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Abstract There are biologically based sex differences in verbal abilities and in neuropsychological systems of verbal processing. Measurement of observable behaviour, however, does not say much about sex differences in the internal, semantic processing of verbal material. The present study, which was conducted in Canada, China and Russia, investigated sex differences in connotative meaning attribution to the most common concepts using an object scale symmetry in the choice of the nouns and bipolar adjectives (projective semantic method). The results showed that males had a tendency to estimate reality- and work-related concepts more negatively and social- and physical attractors more positively than women. The paper hypothesizes that at the level of the most fundamental semantic processing men favour more exceptional objects than women, and women favour more predictable objects, including rules and routines.

Introduction

The reasons why members of the same family do not understand each other in their verbal exchanges are commonly attributed to their individual differences, both in personal experience and in biological characteristics (such as age, sex and temperament). This article focuses on the impact of sex differences, i.e. biological factors, in semantic processing, and therefore uses existing evidence of sex differences in biologically based abilities and

disabilities to develop five hypotheses. It is a challenge to separate the impact of biological factors in verbal processing from the impact of culture and experience—after all, language is a cultural invention, and this is a reason why few studies have investigated sex differences in the intrinsic processing of verbal material.

There are well-documented sex differences in verbal abilities, such as reading, verbal memory, verbal fluency (especially in color-related items), verbal analogy, spelling, language-related reasoning and in naming objects (Bleecker, Bolla-Wilson, Agnew, & Meyers, 1988; Ellis et al., 2008; Hyde & Linn, 1988; Kimura, 1999; McGuinness, Olson, & Chapman, 1990; Wagemaker, 1996), in which females show a strong advantage from a very early age. McGuinness (1981) carefully examined the socio-cultural factors underlying verbal superiority in females (such as cultural expectations in terms of girls' sociability and the socio-economic status of participants in various studies), and concluded that female verbal superiority is likely driven by biological factors. Using measurement of cerebral blood flow, fMRI and MRI, neurophysiological investigations into sex differences during verbal and phonological processing showed a greater hemispheric asymmetry of the plenum temporale in males than in females (Coney, 2002; Levy & Heller, 1992; Meyers-Levy, 1994; Shaywitz, Shaywitz, Pugh, Constable, & Skurlarski, 1995). There is evidence for a strong contribution of hormones and other endocrinal factors to the biology of sex differences, especially in word processing (Berenbaum & Snyder, 1995; Collaer & Hines, 1995; Fitch & Bimonte, 2002).

These findings coincide with a large body of evidence showing a lower responsiveness to verbal instructions and social norms in males in comparison to females (i.e. in observable behaviour), which will be noted below in relation to our hypotheses. We know that there are

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neurophysiological and endocrinal factors for sex differences in verbal behaviour and that there are sex differences in observable verbal behaviour (i.e. verbal abilities and disabilities). We know very little, however, about subjective experience during verbal processing, and whether or not those biological factors lead to sex differences in internal, semantic perception. In other words, the intermediate, cognition-related link between neurophysiology and external behaviour remains a "black box". There are a few studies that have looked at the differences between men and women in meaning attribution to the most basic lexical constructs. These studies report that males conceptualize items in terms of physical or observable attributes whereas females use more evaluative concepts (Haas, 1979; Poole, 1982). Trofimova (1999) showed that men had a tendency to give more negative estimations to very common words than women.

The present study looked into the question of whether or not there are sex differences in the attribution of intrinsic meaning to the most common verbal material. To minimize the impact of culture and experience, we used material which all participants having at least a high school education should know very well. Moreover, material of a very abstract and projective nature has been proven to be the most sensitive to semantic bias and to be open to individual interpretation, so the present study uses a projective semantics method (Trofimova, 1999) based on Osgood's (1975) semantic differential method (SD). SD asks people to estimate well-known general concepts using common adjectives in the form of bipolar scales, which are then grouped into a small number of factors to facilitate the analysis. Osgood named the three most commonly found factors "Evaluation" (which included, for example, the scales "pleasant–irritating", "clear–dirty," "kind–cruel"), "Activity" ("energetic–constrained", "monotonous–keen", "fast–slow") and "Potency" or "Power" ("strong–weak", "firm–flimsy", "massive–miniature"). The universality of these three "dimensions of semantic perception" gained a lot of interest in psychology, followed by the finding of a few additional universal dimensions: "Typicality", or "Probability" ("typical–exclusive", "regular–rare") (Bentler & La Voie, 1972; Trofimova, 1999), "Improvement", or "Organization" ("organized–non-organized", "regular–spasmodic" "constant–changeable", "precise–indefinite"), "Reality" ("imaginary–real", "evident–fantastic", "abstract–concrete"), "Complexity" ("complex–simple", "mysterious–usual", "unlimited–limited"), Stimulation ("interesting–boring", "trivial–new") (Petrenko, 1993; Rosch, 1978; Trofimova, 1999), and other small factors.

The difference between the SD and the projective semantic methods is that the SD studies conducted by Osgood or his followers used a large (sometimes thousands) number of adjectives and concepts to be assessed. The projective semantic method uses primarily concepts of a very specific nature: these nouns correspond to the seven groups (factors) of adjective-scales, which were those most consistently found in cross-cultural studies, as described in the previous paragraph. Seven types of adjective scales and seven types of concepts describing the same aspect of reality as the scale establishes the *object-scale symmetry* (OSS) between scales and objects and such OSS choice improves the cross-cultural universality of the method and its sensitivity to any bias in responses. For example, if there are no differences between participants in the perception of the common words "reality", "present", "complexity", "chaos", "beauty", "freedom", "Time", then the concepts "Reality", "Present" are expected to be assessed unequivocally as "very real" on adjectives such as "real-imagined" (i.e. scales of the Reality factor); the concepts "Complexity", "Chaos" as "very complex" along the scales of the Complexity factor, the concepts "Beauty", "Freedom" are expected to be on the positive pole on the Evaluation scales, "Time", "Development"—on the negative pole of the scales of the Stability factor, etc. It is expected that a deformation of this symmetric and very basic matrix would reveal underlying biases of two types: in either using certain scales and/or in the assessment of certain concepts.

Even though this study did not use clinical samples, the sex differences in rates of mental (especially communicative) disorders complement the information about sex differences in verbal abilities, creating a complete picture of the skew in distributions of verbal (dis)abilities. There are several observations from various branches of psychology indicating that men and women might have a deformation in their OSS matrix and differ in their semantic perception of even the most common verbal material. These observations, however, contradict each other when it comes to hypotheses as to which sex differences to expect in basic meaning attribution. We considered five hypotheses based on the following evidence:

(1) "Men as *inferior in verbal processing*" men are three to four times more likely to be diagnosed with anti-social personality disorder (80 %), psychopathy, and sociopathy than women, have poor compliance with routine and prescribed behaviour, indicating a possible compromised responsiveness in men to social regulations (Black 1999; Davidson & Neale, 1994; Eysenck & Gudjonsson, 1989; Zuckerman, 1994). Males also have higher rates of autism (M:F 4:1) and Asperger's syndrome (M:F 7:1) (Chakrabarti & Fombonne, 2001; Fombonne, 2005; Risch et al., 1999), and learning disabilities (Baron-Cohen, 1999; Rommelse et al., 2008), which are disorders related to the perception of messages from other people. These observations suggest biologically based sex differences in "hearing what they are told", a devaluation or lower responsiveness of males to verbal instructions and

rules, in comparison to females. If this hypothesis is true then in our study men would perceive all objects related to social values (Beauty, Power, Prestige, Reputation, Work, Faith) as more negative and possibly more disorganised and unstable than women.

(2) "Men as *novelty-seekers*" males are 3.5 times more likely to die from all accidental causes and 2.5 times more likely to die in road accidents than are females (Kruger, 2004), which is explained by the higher risk- and sensation seeking (Zuckerman, 1994), and openness to experience (Costa, Terracciano, & McCrae, 2001) of males in comparison to females. The links between sensation seeking and biological, especially hormonal, factors suggests that on a very fundamental level of semantic processing men might be more likely to assign meaning to objects based on the level of its excitement, novelty, extreme experience, rather than based on more rational criteria. This hypothesis also relies on the higher rates of disobedience in males, interpreted by this hypothesis as avoidance of routine and predictable activities. Geodakyan (2000) argued that, judging by the different shape of the distribution for various characteristics in male and female individuals from many biological species, males are biologically designed to be more novelty-seekers, expanding a species' niche, while the female sex is a conservative part of the species, securing beneficial characteristics. If this "novelty-seeking" hypothesis is true in regards to sex differences in semantic perception, then males would have more positive evaluations of concepts indicating exceptional or sensational phenomena (such as Speed, Beauty, Power) and more negative evaluations of concepts related to routine functioning (Reality, Present, Work, Task, Faith).

(3) "Women as *cheerleaders*" females were found to have higher rates of social endurance, extraversion and agreeableness (Costa et al., 2001; Kimura, 1999; Tobin et al., 2000). Several studies linked extraversion (or social endurance) and more positive estimations of neutral concepts or faster processing of positive words (Rusting & Larsen, 1998; Trofimova, 1999; Zelenski & Larsen, 1999), and this coincided with the public perception of women as being better cheerleaders than men. If this "cheerleader" hypothesis is true, then women's estimations of all concepts in our study will be significantly closer to the positive poles of bipolar scales than men's, and this tendency will show up more in relation to social objects (and concepts) than to physical, abstract or functional objects. In other words, women would judge various concepts universally more positively than men.

(4) "Women as the more *depressed* sex" there is a significantly higher rate of reported depression in women, in comparison to men (Culbertson, 1997; Weissman & Klerman, 1985). This implies that women are prone to assign more negative evaluations to objects than men. If this "depression" hypothesis is true, then all women's estimations will be significantly and universally closer to the negative poles of bipolar scales then men's.

(5) "Women as "*drama-queens*" since DSM-III-R (1987) it was noted that women are more likely to be diagnosed by clinicians with histrionic personality disorder than men (p. 349). This implies that women are more prone to assign dramatic and extreme meaning to objects than men, i.e. perceiving positive events more enthusiastically and negative events in more negative evaluations. Women's emotionality might be interpreted as if they amplify a word's meaning to improve the verbal exchange of information during empathic, teaching, parenting, rules-driven and imitative behaviour (Baron-Cohen, 1999; Kimura, 1999). If this "drama-queen" hypothesis is true, women will estimate "symmetric" (in OSS sense) concepts in more extreme terms than men (Beauty as more beautiful, Complexity as more complex, Simplicity as more simple, Power as more powerful, Reality as more real).

To assess the possibility of a cross-cultural universality of effects and an impact of occupation on sex differences in semantic perception, the study was conducted in three cultures with similar educational level, and similar labor force participation rate for two genders (Canada had 46.7 % female rate of total labor force, China 45.2 %, Russia 49.4 %), but different occupation-sex ratio, according to the World Development Indicators report. In 2006, Canada had the strongest bias towards service jobs (requiring verbal skills): 65 % men, 88 % women, in comparison to 32 % of men, 11 % of women in industrial jobs (requiring physical strength); China had much fewer service jobs (43 % men, 54 % women) in comparison to industrial jobs (51/39 %), and Russia was in the middle on these rates (50/72 vs. 38/20 %).

Method

Participants

Undergraduate psychology students and volunteers (12–15 % in each sample), Canadians ($N = 1{,}016$, aged 17–55, including men: $N = 324$, $M_{age} \pm SD$ 22.0 $\pm$ 7.9; women $N = 692$, $M_{age} \pm SD$ 20.9 $\pm$ 5.8, McMaster University, Hamilton, ON), Chinese ($N = 206$, aged 17–54, including men: $N = 78$, $M_{age} \pm SD$ 25.85 $\pm$ 9.7; women $N = 128$, $M_{age} \pm SD$ 24.57 $\pm$ 8.6, Guangzhou Pearl River Piano Group Co., Ltd and Guang Ya School, Guangzhou City, China) and Russians ($N = 119$, aged 17–55, including men: $N = 46$, $M_{age} \pm SD$ 23.52 $\pm$ 10.8; women $N = 73$, $M_{age} \pm SD$ 21.70 $\pm$ 9.47, Moscow State Social University, Russia). All participants were citizens of their

corresponding countries, being fluent in the language of the presented material.

Material

The experiment used 60 six-point bipolar scales to estimate the 24 general concepts chosen according to the projective semantic method (Table 1). This method uses classic Osgood's 60 six-point bipolar scales associated to the seven factors which were most consistently found in reports of semantic spaces: "Stimulation", "Evaluation", "Power", "Complexity", "Reality–Probability", "Organization" and "Stability–Limitation" (the opposite pole of the "Activity" factor). Both poles of the scales have three degrees of freedom ("strongly", "somewhat", "weakly"). For example, the scale warm–cold would read: "strongly warm", "somewhat warm", "weakly warm", "weakly cold", "somewhat cold", "strongly cold". Factor analysis of the data confirmed the affiliation of the listed scales to the seven factors.

The "objects" of estimations are concepts of a most general and neutral nature, which have minimal dependence on training, personal or gender-specific experience. These concepts are chosen to correspond to the seven named groups (factors) of scales to improve the universality of the method and its sensitivity to any bias in responses (OSS). It is expected that a deformation of this symmetric matrix would reveal underlying biases of two types: in either using certain scales or/and in assessment of certain concepts. In this study, the concepts included groups of increasing generality: four concepts related to a physical action (Effort, Motion, Speed, Relaxation), four routine activity concepts (Work, Task, Activity, Faith), three overall reality-related concepts (Life, Reality, Present), five time-related concepts (Past, Future, Time, History, Development), five social attractors (Beauty, Freedom, Prestige, Reputation, Power) and three theoretical abstractions (Complexity, Chaos, Simplicity). The material went through three stages of back-forward translation to have exact correspondence between English, Chinese and Russian versions.

Table 1 The list of 60 bipolar scales (grouped into 7 factors) and concepts

Scales	Deep–superficial	Rational–irrational	History
+ pole − pole	Resonant–tinny	Justified–senseless	Development
	Powerful–weak	Understandable–inexplicable	Time
"Stimulation"	Leading–following	Reliable–unreliable	Activity
Original–trivial	Significant–insignificant	Precise–imprecise	Speed
Exciting–indifferent	**"Complexity"**	Organized–unorganized	Motion
Bright–pale	Continuous–discrete	Assembled–unassembled	Beauty
Stimulating–draining	Multi-dimensional–one-dimensional	Planned–spontaneous	Freedom
Interesting–uninteresting	Chaotic–ordered	**"Stability/Limits"**	Prestige
Unusual–ordinary	Diverse–uniform	Stable–unstable	Reputation
Arouses–calms	Irreplaceable–replaceable	Steady–faltering	Power
Sharp–dull	Complex–simple	Constant–changeable	Complexity
"Evaluation"	Obscure–obvious	Fixed–flowing	Chaos
Pleasant–irritating	Difficult–easy	Restrained–unrestrained	Simplicity
Kind–severe	**"Reality/Probability"**	Limited–boundless	Relaxation
Progress–decline	Natural–artificial	Finite–infinite	
Light–dark	True–false	Solid–fragile	
Pure (clean)–dirty	Existent-imagined	*Concepts for estimation*	
Good–bad	Real–imaginary	Reality	
Warm–cold	Possible–impossible	Life	
Useful–harmful	Known–unknown	Past	
Mine–not mine	Inevitable–improbable	Present	
Soft–rigid	Typical–atypical	Future	
"Power"	Common–rare	Work	
Massive–delicate	**"Organization"**	Effort	
Rough–smooth	Clear–blurred	Task	
Large–small	Regular–irregular	Faith	

The poles of the scales and the order of the scales and concepts randomly changed between subjects during the experiment

Procedures (the semantic task experiment)

All participants went through debriefing and signed consent for participation in the experiment, which was conducted from 1999 to 2006 in Canada, China and Russia. Each concept was presented by the program "Expan" on a computer monitor at the top of the screen along with each of the bipolar evaluating scales placed horizontally at the middle of the screen (i.e. 1,440 screens were presented for the estimation). The order of scales and concepts was changed for each protocol to avoid the consecutive use of several scales related to one factor. This allowed one to minimize the multiple comparisons limitations. To control multiple comparisons further, the Bonferroni's correction for the significance of differences was set to $p < .0063$ for the scales that belong to the factors with eight scales, and to $p < .0056$ for the scales which belong to the factors with nine scales. University students received a practicum credit for their participation. Sex differences in estimations were assessed with the Mann–Whitney U test, due to the order-scale data.

Results

To summarize the results of 1,440 estimations given by each participant in two gender groups and across three cultures, we grouped the scales according to their affiliation to the seven factors, as presented in Table 1: Stimulation, Evaluation, Power, Reality–Probability (typicality), Organization, and Stability–Limitation. Figure 1 shows stacked columns representing the number and the spectrum of statistically significant sex differences with Bonferroni correction (at $p < .0063$) in estimations in 12 groups of concepts.

In more detail, Fig. 1 assigns a specific color pattern to the each of seven factors (connotative groups), to facilitate the perception of the spectrum of differences. The height of the pattern is proportional to the number of scales related to the particular factor that showed significant differences, with greater heights representing more scales (see Tables 2, 3, 4 for statistical details). The position of the patterns with respect to the zero line indicates the polarity of estimations preferred by men, i.e. to which side of the scale men's means were closer. The above 0 position indicates that means were closer to the positive pole of the scale; below 0—to the negative pole, see Table 1 for the assignment of poles.

For example, for three reality-related concepts, Fig. 1 (and Table 2) shows that in total 12 scales had significant sex differences in the Canadian sample. From the height of each pattern one deduces that there were significant differences on the scales of the Stimulation factor (2 scales), Evaluation (1 scale), Power (2 scales), Complexity (3

scales), Probability (2 scales), with men's estimations being closer to the negatively poles than those given by women. Women therefore estimated the reality-related concepts as more stimulating, pure, significant, complex and probable. In the contrast to this example, for the concept Faith there were 24 scales with significant sex differences in this sample, with the height of the patterns indicating significant sex differences on 7 Evaluation scales, 6 Probability scales, and 3 Stimulation, with men also preferring the negative pole of the scales.

Concepts are grouped as: Reality, Life, Present (Reality3), Work, Task, Effort (Work3), Past, History (PastHis), Development, Future (DevelFut), Time, Activity (TimeAct), Speed, Motion (SpeedM), Beauty, Freedom (BeaFree), Prestige, Reputation (PresRep), Complexity, Chaos (Complex), Simplicity, Relaxation (SimplRel), and standalone concepts "Power" and "Faith".

The most consistent sex differences in estimations across three cultures (Fig. 1; Tables 2, 3, 4) were found in estimations of Reality-, Work-, Development- and Time-related concepts, revealing both scale- and concept-related biases. The results show that men estimated the concepts related to routines (such as "Reality", "Present", "Life", Work, Task, Effort, Faith), in significantly more negative terms than women, i.e. as more trivial, draining, uninteresting, dirty, pale, harmful, cold, small, insignificant, uniform, simple, one-dimensional, easy, replaceable, imaginary, rare, false, impossible, imprecise, blurred, and finite, while women estimated them as more original, stimulating, interesting, clean, bright, useful, warm, large, significant, diverse, complex, multi-dimensional, difficult, irreplaceable, real, common, true, possible, precise, and infinite (Fig. 1; Tables 2, 3, 4). Time-related concepts such as Time, Activity, Past, History, Development, and Future, also received more negative estimations by men than by women in two out of three samples.

In terms of scale-related biases, when significant sex differences were found with more negative estimations in men than in women, men had a tendency to estimate objects as universally more simple (Complexity factor), more imaginative and impossible (Reality–Probability factor, in Canadian and Russian samples), more weak, soft or insignificant (Power factor, in Canadian and Chinese samples) and more stable and fixed (Stability–Limitation factor, in Chinese and Russian samples), whereas women estimated non-social concepts as more complex, real, possible, unstable and changing.

The concepts referring to social attractors and theoretical abstractions showed the most cross-cultural differences. Men in the Canadian and Chinese samples favoured phenomena related to social status and social attractors (Power, Prestige, Reputation, Beauty, Freedom) more than women. The Russian sample was given the concept "Force" instead of the concept "Power", but even so the concept "Force"
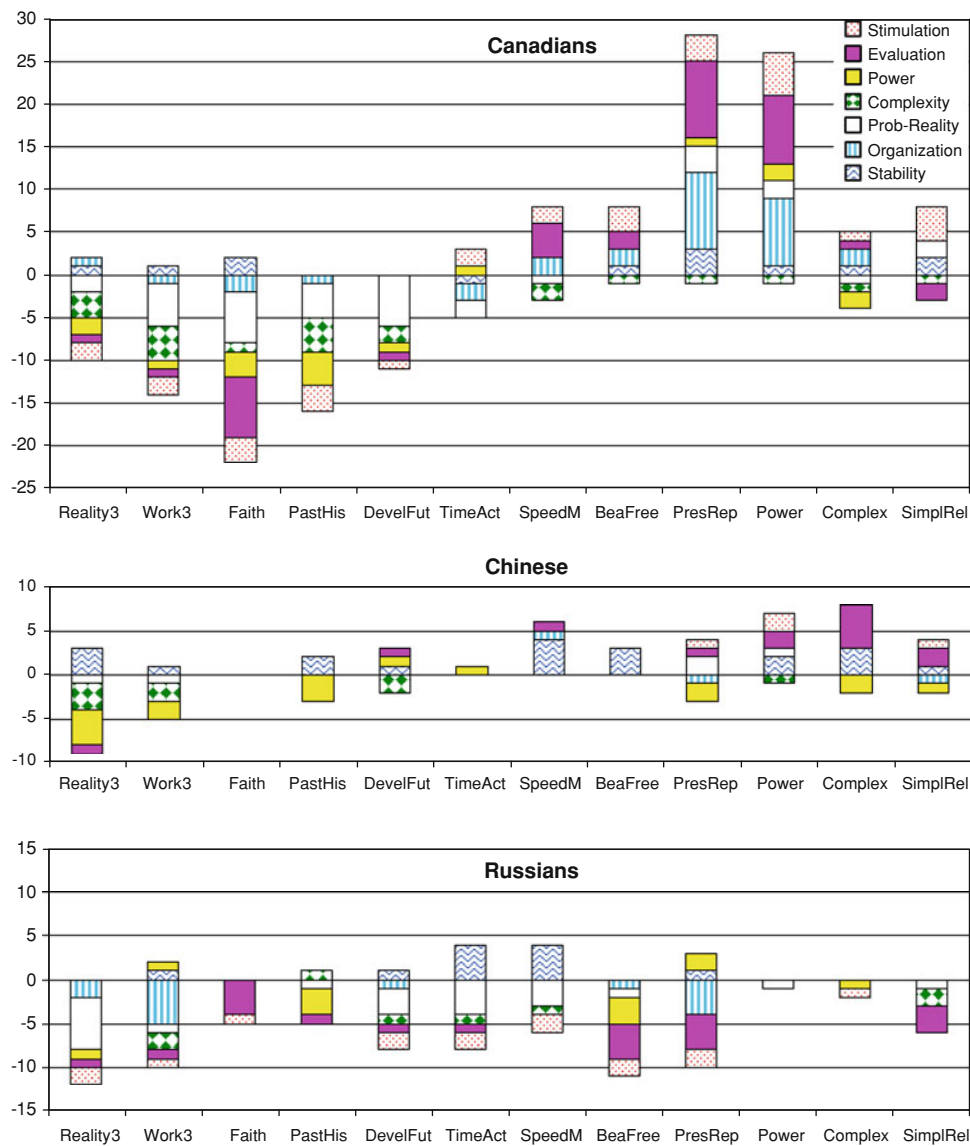
Fig. 1 The number of statistically significant sex differences in estimations assessed with the Mann–Whitney U test, adjusted with Bonferroni's correction. The *stacked columns* represent the total number of significant differences in the groups of concepts. The *colours* represent the spectrum of these differences along seven factors to which the scales are associated. The *sign* indicates the pole of the scales chosen by men for the given concepts (for example, a positive pole of the scales of Complexity factor is "complex" and a negative pole is "simple"). Concepts are grouped as: Reality, Life, Present (Reality3), Work, Task, Effort (Work3), Past, History (PastHis), Development, Future (DevelFut), Time, Activity (Time-Act), Speed, Motion (SpeedM), Beauty, Freedom (BeaFree), Prestige, Reputation (PresRep), Complexity, Chaos (Complex), Simplicity, Relaxation (SimplRel), and stand-alone concepts "Power" and "Faith" (colour figure online)

differed from the others by having less statistically significant sex differences in this sample. Russian men had a tendency to perceive concepts in more negative terms than women.

Discussion

In theory, due to the very general and non-biased nature of the experimental material, there should not be any sex differences in the assessment of the common concepts of this material using very common adjectives: Beauty and Freedom should be equally positive for both sexes, as well "Power" should be equally powerful, "Complexity" should equally complex, and "Reality" and "Work" should be equally real and probable for men and women. Yet, even in such OSS-type evaluations, a significant scale-related and object-related bias was found in men's and women's fundamental connotative meaning attribution to these concepts.

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Table 2 Significant sex differences in estimations in Canadian sample, M/F 324/692

Men	Z	p	Women	Men	Z	p	Women
Estimated it as more:				*Estimated it as more:*			
Reality, Life, Present				*Work, Task, Effort*			
Indifferent	3.64	.0003	Exciting	Uninteresting	3.24	.0012	Interesting
Pale	3.01	.0027	Bright	Calms	3.01	.0026	Arouses
Dirty	2.97	.0029	Pure	Decline	2.88	.0040	Progress
Insignificant	**2.94**	**.0033**	**Significant**	**Insignific.**	**2.74**	**.0061**	**Significant**
Superficial	*2.72*	*.0065*	*Deep*	*One-dimen*	*3.82*	*.0001*	*Multi-dimen*
Discrete	*2.97*	*.0029*	*Continuous*	*Ordered*	*2.86*	*.0042*	*Chaotic*
Ordered	*3.04*	*.0023*	*Chaotic*	*Uniform*	*5.33*	*.0000*	*Diverse*
Uniform	*2.93*	*.0034*	*Diverse*	*Simple*	*5.56*	*.0000*	*Complex*
Improbable	6.54	.0000	Inevitable	Artificial	3.77	.0002	Natural
Rare	3.08	.0020	Common	Imagined	2.84	.0046	Existent
Reliable	*2.74*	*.0062*	*Unreliable*	Imaginary	3.64	.0003	Real
Solid	3.33	.0009	Fragile	Impossible	2.99	.0028	Possible
Past, History				Rare	3.78	.0002	Common
Pale	2.91	.0036	Bright	*Senseless*	*2.74*	*.0062*	*Justified*
Uninteresting	3.77	.0002	Interesting	Finite	2.87	.0041	Infinite
Calms	2.93	.0034	Arouses	*Development, Future*			
Insignificant	**3.99**	**.0001**	**Significant**	Calms	3.21	.0013	Arouses
Small	**2.85**	**.0044**	**Large**	Severe	3.65	.0003	Kind
Following	**3.26**	**.0011**	**Leading**	**Small**	**3.81**	**.0001**	**Large**
Superficial	**3.00**	**.0027**	**Deep**	*Uniform*	*3.49*	*.0005*	*Diverse*
Uniform	*3.86*	*.0001*	*Diverse*	*Replaceable*	*3.50*	*.0005*	*Irreplaceab*
Simple	*2.72*	*.0065*	*Complex*	Imagined	4.09	.0000	Existent
Replaceable	*4.78*	*.0000*	*Irreplaceab*	Impossible	3.11	.0019	Possible
Easy	*2.98*	*.0029*	*Difficult*	Improbable	5.76	.0000	Inevitable
Artificial	3.06	.0022	Natural	Atypical	3.53	.0004	Typical
Imagined	3.78	.0002	Existent	Rare	5.52	.0000	Common
Improbable	3.37	.0007	Inevitable	Unusual	3.86	.0001	Ordinary
Rare	3.18	.0015	Common	*Time, Activity*			
Inexplicable	*3.21*	*.0013*	*Understand*	Original	3.46	.0005	Trivial
Speed, Motion				Sharp	2.90	.0038	Smooth
Original	3.44	.0006	Trivial	**Solid**	**2.87**	**.0041**	**Fragile**
Sharp	3.46	.0005	Smooth	Imagined	3.73	.0002	Existent
Pleasant	2.88	.0039	Irritating	Rare	3.97	.0001	Common
Pure	2.78	.0054	Dirty	*Irregular*	*3.23*	*.0012*	*Regular*
Smooth	3.69	.0002	Rough	*Unassembled*	*3.06*	*.0022*	*Assembled*
Useful	2.95	.0032	Harmful	Flowing	4.10	.0000	Fixed
Uniform	*3.32*	*.0009*	*Diverse*	*Beauty, Freedom*			
Simple	*2.78*	*.0055*	*Complex*	Stimulating	3.22	.0013	Draining
Rare	3.41	.0007	Common	Arouses	3.31	.0009	Calms
Reliable	*4.85*	*.0000*	*Unreliable*	Sharp	4.97	.0000	Smooth
Planned	*3.35*	*.0008*	*Spontaneous*	Pleasant	2.81	.0049	Irritating
Prestige, Reputation				Useful	2.71	.0066	Harmful
Original	3.89	.0001	Trivial	*Simple*	*3.21*	*.0013*	*Complex*
Bright	2.97	.0030	Pale	*Ordered*	*3.16*	*.0016*	*Chaotic*
Stimulating	6.06	.0000	Draining	*Reliable*	*3.09*	*.0020*	*Unreliable*
Pleasant	6.87	.0000	Irritating	Stable	3.26	.0011	Unstable

Table 2 continued

Men	Z	p	Women	Men	Z	p	Women
Kind	6.05	.0000	Severe		*Power*		
Progress	3.07	.0022	Decline	<u>Original</u>	<u>4.20</u>	<u>.0000</u>	<u>Trivial</u>
Safe	4.99	.0000	Dangerous	<u>Exciting</u>	<u>5.36</u>	<u>.0000</u>	<u>Indifferent</u>
Light	3.69	.0002	Dark	<u>Bright</u>	<u>4.77</u>	<u>.0000</u>	<u>Pale</u>
Soft	3.17	.0015	Rigid	<u>Stimulating</u>	<u>7.42</u>	<u>.0000</u>	<u>Draining</u>
Pure	4.51	.0000	Dirty	<u>Interesting</u>	<u>7.32</u>	<u>.0000</u>	<u>Uninteresting</u>
Smooth	5.43	.0000	Rough	Pleasant	4.84	.0000	Irritating
Useful	6.36	.0000	Harmful	Kind	3.85	.0001	Severe
Deep	**3.55**	**.0004**	**Superficial**	Progress	5.59	.0000	Decline
Simple	***2.96***	***.0031***	***Complex***	Light	4.03	.0001	Dark
Natural	3.54	.0004	Artificial	Pure	3.59	.0003	Dirty
True	3.36	.0008	False	Useful	4.25	.0000	Harmful
Known	2.72	.0065	Unknown	Smooth	3.06	.0022	Rough
Inevitable	2.89	.0039	Improbable	Mine	3.86	.0001	Not mine
Clear	*3.07*	*.0021*	*Blurred*	**Significant**	**2.79**	**.0053**	**Insignific.**
Ordered	*5.09*	*.0000*	*Chaotic*	**Leading**	**2.87**	**.0040**	**Following**
Understandb	*4.11*	*.0000*	*Inexplicab.*	Obvious	3.17	.0015	Obscure
Regular	*3.04*	*.0024*	*Irregular*	True	5.02	.0000	False
Rational	*4.10*	*.0000*	*Irrational*	*Known*	*3.62*	*.0003*	*Unknown*
Justified	*5.54*	*.0000*	*Senseless*	*Clear*	*2.93*	*.0033*	*Blurred*
Reliable	*7.81*	*.0000*	*Unreliable*	*Regular*	*3.45*	*.0006*	*Irregular*
Precise	*4.01*	*.0001*	*Imprecise*	*Rational*	*4.73*	*.0000*	*Irrational*
Organized	*3.92*	*.0001*	*Unorganized*	*Ordered*	*4.68*	*.0000*	*Chaotic*
Stable	4.65	.0000	Unstable	*Understand.*	*2.82*	*.0049*	*Inexplicable*
Steady	3.80	.0001	Faltering	*Reliable*	*5.47*	*.0000*	*Unreliable*
Flowing	3.18	.0015	Fixed	*Precise*	*3.22*	*.0013*	*Imprecise*
Dense	3.24	.0012	Scattered	*Organized*	*3.26*	*.0011*	*Unorganized*
	Faith			Steady	2.73	.0063	Faltering
<u>Pale</u>	<u>4.08</u>	<u>.0000</u>	<u>Bright</u>		*Complexity, Chaos*		
<u>Draining</u>	<u>3.66</u>	<u>.0003</u>	<u>Stimulating</u>	Original	3.68	.0002	Trivial
<u>Uninteresting</u>	<u>3.90</u>	<u>.0001</u>	<u>Interesting</u>	Smooth	3.08	.0021	Rough
Irritating	3.78	.0002	Pleasant	**Small**	**4.48**	**.0000**	**Large**
Severe	4.00	.0001	Kind	**Weak**	**4.61**	**.0000**	**Powerful**
Dangerous	4.22	.0000	Safe	***Uniform***	***3.90***	***.0001***	***Diverse***
Dark	4.57	.0000	Light	Imagined	4.35	.0000	Existent
Dirty	3.87	.0001	Pure (clean)	*Planned*	*2.85*	*.0043*	*Spontaneous*
Harmful	3.61	.0003	Useful	*Ordered*	*3.40*	*.0007*	*Chaotic*
Decline	2.92	.0035	Progress	Slow	3.87	.0001	Fast
Insignificant	**3.94**	**.0001**	**Significant**		*Simplicity, Relaxation*		
Superficial	**4.46**	**.0000**	**Deep**	<u>Arouses</u>	<u>3.19</u>	<u>.0014</u>	<u>Calms</u>
Weak	**3.16**	**.0016**	**Powerful**	<u>Original</u>	<u>3.41</u>	<u>.0007</u>	<u>Trivial</u>
Replaceable	***4.72***	***.0000***	***Irreplaceab***	<u>Stimulating</u>	<u>3.06</u>	<u>.0022</u>	<u>Stimulating</u>
Imagined	4.35	.0000	Existent	<u>Sharp</u>	<u>2.84</u>	<u>.0045</u>	<u>Smooth</u>
Imaginary	4.53	.0000	Real	Dark	3.00	.0027	Light
Impossible	3.86	.0001	Possible	Dirty	2.94	.0033	Pure
False	3.36	.0008	True	***Uniform***	***4.01***	***.0001***	***Diverse***
Improbable	3.09	.0020	Inevitable	Inevitable	2.91	.0036	Improbable
Artificial	3.31	.0009	Natural	Ordinary	3.51	.0005	Unusual

Table 2 continued

Men	Z	p	Women	Men	Z	p	Women
Irrational	*3.52*	*.0004*	*Rational*	Fixed	2.85	.0044	Flowing
Unreliable	*3.70*	*.0002*	*Reliable*	Solid	4.76	.0000	Fragile
Rigid	3.60	.0003	Soft				
Limited	3.36	.0008	Boundless				

The table should read as: men estimated (the concept italic-heading each section) as more (an adjective in the left column immediately below 'men'); likewise, women's estimations are in the right column. The font alternates between the scales, which belong to the Stimulation factor (underlined), Evaluation (normal), Power (bold), Complexity (bold italic), Reality–Probability (normal), Organization (italic) and Stability–Limitation (normal)

The first, "verbal inferiority of men", hypothesis was not confirmed: instead of having universally more negative estimation of concepts related to social values than women, men showed selective preference for some social values over others. This speaks against the idea of a deficiency in their semantic processing of social cues, but in favour of their selective acceptance of social values. Men's more negative estimations related to routine and norm-oriented concepts (such as Work, Task, Effort, Faith, Reality, Life, Present, Simplicity, Relaxation), with a tendency to view these phenomena as more simple, fixed and imaginary, in comparison to women's estimations. At the same time, men showed more positive evaluations of a set of concepts describing exceptional or sensational phenomena (such as Beauty, Power, Freedom, Speed, Motion) than women and such selectivity was in line with the second hypothesis, i.e. "men as novelty-seekers".

The three hypotheses based on the observations related to women's mental health were not confirmed by this study. There were no universally more positive or universally more negative estimations by women in Canadian and Chinese samples. The sex differences in the tendency to favour one group of concepts over another, which were found in our study, speak against the first two hypotheses, based on observations concerning female emotionality (women as cheerleaders or as predominantly depressed). The third hypothesis about women as "drama-queens" also did not stand following the results of this study, and this was in line with epidemiological studies describing no significant sex differences in histrionic personality disorder (Nestadt et al., 1990; Samuels et al., 2002; Torgersen, Kringlen, & Cramer, 2001). If the "drama-queens" hypothesis was true, women would have more extreme ratings on "symmetric" objects: Reality for them would be more real, Complexity more complex (as was the case), but also Power would be more powerful, Beauty more pleasant, and socially valuable concepts would be estimated as more valuable, than in men, but this wasn't the case. There were, however, universally more negative estimations by Russian men than by Russian women, which also contradict the statistics in Western countries indicating that more women than men report symptoms of depression. The results from this study show that if there is any predominance in depression, it is men, and not women, who give negative estimations to even neutral objects, at least in Russia. This coincides with higher rates of depression in Russian men, in comparison to Chinese and Canadian men.[1] It is possible that the disagreement between the results of this study and common statistics on women's depression in Western cultures is due to a higher social acceptance of a "cry for help" from a woman than from a man. Similar to the fact that children cry more in the presence of concerned parents, women might feel freer to complain about their moods and even to act out upon these moods, while in reality their perception has brighter colours than men's.

The findings that women (especially in Canadian culture) perceive social attractors in less positive terms than men contradict the common view of men as less responsive to social values than women—a view based on the observable, external behaviour. We found that men likely know very well what is good and what is bad from the society's point of view. Their semantic perception, however, might be set up to go after the most valuable things using "short cuts", avoiding routine and prescribed behaviour when possible. Our results show that in their understanding of the most common verbal material men likely do not share women's sense of importance of conservative and rule-driven behaviour, giving priorities to more exceptional, socially attractive and sensation-driven objects. The reference to evolutionary factors in the explanation of sex differences in semantic perception might appear to be a big stretch, but the links between hormones and verbal abilities, and the pattern of findings in our study suggest that we should not dismiss an impact of these factors completely. In line with Geodakyan's (2000) theory, sex differences in brain asymmetry responsible for verbal processing might reflect an evolution of the human species as a two-part system, with one subdivision of the species (males)

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[1] Russian "nihilism" might be due to the high rate of depression in Russia: in 2004 the World Health Organization reported that suicide rates in Russia are double that of Western countries.

Table 3 Significant sex differences in estimations in Chinese sample, M/F 78/128

Men	Z	p	Women	Men	Z	p	Women
	Estimated it as more:				Estimated it as more:		
	Reality, Life, Present				*Work, Task, Effort*		
Dirty	3.07	.0021	Pure	**Delicate**	**2.86**	**.0043**	**Massive**
Small	**3.20**	**.0014**	**Large**	**Weak**	**3.57**	**.0004**	**Strong**
Smooth	**3.91**	**.0001**	**Rough**	*Simple*	*4.09*	*.0000*	*Complex*
Soft	**4.88**	**.0000**	**Rigid**	*Easy*	*3.19*	*.0014*	*Difficult*
Dependent	**4.00**	**.0001**	**Independ.**	Imaginary	4.03	.0001	Real
Understandab	*3.08*	*.0020*	*Inexplicab.*	Limited	2.75	.0059	Boundless
Simple	*4.27*	*.0000*	*Complex*		Development, Future		
Easy	*3.79*	*.0002*	*Difficult*	**Soft**	**4.37**	**.0000**	**Rigid**
Imaginary	3.36	.0008	Real	**Independent**	**3.52**	**.0004**	**Dependent**
Limited	4.93	.0000	Boundless	*Uniform*	*3.57*	*.0004*	*Diverse*
Solid	3.13	.0018	Fragile	*Simple*	*2.72*	*.0065*	*Complex*
Finite	3.06	.0022	Infinite	Limited	2.78	.0055	Boundless
	Speed, Motion				*Past, History*		
Good	2.77	.0057	Bad	**Delicate**	3.43	**.0006**	**Massive**
Reliable	*2.99*	*.0028*	*Unreliable*	**Following**	2.73	**.0064**	**Leading**
Stable	3.42	.0006	Unstable	**Soft**	3.50	**.0005**	**Rigid**
Constant	2.92	.0035	Changeable	Restrained	2.87	.0068	Unrestrained
Limited	3.27	.0011	Boundless	Limited	2.70	.0041	Boundless
Solid	3.94	.0001	Fragile		*Prestige, Reputation*		
	Complexity, Chaos			Stimulating	2.94	.0033	Draining
Soft	4.66	.0000	Rigid	Soft	2.85	.0005	Rigid
Safe	2.81	.0050	Dangerous	Mine	3.49	.0027	Not mine
Good	2.86	.0042	Bad	**Following**	**3.00**	**.0044**	**Leading**
Light	3.45	.0006	Heavy	Natural	3.15	.0004	Artificial
Mine	4.51	.0000	Not mine	Inevitable	3.55	.0016	Improbable
Delicate	**3.63**	**.0003**	**Massive**	*Unassembled*	*2.79*	*.0053*	*Assembled*
Small	**3.13**	**.0017**	**Large**		Power		
Limited	2.90	.0038	Boundless	Stimulating	2.72	.0066	Draining
Finite	5.05	.0000	Infinite	Interesting	4.52	.0000	Uninteresting
Stable	3.38	.0007	Unstable	Mine	4.43	.0000	Not mine
	Simplicity, Relaxation			Useful	3.74	.0002	Harmful
Arouses	3.04	.0024	Calms	*Easy*	*3.20*	*.0014*	*Difficult*
Irritating	2.79	.0052	Pleasant	Inevitable	3.73	.0002	Improbable
Dirty	3.31	.0009	Pure		*Beauty, Freedom*		
Tinny	**3.01**	**.0026**	**Resonant**	Solid	2.73	.0063	Fragile
Imprecise	*3.23*	*.0013*	*Precise*	Limited	3.00	.0027	Boundless
Limited	3.08	.0021	Boundless	Finite	4.11	.0000	Infinite

No differences, which were significant at $p < .00625$, were found for the concept "Faith"

The table should read as: men estimated (the concept italic-heading each section) as more (an adjective in the left column immediately below 'men'); likewise, women's estimations are in the right column. The font alternates between the scales, which belong to the Stimulation factor (underlined), Evaluation (normal), Power (bold), Complexity (bold italic), Reality–Probability (normal), Organization (italic) and Stability–Limitation (normal)

experimenting with trial and error with the second subdivision (female) preserving those characteristics which were proven to be beneficial.

In terms of cross-cultural differences, any experiment which involves verbal material has little chance to find anything universal across cultures due to the social and cultural nature of languages, and their enormous cross-

Table 4 Significant sex differences in estimations in Russian sample, M/F 46/73

Men	Z	p	Women	Men	Z	p	Women
	Estimated it as more:				Estimated it as more:		
	Reality, Life, Present				*Work, Task, Effort*		
Pale	4.48	.0000	Bright	Calms	3.15	.0016	Arouses
Uninteresting	4.09	.0000	Interesting	Decline	3.73	.0002	Progress
Dark	3.44	.0006	Light	**Resonant**	**3.00**	**.0027**	**Tinny**
Insignificant	**3.45**	**.0006**	**Significant**	**Superficial**	**4.48**	**.0000**	**Deep**
Artificial	3.84	.0001	Natural	*Single*	*3.14*	*.0017*	*Numerous*
False	5.39	.0000	True	Impossible	3.97	.0001	Possible
Imagined	4.26	.0000	Existent	*Senseless*	*3.10*	*.0020*	*Justified*
Imaginary	4.28	.0000	Real	*Inexplicable*	*3.21*	*.0013*	*Understandb*
Impossible	4.92	.0000	Possible	*Unreliable*	*3.38*	*.0007*	*Reliable*
Improbable	3.41	.0006	Inevitable	*Unorganized*	*2.91*	*.0036*	*Organized*
Blurred	*4.23*	*.0000*	*Clear*	*Unassembled*	*3.11*	*.0019*	*Assembled*
Obscure	*5.24*	*.0000*	*Obvious*	Restrained	3.33	.0009	Unrestrained
	Development, Future				*Past, History*		
Indifferent	3.85	.0001	Exciting	Harmful	3.01	.0026	Useful
Uninteresting	5.24	.0000	Interesting	**Small**	**2.72**	**.0065**	**Large**
Decline	4.06	.0000	Progress	**Superficial**	**3.65**	**.0003**	**Deep**
Onedimen	*3.70*	*.0002*	*Multidimen*	**Insignificant**	**3.56**	**.0004**	**Significant**
Artificial	*4.50*	*.0000*	*Natural*	*Uniform*	*2.72*	*.0066*	*Diverse*
Imagined	3.68	.0002	Existent	Imagined	3.02	.0025	Existent
Impossible	5.59	.0000	Possible		*Speed, Motion*		
Senseless	*3.45*	*.0006*	*Justified*	Trivial	3.10	.0019	Original
Limited	4.52	.0000	Boundless	Calms	2.75	.0059	Arouses
	Time, Activity			*Uniform*	*3.17*	*.0015*	*Diverse*
Banal	2.79	.0052	Original	False	3.51	.0005	True
Pale	2.97	.0030	Bright	Imaginary	3.29	.0010	Real
Dark	3.02	.0025	Light	Rare	2.86	.0042	Common
Onedimen	*3.05*	*.0023*	*Multidimen*	Restrained	3.49	.0005	Unrestrained
Imagined	3.12	.0018	Existent	Stable	3.06	.0022	Unstable
Impossible	3.31	.0009	Possible	Steady	3.12	.0018	Faltering
Improbable	3.33	.0009	Inevitable	Fixed	2.92	.0035	Flowing
Rare	3.92	.0001	Common		*Beauty, Freedom*		
Limited	3.46	.0005	Boundless	Indifferent	3.27	.0011	Exciting
Restrained	4.29	.0000	Unrestrained	Typical	3.44	.0006	Atypical
Fixed	3.33	.0009	Flowing	Severe	2.97	.0030	Kind
Constant	2.79	.0053	Changeable	Decline	2.86	.0043	Progress
	Prestige, Reputation			Dark	3.14	.0017	Light
Uninteresting	2.94	.0032	Interesting	Dirty	4.79	.0000	Pure
Small	3.34	.0008	Large	**Small**	**4.35**	**.0000**	**Large**
Decline	3.49	.0005	Progress	**Weak**	**3.14**	**.0017**	**Powerful**
Dark	2.98	.0029	Light	**Tinny**	**3.16**	**.0016**	**Resonant**
Weak	3.14	.0017	Powerful	Imagined	3.11	.0018	Existent
Harmful	5.34	.0000	Useful	*Senseless*	*3.22*	*.0013*	*Justified*
Independent	**2.76**	**.0059**	**Dependent**		*Faith*		
Resonant	**2.77**	**.0056**	**Tinny**	Pale	2.91	.0037	Bright
Obscure	*3.20*	*.0014*	*Obvious*	Dull	2.84	.0045	Sharp
Senseless	*3.21*	*.0013*	*Justified*	Severe	2.94	.0032	Kind

Table 4 continued

Men	Z	p	Women	Men	Z	p	Women
Spontaneous	*3.66*	*.0003*	*Planned*	Dark	2.82	.0049	Light
Unorganized	*3.17*	*.0015*	*Organized*	Dirty	2.94	.0033	Pure (clean)
Scattered	2.82	.0047	Dense		*Simplicity, Relaxation*		
	Force			Severe	4.13	.0000	Kind
Imaginary	3.00	.0027	Real	Dangerous	3.10	.0019	Safe
	Complexity, Chaos			Dark	3.18	.0015	Light
<u>Calms</u>	<u>3.63</u>	<u>.0003</u>	<u>Arouses</u>	***Chaotic***	***2.95***	***.0032***	***Ordered***
Insignificant	**2.98**	**.0029**	**Significant**	***Inexplicable***	***2.72***	***.0066***	***Understandb***
				False	2.95	.0032	True

The table should read as: men estimated (the concept italic-heading each section) as more (an adjective in the left column immediately below 'men'); likewise, women's estimations are in the right column. The font alternates between the scales, which belong to the Stimulation factor (underlined), Evaluation (normal), Power (bold), Complexity (bold italic), Reality–Probability (normal), Organization (italic) and Stability–Limitation (normal)

cultural differences. Our results show that a cross-cultural comparison of evaluations of single concepts by single scales would show different significant results across three cultures. Indeed, the tables demonstrate that often a significant sex difference in estimation of some concept along some scale was found in one sample and was absent in another. However, when the scales and concepts are grouped using Osgood's discovery of universality in semantic dimensions, the cross-cultural similarities in sex differences emerge. An adjustment of the SD with our projective semantic method using OSS-specific nouns for estimations indeed show that sex differences are stronger than cross-cultural differences for the concepts related to routine functioning (Work, Task, Effort, Faith, Reality, Life, Present).

On the other hand, concepts related to social attractors (Beauty, Freedom, Prestige, Reputation, Power) showed more cross-cultural variation in sex differences than other concepts. This can be explained by cross-cultural similarity when it comes to everyday routines, and cross-cultural differences when it comes to value systems. It is possible that if men are sensitive to exceptional stimuli, this will include exceptional social values as well. For example, in Russian culture, with common mistrust and depression, ambitious attitudes, Prestige, Beauty, as well as all other "big words" are often considered to be empty, worn words used to confuse the public, and which independent thinkers should not take seriously. Moreover, Russian women participate in society and politics much more actively than Canadian and Chinese women and therefore might perceive social attractors (Prestige and Reputation) more positively than women in other cultures. In Chinese culture complexity of thought and expression was always among the highest values, and certainly higher than concepts of Freedom or Beauty.

In conclusion, our results using young adults in three different cultures showed significant sex differences in connotative meaning attribution to the most common concepts. The four hypotheses based on behavioural observations and the rates of (dis)abilities in verbal activities were not confirmed by this study. The observable sex differences in verbal behaviour appeared to have a mismatch with the sex differences in internal, cognitive processes. In contrast to common beliefs, women in two cultural samples gave more negative estimations to the concepts describing social and physical attractors but more positive estimations to work- and reality-related the concepts than men. The pattern of these differences can be summarised as men favouring concepts related to extreme experience and women favouring concepts related to predictable and controllable routines. These results coincide with a strong contribution of biological factors to higher rates of sensation seeking and deviancy in males, in comparison to females. It is possible that sex differences in observable (external) and internal components of cognition might reflect systemic, evolutionary sex roles.

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