I successfully carry out tasks requiring subtle or fine movements.
Intellectual Plasticity	8. It is easy for me to simultaneously do several things, for example, to watch TV and read.
	18. I easily switch from solving one problem to another.
Social Plasticity	15. It's easy for me to enter into conversation with strangers.
	51. It's easy for me to make new acquaintances.
Motor Tempo	118. I work slowly when I make something by hand.
	122. I prefer to do my physical work at a fast rate.
Intellectual Tempo	23. I like intellectual games that require fast decision making.
	38. My thoughts flow slowly.
Social Tempo	50. It's hard for me to talk fast.
	71. I'm a talkative person.
Motor Emotionality	52. I get annoyed if I am not agile during recreational games.
	73. My mood is often spoiled when the things made by myself are not as good as I hoped.
Intellectual Emotionality	12. I am upset finding an error in my decisions, even small ones.
	25. I fear that I cannot perform work requiring mental strain.
Social Emotionality	56. I'm upset if the people whom I'm talking with do not understand me.
	109. I worry a lot when I must discuss relationships with friends.

APPENDIX B

Validation History of the Structure of Temperament Questionnaire

During the experimental validation of the STQ, the performance by participants on the following measures was compared with scores on STQ scales in a series of studies in the 1980s: speed of writing; reading and speed of generation of words; maximal and optimal tempo of performance in sensory-motor tasks and intellectual (including unsolvable) tasks; performance on nonverbal tasks, with which participants were unfamiliar; rigidity of perception in tactile and visual modalities; duration of the switch between one method of solving a task and another; mobility in attention; and variability in line drawing (Rusalov, 1979, 1997, 2004; Rusalov & Trofimova, 2007). Ergonicity scales of the STQ correlated positively with the Eysenck Personality Questionnaire's Extraversion scale (Rusalov, 1989; Brebner & Stough, 1993; Zin'ko, 2006), with the Big Five Extraversion scale (Bodunov, Bezdenezhnykh, & Alexandrov, 1996; Rusalov & Trofimova, 2007), with Strelau's PTS Strength of Excitation scale (Ruch, *et al.*, 1991; Bodunov,*et al*., 1996; Strelau, 1999), with Torrance's Nonverbal Tests of Creative Thinking (Rusalov & Poltavtzeva, 1997), with Rotter's Locus of Control scale (Byzova, 1997), with goal-driven choice of profession as opposed to accessibility of profession (Rusalov, Rusalova, & Strel'nikova, 2000), and with the Motivation for Achievement scale (Vorobieva, 2004).

Scores of the Motor and Social Plasticity and Tempo scales of the STQ correlated positively with Strelau's PTS Mobility scale (Ruch, *et al*., 1991; Bodunov, *et al*., 1996; Strelau, 1999), with adaptivity of behaviour on the Dembo-Hoppe Level of Aspiration experiment (Zin'ko, 2006), with Torrance's Nonverbal Tests of Creative Thinking (Rusalov & Poltavtzeva, 1997), with Rotter's Locus of Control scale (Byzova, 1997), and with the Motivation for Achievement scale (Vorobieva, 2004). Rathee and Singh (2001) reported a comparison of 25 measures of Mobility, including the Plasticity and Tempo scales of the English version of the STQ. The authors found high correlations of scores on the Extended STQ Plasticity scales with those for Alteration task, Flexibility of attention, proof-reading ability, the number of trials needed for participants to reach the optimal reaction time after alteration of a stimulus, and Mobility measured by Strelau's Pavlovian Temperamental Survey (PTS). Tempo in Motor Activity as measured by the English STQ in this study was correlated with EEG α-general speed, time taken to generate simultaneous contrast, duration of "after-image" reaction, critical flicker fusion, and size of uncertainty interval. Scores on the Plasticity scales also positively correlated with those on Eysenck's EPQ Extraversion scale (Rusalov, 1989; Brebner & Stough, 1993; Zin'ko, 2006), on the Big Five Extraversion scale (Dumenci, 1995; Bo-

dunov, *et al*., 1996), and on the PTS Strength of Excitation scale (Ruch, *et al*., 1991; Strelau, 1999).

Emotionality scales scores correlated positively with those on the Neuroticism scale of the Eysenck Personality Questionnaire (Rusalov, 1989; Brebner & Stough, 1993; Zin'ko, 2006), with the Big Five Neuroticism scale (Dumenci, 1995; Bodunov, *et al*., 1996), on the State-Trait Anxiety Inventory (Popov, 2006), with Taylor's Manifest Anxiety Scale (Popov, 2006; Zin'ko, 2006), and use of alcohol (Bodunov,*et al*., 1996), and correlated negatively with scores on the Dissociative Experiences Scale (Beere & Pica, 1995; Eputaev, Ikonnikova, Agarkov, & Tarabrina, 2003), the Rosenzveig test (Zin'ko, 2006), the PTS Strength of Excitation and Strength of Inhibition scales (Ruch, *et al*., 1991; Strelau, 1999), scores on Cattell's A, H, Q2, and Q4 factors (Vasyura, 2008), Torrance's Nonverbal Tests of Creative Thinking (Rusalov & Poltavtzeva, 1997), and the Motivation for Achievement scale (Vorobieva, 2004). Trofimova (1999) applied the semantic differential method to contrast temperamental groups selected on the basis of STQ scores. She reported that subjects with the highest and lowest scores on the STQ scales show differences in their perceptions of semantically neutral objects, including self-perception. The STQ scales which measure dynamic aspects of intellectual activity had positive correlations with such measures of intelligence as the Wechsler and Shepard tests, including the tasks measuring classification abilities ("Excluding the third") and plasticity in nonverbal thinking (Rusalov & Dudin, 1995; Rusalov & Naumova, 1999). Intellectual activity scales had positive correlations with scores on the Locus of Control scale (Byzova, 1997), and goal-oriented choice of profession (Rusalov, *et al*., 2000), and negative correlations with translations of the State-Trait Anxiety Inventory (Popov, 2006), Taylor's Manifest Anxiety Scale (Popov, 2006; Zin'ko, 2006), and the access-oriented choice of profession (Rusalov, *et al*., 2000). Intellectual plasticity correlated with 25 measures of mobility in Rathee and Singh's study (2001).

The administration of the English version of the STQ to American, Australian, and Canadian samples showed the factor structure of this version similar to the Russian language version and that the English version possessed good reliability and internal consistency (Stough, Brebner, & Cooper, 1991; Bishop, Jacks, & Tandy, 1993; Dumenci, 1995, 1996; Bishop & Hertenstein, 2004; Rusalov, 2004; Rusalov & Trofimova, 2007).

Exploration of the benefits of an activity-specific test of temperament[1,2]

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Summary.—The Structure of Temperament Questionnaire (STQ) was proposed by Rusalov in 1989 and subsequently tested in five languages. The questionnaire assesses four temperamental traits (Ergonicity, Plasticity, Tempo, and Emotionality) in three separate areas of activity: physical, verbal-social and intellectual. The scales are all activity-specific. In 775 Canadian subjects, two temperament tests were compared, both developed on the basis of Pavlovian studies of the nervous system: the activity-specific approach (STQ) and the nonspecific Pavlovian Temperamental Survey (PTS). More significant sex differences were found on activity-specific scales of the STQ than on the nonspecific PTS scales. The pattern of correlations between the STQ scales and the time taken on an experimental task requiring a prolonged and intense word-assessment activity showed stronger correlations with the specific scales of the STQ measuring the dynamical aspects of social-verbal activity, and not with the PTS Strength of Excitation scale, which is based on a "general arousal" concept. The results supported the separation of temperament traits related to three different types of activities and opposed to "general arousal" theories of temperament.

Many researchers consider temperament to comprise the content-free, formal dimensions of behaviour, whereas personality is to be considered a sociopsychological construct comprising the content characteristics of human behaviour (Eysenck & Eysenck, 1968; Nebylitsyn, 1972; Gray, 1982; Rusalov, 1989; Strelau & Angleitner, 1991). As Strelau and Angleigtner (1991, p. 6) pointed out in their review, "most temperament researchers agree that temperament, whatever the traits and structure to which this concept refers, has a strong biological determination." This assumption has its roots in the facts that temperament characteristics can be observed from the first weeks of life and individual differences in temperamental traits have a strong genetic determination." The European tradition in analysis of temperament (Kant, 1798; Stern, 1900; cited from Lamiell, 2003; Heymans, 1929; Pavlov, 1941; Eysenck & Eysenck, 1968) described two basic components of temperament, Activity characteristics and Emotionality characteristics.

A two-component model of temperament was developed further in the Russian psychological school, which studied the types and properties of nervous system as the basis of the most consistent personality traits. Since Pavlov's time at the beginning of the 20th century extensive experimental work with human participants was conducted in the laboratories of Teplov and Nebylitsyn (see the review of Gray, 1964), and Rusalov (1979). These experiments showed that the strength of excitation or inhibition in the central nervous system (CNS) is expressed as how long the individual can sustain activation or inhibition of activation. The mobility of the CNS processes is indicated as the plasticity of behaviour, how easily the individual can start or stop activity, and how flexible and adaptive the individual is to new

circumstances or instructions. The balance between excitation and inhibition was thought to be the basis of emotionality, impulsivity, or detachment behaviour. The British psychologist Jeffrey Gray, who conducted most of the work on the translation and analysis of Pavlov's "types of CNS" (Gray, 1964), found a strong parallel between the concept of arousal and the Pavlovian concept of the strength of a nervous system. Elucidating the relationships between various brain structures, Gray proposed a model that explains both the four classical temperamental types and Pavlov's types in terms of the relationship between approach and withdrawal systems (Gray, 1982).

Vladimir Rusalov who, after Nebylitsyn, inherited the Laboratory of Differential Psychology and Differential Psychophysiology in the Institute of Psychology under the Russian Academy of Sciences, started in the 1970s a large experimental project analyzing types of EEG activity, strength and mobility of nervous processes in various modalities, performance by humans in deterministic and probabilistic conditions, tempo of reading and motor tasks, verbal activity, performance on tests of intelligence and behavioral particularities associated with the various temperamental traits. Based on this work, Rusalov concluded that temperamental traits are activity-specific: energetic level or tempo of performance might be different for a given individual in physical, social or intellectual activities, therefore the aspects of the performance of these activities should be assessed and analysed separately.

Based on his experiments, Rusalov proposed the Structure of Temperament theory and developed his Structure of Temperament Questionnaire. The first version of the English version of the Structure of Temperament Questionnaire (STQ: Rusalov, 1989) had four scales Ergonicity (endurance, the ability to keep intensive work), Plasticity (or flexibility, the ability to effectively switch between tasks or to change the way of performance), Tempo, and Emotionality separately

in physical-motor (Motor) activity, and social activity (such as reading, writing, speaking, communication). Estimates of internal reliability for the scales has ranged from .70 to .81. Then a third set of four scales was added to measure aspects of intellectual activity, with the development of adult, teenage, middle school and preschool Extended versions of the STQ (Rusalov, 1997, 2004). The Extended STQ has 4-point Likert scale format; see Appendix A for examples of items. A summary of the validation of the Structure of Temperament Questionnaire is provided in Appendix B.

Comment [SAI1]: Appendix A

Comment [SAI2]: Appendix B

The benefits of the Rusalov Structure of Temperament Questionnaire were that it used the activity-specific model of temperament in which the scales were grouped in factors by the types of activity (for example, Social Ergonicity, Social Plasticity and Social Tempo) and not by dynamic aspects of activity. The previous models of temperament and personality did not distinguish among areas of activity, considering, for example, arousal in motor and social activity (Extraversion or Strength of the nervous system) as a nonspecific general activation of the nervous system (Pavlov, 1941; Eysenck & Eysenck, 1968; Nebylitsyn, 1972; Gray, 1982; Costa & McCrae, 1992; Strelau, 1999).

The theoretical rationale of the present study was to explore the benefits of analysis of temperament traits separately in physical, social-verbal, and intellectual activities. Many models of temperament and personality continue to follow the so-called “general arousal” approach, considering that only one general trait is related to the energetic component of behaviour, namely “strength of excitation” (Pavlov, 1941; Strelau, 1999), “liveliness” (Cattell, 1965), “extraversion” (Eysenck & Eysenck, 1968; Rothbart, 1988; Big Five model, including Costa & McCrae, 1992), “activity” (Buss & Plomin, 1984; Windle & Lerner, 1986; Behavioural Approach System of Gray, 1982), “drive persistence” (Carver & White, 1994; Cloninger,

Przbeck, Svrakic, & Wetzel, 1994) or just “arousal” (Mehrabian & Bank, 1978). The same is true for mobility (i.e., how easily the activity can be started and carried out). Previous studies using the STQ showed that the arousal-related traits of temperament correlate with the personality traits in a discriminatory manner. For example, high correlations of Extraversion, as measured by Eysenck Personality Questionnaire are found with the Social Ergonicity (*r*s=.68–.74), Social Plasiticity (*r*s=.43-.65) and Social Tempo (*r*s=.39-.51) scales of the STQ (Rusalov, 1989; Brebner & Stough, 1993; Dumenci, 1995; Zin’ko, 2006), but not with the scales of Motor or Intellectual Ergonicity. Similarly, high correlations of Extraversion, as measured by Big Five are found with the Social Ergonicity (*r* = .29) and Social Tempo (*r* = .29) while the correlations with Motor Ergonicity and Motor Tempo were not significant (Dumenci, 1995)

In this study, a test measuring temperament traits separately in three areas of activity (i.e., Structure of Temperament Questionnaire) was expected to yield more knowledge about biologically-based individual differences than a nonspecific test of temperament. Sex is one of the main biological factors related to individual differences, often associated with particular temperaments. Previous studies using the STQ have shown that separation of temperament traits related to verbal-social and physical activities provides important information about sex differences (Vasyura, 2008; Trofimova, 2009). The second main factor universally listed as a temperament dimension is arousal within the nervous system, helping an individual to stay active on a task. If there is a “general arousal” factor (described as “strength of excitation”, or “extraversion”, or “activity”, or “drive persistence”, or just “arousal”) and if there is no need for the separation of arousal by type of activity, then performance on any task requiring constant activation would show nonspecific correlations with temperament scales measuring arousal. On the other hand, if the specific task affected the pattern of correlations between specific

temperament traits and speed of performance on this task, then that would demonstrate the need to use temperament scales designed to measure the dynamic aspects of activity separately in physical, social-verbal, and intellectual areas. For this study, a task requiring a prolonged semantic estimation of the abstract words (i.e., requiring arousal in verbal and intellectual activities) was performed under time pressure. This task was chosen over other social activities to measure the ability to sustain prolonged repetitive activity associated with verbal material based upon its duration and intensity. The use of other social activities would bring unnecessary variance to the data and also might be more stimulating for some subjects, potentially biasing the results.

In summary, the goals of the present study were: (a) to assess the benefits of an activity-specific test of temperament (STQ) in the analysis of sex differences; (b) to investigate the differential power of two temperament tests developed within the Pavlovian tradition (the activity-specific Structure of Temperament Questionnaire and the nonspecific Pavlovian Temperament Survey) using an experimental task requiring intense and fast verbal intellectual activity; (c) to compare these two tests by finding the correlations between their scales. The corresponding hypotheses were that (a) significant differences would be observed between the scores of men and women on the scales of the STQ when the scales assess dynamic properties separately in three different types of activities; (b) among these two temperament tests developed within the Pavlovian tradition, the activity-specific test of temperament would have stronger correlations with the time required to complete a prolonged word-assessment task than a nonspecific test of temperament—specifically, the duration of this task would correlate negatively mostly with the dynamic aspects of verbal-social and possibly intellectually activity, but not with the aspects of physical activity; (c) STQ scales measuring the arousal aspects of

activity (i.e., Ergonicity) would correlate positively with the PTS scale of Strength of Excitation, while the STQ scales of Plasticity and Tempo would correlate positively with the PTS Mobility scale, and the STQ scale of Intellectual Ergonicity would correlate positively with the PTS scale of Strength of Inhibition.

Method

Participants

Canadian participants (*N*=966; 233 men, 733 women) ages 17 to 35 years (*M* = 20.2, *SD* = 3.3), of whom 171 were volunteers and 743 were psychology students of McMaster University and 52 were psychology students of Brock University (both universities are located in Southern Ontario, Canada) took part in this study in 1999 to 2006. Of these, 775 of 966 participants, 175 men and 600 women (*M* age = 19.8 yr., *SD* = 3.0), 63 volunteers (8%) and 712 students completed all measures; 74 student participants (*M* age = 20.1 yr., *SD* = 3.2) completed the experimental task and the STQ, and 117 volunteers completed the STQ only (they were not invited to participate in the experiment).

Measures

Participants (*N*=775) completed the extended English version of Rusalov's Structure of Temperament Questionnaire (Rusalov & Trofimova, 2007), and the English version of Pavlovian Temperament Survey (Strelau, 1999).

Structure of Temperament Questionnaire (STQ: Rusalov, 1989; Rusalov & Trofimova, 2007).— This questionnaire has 150 statements to be answered using a 4-point Likert-type scale with labels 1: Strongly disagree 2: Disagree, 3: Agree, and 4: Strongly agree. Six items are assigned to a validity scale, and 144 items to 12 temperamental scales (12 items each) measuring

the four traits of Ergonicity, Plasticity, Tempo, and Emotionality in each of three areas of activity (motor-physical, social-verbal, and intellectual-mental). The Cronbach alpha reliability coefficient for the STQ scales ranged from .70 to .84 (Rusalov & Trofimova, 2007).

Pavlovian Temperament Survey (PTS: Strelau, 1999).—This survey has 66 statements to be answered on a 4-point Likert-type scale with labels 1: Strongly disagree 2: Disagree, 3: Agree, and 4: Strongly agree. There are three scales, Strength of Excitation, Strength of Inhibition, and Mobility (22 items each), for which Cronbach coefficients alpha were reported to range from .81 to .84.

Semantic task.— To complete this task, participants rated 30 abstract concepts (words) on 60 7-point, bipolar scales (i.e., warm vs. cold, soft vs. hard, interesting vs. uninteresting, etc.). Each concept was presented as a word on a computer monitor along with each of the bipolar scales.

Procedure

Participants were debriefed about the duration and nature of the experiment. They were instructed to work as fast as possible and their time on this task was recorded. The computer program Expan (provided by HR-Laboratory "Human Technologies")[3] detected whether a participant was giving random or inconsistent answers. The procedure took 1 to 3 hours depending on the speed of the participant's performance. All participants signed an informed consent form before testing and participation in the experiment. Afterwards university students received the practicum credit for their participation. All subjects were fluent in English.

Results and Discussion

[3] http://www.ht.ru/about/index_eng.php

Table 1 shows means, standard deviations and confidence intervals for the applied measures. Each STQ scale had a normal distribution of scores with range 12 to 48. The sex differences in the scores on STQ scales were much stronger than on PTS scales, supporting the first hypothesis. Analysis of sex differences using one-way ANOVA showed that women performed the Semantic Task significantly faster than men, which was consistent with significantly higher scores for women than men on Social Ergonicity and Social Tempo scales (Table 1). Men had higher scores on Motor Ergonicity, Plasticity, Tempo, and Emotionality, and also on Intellectual Plasticity and Tempo. Sex differences in PTS scores were found to be statistically significant only for the Mobility scale ($p < .01$). These results are in line with findings from studies showing that men have higher physical activity than women, especially in activities requiring upper body strength (Thomas & French, 1985; Eaton & Enns, 1986), and that on the average men perform better than women on tests of visual-spatial abilities but more poorly than women on verbal tests (Hyde & Linn, 1988; Halpern, 2000).

Comment [SAI3]:
Table 1

Contrary to the common view of women as being more emotional than men, the results showed that while women had higher scores on Social and Intellectual Emotionality scales, it was men who had significantly higher scores on the scales of Motor Emotionality, i.e., male subjects reported being more sensitive to success or failure in physical activities than did the women. This result supports the idea of separation of two definitions of emotionality, expression of an emotion or experience of an emotion. Several studies have found previously that the sex differences were statistically significant when situational factors modeled underlying sex stereotypes: women reported more intense emotional experiences than men in situations which involved interpersonal rather than impersonal emotion elicitors (LaFrance & Banaji, 1992; Fischer, 1993). In this sense, sensitivity to failure in relations and social activities might be

greater for women, and sensitivity to failure in physical activity might be greater for individuals who are expected in society to be stronger or more physically fit, i.e., in general men. Interestingly, that there was a significant negative correlation ($p < .001$) between the PTS Strength of Inhibition and Social Emotionality scales (Table 2). It is possible that men consider behavior related to social emotionality as disinhibited and inappropriate for their sex.

Sex differences among correlations of the temperament scales with duration on the Semantic Task were not dramatic, but significant (Table 2). The temperament traits associated in men with faster performance on the Semantic Task were different from those for faster performance among women. The duration of this task for women showed significant correlations with all three Tempo scales, Intellectual Plasticity, and Motor Ergonicity scales; these were not observed for men. The duration of the Semantic Task for men had the strongest correlation with the STQ Social Plasticity scale, which assesses how easily an individual generates, stops or switches between verbal-social actions. It is possible that the size of the male sample was a factor contributing to these differences. It is also possible, however, that men and women used different abilities to perform the task and so had different styles of working on it. If women indeed are more accustomed to working with words, then for them the Semantic Task is a matter of speed in doing rather automatic, well-known work. If men on average report lower speed and endurance in verbal-social activities than women (as noted above), then men might compensate through higher flexibility in the "switches" required in such activities, and use their verbal-social plasticity to succeed on the Semantic Task.

Comment [SAI4]:
Table 2

Among all applied temperament scales, significant correlations ($p < .001$) of performance times on the semantic task were found with the scales measuring dynamic aspects of social-verbal activity, i.e., Social Ergonicity, Social Plasticity, and Social Tempo, and much less with other scales. Higher scores on these scales were associated with faster performance on the task, which involves rating of abstract concepts. The correlations of other scales with the time

required to complete the Semantic Task were not consistent across sexes (Table 2), and not as often significant. The three scales of the STQ related to verbal-social activity (Social Ergonicity, Social Plasticity, and Social Tempo) must reflect the ability for intense and fast verbal activity much better than do the scales of intellectual and motor activity. The semantic task required a prolonged, intense activation of nervous processes related to verbal activity and the inhibition of unrelated behaviors in order to stay focused; however, there were no significant correlations consistent in either group by sex, between the PTS Strength of Excitation or Strength of Inhibition scales and the duration of performance on the semantic task. There was only one negative correlation of small effect size ($p < .05$) between the PTS Strength of Excitation scale and the duration of the Semantic Task in the women, which affected the correlation between the same in the whole sample. The PTS Mobility scale did not show significant correlation with the duration of the Semantic Task, in spite of the fact that the task required flexibility of performance in switching from one concept to another.

Such a selective pattern of correlations supports the second hypothesis, showing that the STQ scales, designed to measure dynamic aspects of specific activities, have stronger correlations with the speed of performance in corresponding activities than the nonspecific PTS scales. Overall, the selectivity of correlations of temperament scales with the duration of the semantic task and the findings on sex differences show the benefits of separation of temperamental aspects according to the type of activity in the analysis of biological individual differences.

Correlations between the STQ and PTS scales were in accord with the third hypothesis: there were significant positive correlations between the STQ Ergonicity scales and the PTS scale of Strength of Excitation, between the STQ Plasticity and Tempo scales and the PTS Mobility

scale, and between the STQ Intellectual Ergonicity scale and the PTS scale Strength of Inhibition (Table 2). The significance of correlations between STQ scales and the PTS scales of Strength of Excitation and Mobility was identical for men and women, so only "all sample" correlations are given on these two PTS scales. Overall patterns of correlations between of STQ and PTS scales, however, were nonspecific and were similar to those reported by Strelau (1999) for Polish and German samples, and by Ruch, *et al*. (1991) for a German sample. All STQ scales measuring characteristics of activity (i.e., Ergonicity, Plasticity, Tempo) in all three areas of activity (motor, social and intellectual) had statistically significant ($p < .001$) positive correlations of various magnitudes with the PTS scales of Strength of Excitation and Mobility. Such a pattern of correlations indicates that almost all STQ scales measure arousal and mobility aspects of activity, but PTS scales do not differentiate between aspects of arousal or types of activity.

The scales of Emotionality in Social and Intellectual activities (which measure sensitivity of a person to failure or success) had significant negative correlations with the Strength of Excitation and Mobility scales of the PTS. Such correlation suggests that people with low arousal (i.e., with the low ability to sustain intense or prolonged work) and low mobility of behavior might have frequent expectations of failure, increased neuroticism in social settings, and overall problems in social adaptation. Significant negative correlation consistent for both sexes was also found between the scores on the STQ Social Plasticity scale and the PTS Strength of Inhibition, which suggests that inhibitory behavior as measured by PTS relates to hesitancy in social activity as measured by the STQ, or that the content of the STQ Social Plasticity scale to a large extent describes disinhibited behavior and should be examined further.

In conclusion, STQ and PTS both emerge from the Pavlovian tradition of experimental study of properties of nervous systems and share the tenet that these properties have biological

basis and appear as dynamic aspects of human behaviour: energetic, mobility, and regulatory aspects. The results illustrate the importance of separation of such dynamic aspects into three main types of activity—physical, verbal, and intellectual—as such separation provides more sensitive and detailed analysis of biologically based individual differences.

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Table 1. Means, Standard Deviations, 95% Confidence Intervals and *F* Values of One-way Analyses of Varaince for Sex For Each Measure

Measure	*M*	*SD*	*95%CI*	*M*	*SD*	*95%CI*	*F ( )*
Time on Semantic	Men, *n*= 202			Women, *n*= 647			*df*=1, 847
Task, min.	84.5	25.5	80.9–88.0	75.7	20.4	74.1-77.3	24.80‡
PTS scales	Men, *n*= 175			Women, *n* = 600			*df*= 1, 773
Strength of Excitation	58.4	7.5	57.2-59.5	57.4	6.9	56.9-58.0	2.45
Strength of Inhibition	58.7	6.4	57.7-59.6	58.3	6.4	57.8-58.8	0.41
Mobility	58.4	6.7	57.4-59.4	56.8	6.8	56.3-57.4	6.83†
STQ scales	Men, *n* = 233			Women, *n* = 733			*df*=1, 964
Motor Ergonicity	33.5	7.4	32.5-34.4	30.9	7.0	30.4-31.4	22.72‡
Intellectual Ergonicity	31.4	5.5	30.7-32.1	30.8	5.6	30.4-31.2	1.69
Social Ergonicity	34.4	7.1	33.5-35.4	36.0	6.7	35.5-36.4	8.76‡
Motor Plasticity	32.2	5.7	31.5-32.9	30.7	5.5	30.3-31.1	12.05‡
Intellectual Plasticity	30.7	5.4	30.0-31.4	29.2	5.2	28.8-29.6	14.61‡
Social Plasticity	29.6	6.3	28.8-30.4	28.8	6.6	28.3-29.3	2.51
Motor Tempo	33.7	6.0	33.0-34.5	32.8	5.3	32.4-33.2	4.78*
Intellectual Tempo	34.4	5.6	33.7-35.2	32.1	5.3	31.7-32.5	34.16‡
Social Tempo	33.6	5.9	32.8-34.3	36.5	5.5	36.1-36.9	47.58‡
Motor Emotionality	26.9	5.7	26.1-27.6	25.4	6.0	25.0-25.8	10.96‡
Intellectual Emotionality	29.6	5.7	28.8-30.3	30.8	6.0	30.4-31.3	8.16‡
Social Emotionality	28.1	6.1	27.3-28.8	29.6	5.7	29.2-30.0	11.85‡

*p<.05. †p<.01. ‡p>001.

Comment [SAI5]: All en dashes

Table 2. Correlations Between the Structure of Temperament Questionnaire (STQ) Scales, Duration of Semantic Task (min.) (n=849) and Pavlovian Temperament Survey (PTS) scales (n=775).

Scales	Time on ST			PTS-E	PTS-M	PTS-I		
	Total	Men	Women	Total	Total	Total	Men	Women
STQ								
Motor Ergonicity	-.05	.00	-.11†	.38‡	.22‡	.04	-.04	.06
Intellectual Ergonicity	.01	-.01	.00	.33‡	.23‡	.15‡	.16*	.15‡
Social Ergonicity	-.18‡	-.14*	-.18‡	.33‡	.31‡	-.09*	-.09	-.09*
Motor Plasticity	.03	-.02	.01	.35‡	.38‡	.12‡	.09	.13‡
Intellectual Plasticity	-.06	-.07	-.09*	.41‡	.45‡	.02	.09	-.01
Social Plasticity	-.14‡	-.18†	-.14‡	.37‡	.39‡	-.27‡	-.28‡	-.28‡
Motor Tempo	-.10†	-.08	-.13†	.43‡	.33‡	.05	-.06	.09*
Intellectual Tempo	-.08*	-.13	-.11†	.40‡	.34‡	.02	.07	.00
Social Tempo	-.20‡	-.14*	-.18‡	.40‡	.32‡	-.09*	-.11	-.09*
Motor Emotionality	.02	.04	-.01	-.01	-.01	-.05	-.06	-.05
Intellectual Emotionality	-.02	-.11	.04	-.09*	-.11†	.00	-.03	.01
Social Emotionality	.00	.06	.01	-.21‡	-.14‡	-.07	-.16‡	-.04
PTS								
Strength of Excitation (n=722)	-.08*	-.06	-.10*	-	.52‡			
Strength of Inhibition (n=722)	.05	-.01	.06	.09*	.13‡			
Mobility (n=722)	-.05	-.07	-.07					

Note.— PTS-E=PTS Strength of Excitation scale, *PTS-I* =Strength of Inhibition scale, *PTS-M*= Mobility scale. $^{*}p < .05$. $^{\dagger}p < .01$. $^{\ddagger}p < .001$.

Appendix A

Examples of the items of the Extended Structure of Temperament Questionnaire.

STQ Scale	Item
Motor Ergonicity	4. I get pleasure from doing physical work in my free time.
	32. It is easy for me to do hard physical work.
Intellectual Ergonicity	17. I get tired of prolonged mental work.
	82. I carry out my mental activities with pleasure.
Social Ergonicity	33. I would feel uncomfortable if I didn't communicate with people for a long time.
	98. I'm silent even among my friends.
Motor Plasticity	11. I quickly move into high gear.
	40. I successfully carry out tasks requiring subtle or fine movements.
Intellectual Plasticity	8. It is easy for me to simultaneously do several things, for example, to watch TV and read.
	18. I easily switch from solving one problem to another.
Social Plasticity	15. It's easy for me to enter into conversation with strangers.
	51. It's easy for me to make new acquaintances.
Motor Tempo	118. I work slowly when I make something by hand.
	122. I prefer to do my physical work at a fast rate.
Intellectual Tempo	23. I like intellectual games that require fast decision making.
	38. My thoughts flow slowly.
Social Tempo	50. It's hard for me to talk fast.
	71. I'm a talkative person.
Motor Emotionality	52. I get annoyed if I am not agile during recreational games.
	73. My mood is often spoiled when the things made by myself are not as good as I hoped.
Intellectual Emotionality	12. I am upset finding an error in my decisions, even small ones.
	25. I fear that I cannot perform work requiring mental strain.
Social Emotionality	56. I'm upset if the people whom I'm talking with do not understand me.
	109. I worry a lot when I must discuss relationships with friends.

Appendix B

Validation history of the Structure of Temperament Questionnaire

During the experimental validation of the STQ the performance by participants on the following measures was compared with scores on STQ scales in a series of studies in the 1980s: speed of writing, reading and speed of generation of words, maximal and optimal tempo of performance in sensory-motor tasks and intellectual (including unsolvable) tasks, performance on nonverbal tasks, with which participants were unfamiliar, rigidity of perception in tactile and visual modalities, duration of the switch between one method of solving a task and another, mobility in attention, variability in line drawing (Rusalov, 1979, 1997, 2004; Rusalov & Trofimova, 2007). Ergonicity scales of the STQ correlated positively with Eysenck Personality Questionnaire's Extraversion scale (Rusalov, 1989; Brebner & Stough, 1993, Zin'ko, 2006), with the Big-Five Extraversion scale (Bodunov, Bezdenezhnykh, & Alexandrov, 1996; Rusalov & Trofimova, 2007), with Strelau's PTS Strength of Excitation scale (Ruch, Angleitner, & Strelau, 1991; Bodunov,*et al*., 1996; Strelau, 1999), with Torrance' Nonverbal Tests of Creative Thinking (Rusalov & Poltavtzeva, 1997), Rotter's Locus of Control scale (Byzova, 1997), with goal-driven choice of profession as opposed to accessibility of profession (Rusalov, Rusalova, & Strel'nikova, 2000), and with the Motivation for Achievement scale (Vorobieva, 2004).

Scores of the Motor and Social Plasticity and Tempo scales of the STQ correlated positively with Strelau's PTS Mobility scale (Ruch, *et al.*, 1991; Bodunov, *et al*., 1996; Strelau, 1999), with adaptivity of behaviour on the Dembo-Hoppe Level of Aspiration experiment (Zin'ko, 2006), with the Torrance' Nonverbal Tests of Creative Thinking (Rusalov & Poltavtzeva, 1997), Rotter Locus of Control scale (Byzova, 1997) and with the Motivation for

Achievement scale (Vorobieva, 2004). Rathee and Singh (2001) reported a comparison of 25 measures of Mobility, including the Plasticity and Tempo scales of the English version of the STQ. The authors found high correlations of scores on the Extended STQ Plasticity scales with those for Alteration task, Flexibility of attention, proof-reading ability, the number of trials needed for participants to reach the optimal reaction time after alteration of a stimulus, and Mobility measured by Strelau's Pavlovian Temperamental Survey (PTS). Tempo in Motor Activity as measured by the English STQ in this study was correlated with EEG α-general speed, time taken to generate simultaneous contrast, duration of "after-image" reaction, critical flicker fusion and size of uncertainty interval. Scores on the Plasticity scales also positively correlated with those on Eysenck's EPQ Extraversion scale (Rusalov, 1989; Brebner & Stough, 1993; Zin'ko, 2006), on the Big-Five Extraversion scale (Dumenci, 1995; Bodunov,*et al*., 1996), and on PTS Strength of Excitation scale (Ruch, *et al.*, 1991; Strelau, 1999).

Emotionality scales scores correlated positively with those on the Neuroticism scale of the Eysenck Personality Questionnaire (Rusalov, 1989; Brebner & Stough, 1993; Zin'ko, 2006), with the Big-Five Neuroticism scale (Dumenci, 1995; Bodunov, *et al*., 1996), on the State Trait Anxiety Inventory (Popov, 2006), with Taylor Manifest Anxiety Scale (Popov, 2006; Zin'ko, 2006), and use of alcohol (Bodunov,*et al*., 1996), and correlated negatively with scores on the Dissociative Experiences Scale (Beere & Pica, 1995; Eputaev, Ikonnikova, Agarkov, & Tarabrina, 2003), the Rosenzveig test (Zin'ko, 2006), PTS Strength of Excitation and Strength of Inhibition scales (Ruch, *et al.*, 1991; Strelau, 1999), scores on Cattell's A, H, Q2 and Q4 factors (Vasyura, 2008), Torrance' Nonverbal Tests of Creative Thinking (Rusalov & Poltavtzeva, 1997), and the Motivation for Achievement scale (Vorobieva, 2004). Trofimova (1999) applied the semantic differential method to contrast temperamental groups selected on the basis of STQ

scores. She reported that subjects with the highest and lowest scores on STQ scales show differences in their perceptions of semantically neutral objects, including self-perception. The STQ scales which measure dynamic aspects of intellectual activity had positive correlations with such measures of intelligence as the Wechsler and Shepard tests, including the tasks measuring classification abilities ("Excluding the third") and plasticity in nonverbal thinking (Rusalov & Dudin, 1995; Rusalov & Naumova, 1999). Intellectual activity scales had positive correlations with scores on the Locus of Control scale (Byzova, 1997), and goal-oriented choice of profession (Rusalov, *et al*., 2000), and negative correlations with translations of the State Trait Anxiety Inventory (Popov, 2006), Taylor Manifest Anxiety Scale (Popov, 2006; Zin'ko, 2006) and the access-oriented choice of profession (Rusalov, Rusalova, & Strel'nikova, 2000). Intellectual plasticity correlated with 25 measures of mobility in Rathee and Singh's study (2001).

The administration of the English version of the STQ to American, Australian, and Canadian samples showed the factor structure of this version similar to the Russian language version, and that the English version possessed good reliability and internal consistency (Stough, Brebner, & Cooper, 1991; Bishop, Jacks, & Tandy, 1993; Dumenci, 1995, 1996; Bishop & Hertenstein, 2004; Rusalov, 2004; Rusalov & Trofimova, 2007).