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THE CORRELATIONS OF BIS/BAS, SIS/SES-SF AND SOI-R QUESTIONNAIRES IN TWO CZECH SAMPLES: AN IMPLICATION FOR FUTURE NATIONAL STUDIES

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ABSTRACT

Objectives. Research of sexuality often times includes individuals who choose to be researched and are willing to undergo the procedures. Samples of population (students and self-selected enthusiasts) may not resemble the nation's population structure nor general idea of random human even though the psychological mechanisms researched are thought to be universal. The aim of this study was to investigate the relationship between proximal measures of domain specific and non-specific excitation and inhibition in two (probabilistic and non-probabilistic) samples.
Sample and settings. The authors collected approximately 400 individuals from Central European country – Czech Republic – via specialized agency to match the probabilistic sample (stratified sample) and a second similarly sized sample (chance sample) via snowball sampling and online advertisements at the same time. The participants were asked to fill in two questionnaires widely used by sex researchers (Sexual Inhibition and Excitation Scale, and Sociosexual Orientation Inventory Revised), and one scale designed to map broader motivations to avoid aversive outcomes and motivation to approach goal-oriented outcomes (Behavioral Inhibition and Activation Scale).
Hypotheses. The authors expected partial or complete confirmation of previously found results (general and sexuality specific activation and inhibition and sociosexuality), and also that the replication will be affected by the sample choice.
Statistical analyses. To follow methodologies of previous studies used to create hypotheses the authors decided to use partial correlation controlling for age of the participants.
Results. Generally, the chance sample findings resembled the published results whereas the stratified sample showed bigger differences. The results, relying on correlational analyses as majority of studies does, provided a valuable insight to impact of sampling on results. Using the SEM methodology the study provided further support for the incomparability of the results obtained employing different sampling.
Limitations. The sample size, thus larger than usual studies, could be higher.

key words:
Dual Control Model,
Behavioral Inhibition and Activation System,
sociosexuality,
sampling,
self-selection

klíčová slova:
model dvojí kontroly,
behaviorální inhibiční a aktivační systém,
sociosexualita,
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INTRODUCTION

Human behavior can be broadly reduced to a dichotomous motivational system of approach and avoidance. According to Reward Sensitivity Theory (Gray, 1973; McNaughton & Corr, 2008), whilst the former regulates behavior towards something appetitive, the latter regulates behavior away from something aversive. These two systems – excitatory and inhibitory – are thought to be independent; for example, a high level of excitation is not necessarily related to low inhibition (Corr, 2002, 2004). The Behavioral Inhibition System and Behavioral Activation System (BIS/BAS) questionnaire was developed to measure an aspect of personality derived from variation in patterns of excitatory and inhibitory responses across non-specific contexts.

Derived from the core system proposed in the BIS/BAS, the Sexual Inhibition System and Sexual Excitation System questionnaire (SIS/SES) was developed to measure the motivational system underlying sexual behavior exclusively. Based on the Dual Control Model (originally developed by Bancroft and Janssen, 2000), a dichotomous division of appetitive and aversive motivations are postulated to influence sexual behavior. The SIS/SES aimed to predict individual differences in behavior arising from the relative patterns of excitatory and inhibitory sexual responses (Bancroft & Janssen, 2000; Graham et al., 2006; Hodgson et al., 2016). While theoretically proximal, SIS/SES showed modest overlap with the BIS/BAS (Janssen et al., 2002). Given the domain specificity, SIS/SES should share a stronger relationship with measures of sexual behavior. For example, there is a relationship between SIS/SES items and scores on the sociosexual inventory (Bártová et al., 2021; Janssen et al., 2002; Nolet et al., 2021). However, the notion of domain specificity is somewhat equivocal given evidence that both scales contribute to the prediction of sexual and non-sexual behavior (van Lankveld et al., 2015).

Previous studies have shown the SIS/SES satisfy criteria for establishing psychometric properties (Bloemendaal & Laan, 2015; Graham et al., 2006; Nowosielski et al., 2021; Velten et al., 2018). Application of the SIS/SES scale has also proven useful; evidence of high SES and SIS scores have been linked to sexual dysfunction and pathology (Bancroft et al., 2009; Velten et al., 2018). However, research in the development and assessment of the psychometric properties predominantly utilized convenience sampling of university students, for example, raising questions about the extent to which results from the questionnaire can be accurately attributed to a broader population (Shrout & Rodgers, 2018). This issue has been raised in social psychology more broadly (Earp & Trafimow, 2015), where it is estimated that samples ranging from 20–70% of studies comprise undergraduate students (Rad et al., 2018).

The use of convenience and non-representative samples can lead to bias in the research findings: (a) students (regardless of their age) are in close contact with their peer group, which is likely to influence social behavior and strategy (Binter et al., 2012). Furthermore, psychological problems and lower quality of life are more prevalent amongst students (Henning et al., 2012). Another issue pertains to the self-selected sample (Bethlehem, 2010): (b) individuals that participate in a study focused on sensitive topics such as sexuality tend to be more open-minded and experienced; individuals that choose not to participate in such a study tend to be more insecure or conservative (Copas et al., 2020; Wiederman 1999). As such, the narrow focus of participants could lead to less reliable predictions when applied to sexual behavior in the broader population. It is not to say that the sample that is collected as probabilistic is at all not affected by the self-selection. Also part of population that does not use internet is hardly researched in quantitative studies in last decade. Furthermore, those who take part in such studies may have other motivations such as financial reward for

participation. Thus, the chances of discovering generalizable phenomena are higher in population that are motivated by different notions than interest in the topic or signing in a subject taught at university.

In addition to acknowledging factors related to sampling, it has long been recognized that the development of psychometrics is subject to cultural bias; estimates indicate that 96% of research in the social sciences is conducted in western, educated, industrialized, rich, and democratic (WEIRD; Rad et al., 2018) regions. Furthermore, more than half of the studies are carried out in the United States (Rad et al., 2018). The universal nature of psychological mechanisms is often belied by socio-cultural, political, and linguistic manifestations. The SIS/SES has been translated and applied in several countries including Germany, Italy, Portugal and Poland (Gomes et al., 2018; Nowosielski et al., 2021; Panzeri et al., 2008; Velten et al., 2018). While the results are generally supportive, there are some differences in the comprehension of individual items and variation in the optimum factor structure.

Several studies have indicated gender differences in SIS/SES scores: in comparison to men, women tend towards higher sexual inhibition and lower sexual excitation (Carpenter et al., 2008). Validation of the SIS/SES with women confirmed a similar factor structure although the model fit was less convincing (Carpenter et al., 2008). There were some gender differences in the relevance of items with respect to sexual arousal (Carpenter et al., 2008). Interestingly, it was noted that women's scores correlated more strongly to measures of sexual behavior while men's scores were more closely related to the BIS/BAS (Carpenter et al., 2008). A short version of the scale was developed that incorporated items deemed to have invariant psychometric properties across genders (Carpenter et al., 2011). However, the short form was also developed based on the responses of higher education students.

Previous studies have explored the relationship between BIS/BAS-SIS/SES (Carpenter 2008, 2011; Janssen et al., 2002; van Lankveld et al., 2015) and SIS/SES-SOI (SOI: Sociosexual Orientation Inventory; Bártová et al., 2021; Carpenter 2008, 2011; Janssen et al., 2002). We used these studies to generate hypotheses and extend our study to investigate the relationship between the BIS/BAS and SIS/SES-SF questionnaires together with the SOI-R using two methods of sampling – chance convenient sample and stratified sample representative of the population. Both samples were collected in the Czech Republic, a central European country that arguably does not conform to a typical WEIRD population. The aim of this study was to determine whether predicted relationships between questionnaires were evident when applied to a broader population.

Hypotheses

Hypotheses were based on previously published results.

H1: Sexual excitation (SES) will positively correlate with the behavioral activation dimensions of Drive (BAS-D), Fun-seeking (BAS-FS) and Reward Responsiveness (BAS-RR) in women (Carpenter at al., 2008; van Lankveld et al., 2015) and men (Carpenter at al., 2008, 2011; Janssen et al., 2002; van Lankveld et al., 2015).

H2: Sexual inhibition due to treat performance failure (SIS1) and sexual inhibition due to treat performance consequences (SIS2) will negatively correlate with the dimension Fun-seeking of behavioral activation (BAS-FS) in men (Carpenter at al., 2008, 2011; Janssen et al., 2002; van Lankveld et al., 2015).

H3: SIS1 and SIS2 in men will positively correlate with behavioral inhibition (BIS; Carpenter at al., 2008, 2011; Janssen et al., 2002; van Lankveld et al., 2015).

H4: Sexual excitation (SES) will positively correlate with the three sociosexual

orientation (SOI-R) subscales (Bártová et al., 2021) and SOI-R total score in both men and women (Bártová et al., 2021; Carpenter at al., 2008, 2011; Janssen et al., 2002).

H5: Both measures of sexual inhibition (SIS1 and SIS2) will negatively correlate with the three sociosexual orientation (SOI-R) subscales and SOI-R total score in men and women (Bártová et al., 2021; Carpenter at al., 2008, 2011; Janssen et al., 2002).

METHOD

Participants

The stratified (representative) sample was collected by a data collection agency (Czech National Panel; narodnipanel.cz). The sample was randomly sampled based on strata including sex, age groups, level of education, and size of inhabited area. The chance convenience (non-representative) sample was collected using combination of online advertising on science and life style oriented webpages and snowball sampling (websites pokusnikralici.cz; bezpasaka.cz). Data were collected using Qualtrics online platform, which could be completed on both computer and mobile devices. Both samples were collected simultaneously in the Czech Republic in 2021.

The data was part of a larger research project focused on affective state perception (pre-registered https://osf.io/bhk6m/). Criteria for inclusion were: (a) age of respondent between 18 and 50 years, and (b) at least minimal reported experience with pornographic materials (due to fact that pseudo-sexual images – facial expressions and vocalizations of individuals experiencing sexual pleasure, but no explicit visual materials – were presented to participants during the study). The exact formulation was as follows: "I declare that I have at least minimal experience with pornographic materials."

In the stratified sample, a total of 417 respondents (aged 18–50, M age=33.69, SD=9.72) completed the questionnaires. We aimed for N= 400 (but extra 17 individuals filled in the questionnaire). In total 213 women (aged 18–50, M age=31,98, SD=9,02) and 204 men (aged 18–50, M age=31,98, SD=9,02) took part in the study. In the chance sample, 485 participants filled in the questionnaire, 313 women (M age=30.17, SD=7.77) and 172 men (M age=31.43, SD=8.01). Further demographic information for both samples are included in Table 1.

Since the aim of the study is to compare the presence or absence of correlations previously found in samples that we collected based on spontaneous availability (chance sample) or representability of the Czech population (stratified sample) in regards of specific parameters (sex, age, size of the inhabited area and level of education), we tested the two samples for statistically significant differences in these parameters. We tested the two samples independently for women and men, because the analysis presented in the present study were always executed separately for the two sexes. We confirmed that the women's samples were significantly different for age (F=6.047, p<.05), the size of the inhabited area (χ^2=74325, p<.001) and education (χ^2=163123, p<.001). The men's samples were also significantly different for age (F=17.806, p<.001), the size of inhabited area (χ^2=43132, p<.001) and education (χ^2=24807, p<.001)

Measures

Following an onscreen introduction to the study, participants provided informed consent before completing the demographic information set of questions. The BIS/BAS and SIS/SES-SF, questionnaires were translated to Czech and back-translated by experienced researchers and trained psychologist. The SOI-R questionnaire was already translated and validated for Czech language use (Bártová, 2020).

Table 1a Demographic data for women's stratified and chance samples. For each variable, apart for age, is reported the relative frequency and the percentage in the sample.

Women Samples		
	Stratified	**Chance**
N	213	313
Age, mean (SD)	31.98 (9.015)	30.17 (7.769)
Size of inhabited area		
Less than 1000	48 (22.5%)	29 (9.3%)
1 000 – 4 999	49 (23%)	38 (12.1%)
5 000 – 19 999	44 (20.7%)	35 (11.2%)
20 000 – 99 999	29 (13.6%)	44 (14.1%)
100 000 – 999 999	24 (11.3%)	48 (15.3%)
Above 1 mil. (Prague)	19 (8.9%)	119 (38%)
Education		
Primary	51 (23.9%)	6 (1.9%)
Vocational	67 (31.5%)	114 (36.4%)
Secondary	55 (25.8%)	8 (2.6%)
University degree	40 (18.8%)	185 (59.1%)
Partnership status		
Single	61 (28.6%)	122 (39%)
In relationship	66 (31%)	111 (35.5%)
Married	70 (32.9%)	59 (18.8%)
Divorced	15 (7%)	20 (6.4%)
Widowed	1 (0.5%)	1 (0.3%)

The sexual inhibition and excitation scales (SIS/SES-SF)

The questionnaire is composed of 3 separate types of questions targeting hypothetical situations related to sexual performances, risks related to sexual interaction, and arousal reactivity involving situations. The rating is on 4-point scale (Very false to me – Very true to me). SIS1, Inhibition Due to Threat of Performance Failure, consists of 4 questions (i.e., "I cannot get aroused unless I focus exclusively on sexual stimulation"). SIS2, Inhibition Due to Threat of Performance Consequences, consists also of 4 questions (i.e., "If I realized there is a risk of catching a sexually transmitted disease, I am unlikely to stay sexually aroused"). SES, Sexual Excitation, consists of 6 questions (i.e., "When a sexually attractive stranger accidentally touches me, I easily become aroused").

The questionnaire was used is a shorter form (Carpenter et al., 2011) of the original Sexual Inhibition and Sexual Excitation Scales (Janssen et al., 2002). The reason for choosing the short version, apart from time-consumption in an online experiment, is that the version is valid for both sexes. The Czech version (Appendix 1)[1] allows for

[1] To see translations, reliability measures outcomes and further analytical recommendations please see: https://osf.io/breh4.

Table 1b Demographic data for men's stratified and chance samples. For each variable, apart for age, is reported the relative frequency and the percentage in the sample.

Men Samples		
	Stratified	**Chance**
N	204	172
Age, mean (SD)	35.47 (10.116)	31.43 (8.101)
Size of inhabited area		
Less than 1000	23 (11.3%)	20 (11.6%)
1 000 – 4 999	33 (16.2%)	30 (17.4%)
5 000 – 19 999	38 (18.6%)	18 (10.5%)
20 000 – 99 999	53 (26%)	22 (12.8%)
100 000 – 999 999	28 (13.7%)	29 (16.9%)
Above 1 mil. (Prague)	29 (14.2%)	53 (30.8%)
Education		
Primary	29 (14.2%)	3 (1.7%)
Vocational	79 (38.7%)	65 (37.8%)
Secondary	62 (30.4%)	12 (7%)
University degree	34 (16.7%)	92 (53.5%)
Partnership status		
Single	80 (39.2%)	85 (49.4%)
In relationship	46 (22.5%)	36 (20.9%)
Married	58 (28.4%)	39 (22.7%)
Divorced	20 (9.8%)	12 (7%)
Widowed	0	0

administration for both sexes with no modification. There are number of studies demonstrating consistency of the short version with the original one (Bancroft et al., 2009; Carpenter et al., 2011; Rettenberger et al., 2016; Turner et al., 2013).

Behavioral Inhibition System/Behavioral Activation System Scales (BIS/BAS-Scales)

The BIS/BAS-scales consist of 4 separate types of questions targeting motivation to avoid aversive outcomes and motivation to approach goal-oriented outcomes. The rating is realized on a 4-point scale (Very false to me – Very true to me). The Behavioral Inhibition (BIS) scale consists of seven questions (i.e., "I worry about making mistakes", "Criticism or scolding hurts me quite a bit"). Other 13 questions are dedicated to the Behavioral Activation Scale (BAS). Thus, three separate subscales are Fun-Seeking (BAS-FS) which consists of 4 questions (i.e., "I will often do things for no other reason than that they might be fun"), Reward Responsiveness (BAS-RR) consisting of 5 questions (i.e., "When I'm doing well at something, I love to keep at it"), and Drive (BAS-D), also consisting of 4 questions (i.e., "I go out of my way to get things I want"). The Czech version (Appendix 2) allows for administration

for both sexes with no modification. The questionnaire was used in other languages and consistency of the results was successfully demonstrated (Carver & White, 1994; Jorm et al., 1998).

The socio-sexual orientation inventory (SOI-R)

The questionnaire maps individual willingness to engage in uncommitted sexual activity. The questionnaire consists of 9 questions that can be divided to 3 subscales, each consisting of 3 questions: Behavior (i.e., "With how many different partners have you had sex within the past 12 months?"), Attitudes (i.e., "Sex without love is OK."), and Desires (i.e., "How often do you have fantasies about having sex with someone you are not in a committed romantic relationship with?"). A total score (SOI-TOT) can be obtained by summing (or less commonly averaging) scores from all questions. We used the version that uses 9-point scales that all responses are mapped into. The revised scale (Penke, 2011), from the originally developed scale by Penke & Asendorf (2008) is commonly used in Czech language (e.g., Bártová et al., 2020; Bártová et al., 2021) and consistency with the original language has been demonstrated by above mentioned authors.

Data analysis

The statistical software JASP Version 0.16.3 software (JASP Team (2022) was used to analyze the data. The data from each sex were analyzed separately at all times due to theoretical (differences in physiological and psychological experiences related to sexuality, Chivers et al., 2004) and practical reasons as we are limited by the space. Further analyses can be performed using the linked data.

The Cronbach's alpha (α) is typically used as coefficient of reliability of the scale but it's prerequisites are rarely met (namely Tau-equivalence), McDonald (1978, 1999) proposed measure for reliability – a McDonald's omega (ω) – which overcomes the problem. Since our article aims to discuss comparability of samples and many of the previous studies only used the α coefficient we will report both thus only ω will be discussed as a reliability measure in this article.

The confirmatory factor analysis (SEM function based on configural variance testing) was conducted using the lavaan (Rosseel, 2012) package for latent variable models implementation in JASP software. The DWMS (diagonally weighted mean squares) method was used. This type of estimation is suitable for ordered categorical data (in our case Likert scales; Mîndrilă, 2010).

We used the following model fit indicators: Chi square test (χ^2), Root Mean Squared Error of Approximation (RMSEA), Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) to evaluate the models. Root Mean Square Error of Approximation (RMSEA) measures the difference between the reproduced covariance matrix and the population covariance matrix, with values less than .06 reflecting a small approximation error, indicating a good model fit, values between .08 and .10 a mediocre fit and values above 0.10 a poor model fit (MacCallum et al., 1996). Additionally, the SRMR (Standardized Root Mean Square) is another index reflecting the overall model fit, with values between .05 and .08 indicating an acceptable, and values below .05, a good model fit (Hu & Bentler, 1998). Thus the use of DWLS with robust error calculation that is recommended for the ordered categorical data, and in that case the rules of thumb are not equally applicable.

DWLS is more likely than maximum likelihood (ML) to indicate better model-data fit because it produces smaller RMSEA and larger CFI and TLI than ML (Xia & Yang, 2019). Thus, we were using the goodness of fit indicators as diagnostic tools, without

a set of desired values of RMSEA, CFI and TLI. We used multi-group confirmatory factor analysis to examine the invariance of the latent construct of each questionnaires in the stratified and chance sample. We performed the analysis separated for women and man because the constructs behind the questionnaires used are known to vary between sexes (Chivers et al., 2004; Carpenter et al., 2008; Gomes et al., 2018). We tested separated for configural invariance, scalar invariance and metric invariance and we compared the models using the chi-squared difference test ($\Delta\chi^2$) as indicator of the best model of invariance (Xu & Tracey, 2017). We first tested for configural invariance and we examined the model's indicators CFA, TLI, RMSEA and SRMR to investigate if the original factor structure of the questionnaire was supported in both groups (Xu & Tracey, 2017). To test for metric invariance we constructed a model constraining the factor loadings to be equal across the two groups and we compared the model obtained through this operation with the configural model, using the chi-squared difference test as indicator of the best fitting model (Putnick & Bornstein, 2016). This step allowed us to find out if the items of each factors contributed in similar manner to the latent construct represented by the factor and if variance among the group can be attributed to differences in how equally the item of the questionnaire related to the questionnaire's factors in the two groups. As the last step we tested for scalar invariance by constraining the item intercepts to be equal among the two group and we compared it with the scalar model ($\Delta\chi^2$ was used as indicator of best fitting model). If scalar invariance is supported the level of the latent constructs is equivalent across the two groups.

We performed the correlation analyses controlled for age. The reason is maximal comparability with existing studies, especially Bártová et al. (2021), conducted on Czech non-probabilistic sample. Furthermore, the means of the samples are in case of men and women significantly different in the two compared groups (see Table 1a, b).

The n=400 is sufficiently large sample for the analysis. Some authors conclude that n=400 poses higher chance of rejecting well fitted models (Nye & Drasgow, 2011). Specifically for ML method samples smaller than n=500 are disadvantageous, whereas for DWLS the n=400 is fully sufficient (Baghdarnia et al., 2011).

RESULTS

Reliability

Analysis of the internal consistency was conducted separately on data from the stratified sample and from the chance sample, and respectively for men and for women. Furthermore, analyses were conducted on each subscales of the questionnaires used. The cutoffs for internal consistency are arbitrary (Lance et al., 2006), and there is lack of empirical evidence for difference between the two most used reliability measures (Cronbach's α and McDonald's ω; Cho, 2021), therefore cutoffs are recommended to be similar for the two measures. An interpretation for Cronbach's α values is: a value of 0.5–0.75 indicates moderate reliability; a value of 0.76–0.9 indicates good reliability; and a value above 0.90, indicates excellent reliability (Koo et al., 2016). In the current paper we follow Koo's cutoffs. For the reasons explained above in the text we only reported the McDonald's ω, the Cronbach's α is reported in the Appendix 1.

For the subscale Behavior of SOI-R questionnaire, the internal consistency was very good in both samples for women (ω=.909 for the stratified sample and ω=.895 for the chance sample) and for men (ω=.88 for the stratified sample and ω=.904 for the chance sample).

For the subscale Attitudes of SOI-R, we observed good consistency for women (ω=.746 for the stratified sample and ω=.758 for the chance sample) and for men (ω=.846 for the stratified sample and ω=.746 for the chance sample).

For the subscale Desire of SOI-R, we observed good internal consistency for women (ω=.781 for the stratified sample and ω=.803 for the chance sample) and men (ω=.818 for the stratified sample and ω=.789 for the chance sample).

Taken together these results showed good internal consistency for the SOI-R questionnaire in our samples, irrespective of the sex of the participant.

For the subscale Drive of BIS/BAS questionnaire (BAS-D), the internal consistency was acceptable for women (ω=.713 for the stratified sample and ω=.682 for the chance sample) and for men (ω=.646 for the stratified sample and ω=.754 for the chance sample).

For the Fun Seeking subscale of BIS/BAS questionnaire (BAS-FS), the internal consistency was acceptable for women (ω=.687 for the stratified sample and ω=.652 for the chance sample) and for men (ω=.664 for the stratified sample and ω=630 for chance sample).

For the Reward Responsiveness subscale (BAS-RR), the internal consistency was also acceptable for women (ω=.689 for the stratified sample and ω=.676 for the chance sample) and for men (ω=.700 for the stratified sample and ω=.673 for the chance sample).

For the Behavioural Inhibition subscale of BIS/BAS questionnaire (BIS), the internal consistency was good for women (ω=.742 for the stratified sample and ω=.766, for the chance sample) and for men (ω=.718 for the stratified sample and ω=.765 for the chance sample).

The results of the subscales of BIS/BAS showed that generally the internal consistency of the questionnaire is acceptable for the four subscales and irrespective of the sex, but some subscales (BAS-D and BIS) are more reliable than others (BAS-FS and BAS-RR).

For the Sexual Excitation subscale of the SIS/SES-SF questionnaire (SES), the internal consistency was good for women (ω=.769 for the stratified sample and ω=.783 for the chance sample) and for men (ω=.775 for the stratified sample and ω=.782 for the chance sample).

For the SIS1 subscale, we tested the consistency with the 4 items belonging to the factor but the query number 9 (item number 2 of the SIS1, "Once I have an erection, I want to start intercourse right away before I lose my erection/Once I am sexually aroused, I want to start intercourse right away before I lose my arousal") yielded the models to be inadmissible. The same query showed a negative item-rest correlation in the chance sample of women and its removal showed improvement in the internal consistency for women and man in both samples. Therefore, we removed this query from further analysis, including the internal consistency of the SIS1 subscale.

With the removal of the item the internal consistency for women's samples improved (ω=.59 for the stratified sample and ω=.586 for the chance sample) and similar results were obtained for the men's samples, with an improvement of the internal consistency of SIS1 after the removal of query number 9 (ω=.616 for stratified sample and ω=.629 for the chance sample) but still not enough for fully satisfactory results in neither case.

For the subscale SIS2 of SIS/SES-SF questionnaire, the internal consistency was acceptable for women (ω=.664 for the stratified sample and ω=.663 for the chance sample) and for men (ω=.622 for the stratified sample and ω=.626 for the chance sample).

The results of SIS/SES-SF, similarly to BIS/BAS, showed that in general the consistency is acceptable for both sexes but with differences in the subscale considered (SES showed higher consistency then SIS1 or SIS2).

Multi-group Confirmatory Factor Analysis

The CFA and the measurement of invariance were conducted separately for men and women. For each sex the multi-group analyses aimed to find differences between the stratified and chance sample. We used the Structural Equation Models (SEM): the first step is testing the factors model and it is equivalent to confirmatory factor analysis (CFA), the following steps are test for invariances of the structural models.

The results of the CFA for SOI-R, conducted separately for men and women, showed high indicators of goodness of fit, meaning that the overall factor structure is similar for the two groups in both sexes (for women CFI=.995, TLI=.993, RMSEA=.025 and SRMR=.056 while for men CFI=1.000, TLI=1.016, RMSEA=0.000 and SRMR=.043) and that the model can be equally applied to both groups, the stratified and the chance sample (Table 2). The results of the following step showed no evidence of statistically significant metric invariance for neither women ($\Delta\chi^2$=18.282; $p < .01$) nor men ($\Delta\chi^2$=22.772; $p< .001$). This means that factor loadings may be different between groups indicating potential bias in responding to one or more items of the SOI-R attributable to the group samples. The results of the comparison between the metric model and the scalar model also show no statistically significant evidence for scalar invariance, in neither sexes ($\Delta\chi^2$=92.797; $p< .001$ for women and $\Delta\chi^2$=35.959, $p<.001$ for men). The scalar invariance model is the most constrained, with both factor loadings and intercepts constrained to be equal across groups. The results of the invariance tests suggest that for both sexes the differences found between the two tested groups may not be related to the latent factors (attitude, behaviour and desire), but to differences in the measurement of the instrument parameters (item score and their loading in the factors).

The results for CFA on BIS/BAS questionnaire conducted independently for men and women samples showed a good fitting of the factor model for both sexes (for women CFI=.933, TLI=.921, RMSEA=.056 and SRMR=.073 while for men CFI=.938, TLI=.928, RMSEA=.049 and SRMR=.079) ensuring that the model can be applied to both groups (see Table 2). The results of metric invariance for women ($\Delta\chi^2$=59.949, $p<.001$) showed no evidence of invariance, implying that one or more item of the BIS/BAS are answered differently in the two groups. Differently, for the men samples the results support the presence of scalar invariance ($\Delta\chi^2$=18.943 p=.216), meaning that the item loaded equally in the factor for the two groups (stratified and chance sample). The next step of comparison between the metric model and the scalar models showed for both sexes no evidence of scalar invariance ($\Delta\chi^2$=144.742, $p<.001$ for women and $\Delta\chi^2$=107.003, $p <.001$ for men). These results imply that the BIS/BAS questionnaire may not give an equivalent measure of behavioral activation and inhibition in the two groups (stratified and chance samples). While for the women samples we found no evidence of invariance (metric and scalar), for the two samples of men we found evidence for metric invariance between the groups but no evidence for scalar invariance. This implies that the items are answered consistently by members of the two groups of men but the measures of the parameters are not equivalent across groups.

The results of CFA for the SIS/SES-SF questionnaire were similar for men and women (Table 2). The overall factor structure, performed independently for the two sexes, showed a good fitting (for women CFI=1.000, TLI=1.001, RMSEA=.000 and SRMR=.051 while for men CFI=.975, TLI=.968, RMSEA=.037 and SRMR=.069). When testing for scalar invariance, we found in both sexes that such model, with

Table 2 Fit indices for testing invariance between the stratified and chance samples

Model	χ^2	df	$\Delta\chi^2$	Δdf	SRMR	RMSEA	TLI	CFI
SOI-R Women								
Configural	55.783	48			0.056	0.025	0.993	0.995
Metric	74.065*	55	18.282**	7	0.061	0.036	0.985	0.989
Scalar	166.862***	64	92.797***	9	0.083	0.079	0.931	0.939
SOI-R Men								
Configural	29.426	48			0.043	0.000	1.016	1.000
Metric	52.199	55	22.772***	7	0.054	0.000	1.002	1.000
Scalar	88.158*	64	35.959***	9	0.068	0.045	0.985	0.986
BIS/BAS Women								
Configural	580.201***	328			0.073	0.056	0.921	0.933
Metric	644.013***	344	63.812***	16	0.058	0.059	0.911	0.920
Scalar	791.089***	364	147.075***	20	0.067	0.069	0.879	0.884
BIS/BAS Men								
Configural	477.586***	328			0.079	0.049	0.928	0.938
Metric	499.312***	344	21.726	16	0.081	0.049	0.929	0.936
Scalar	610.808***	364	111.496***	20	0.088	0.060	0.893	0.898
SIS/SES-SF Women								
Configural	122.548	124			0.051	0.000	1.001	1.000
Metric	130.814	134	8.265	10	0.053	0.000	1.002	1.000
Scalar	170.286	147	39.472***	13	0.059	0.025	0.987	0.987
SIS/SES-SF Men								
Configural	156.363*	124			0.069	0.037	0.968	0.975
Metric	168.675*	134	12.312	10	0.071	0.037	0.969	0.973
Scalar	216.851***	147	48.176***	13	0.079	0.050	0.942	0.946

Note. Df = degrees of freedom; SRMSR = standardized root mean square residual; RMSEA == root mean square error of approximation; TLI = Tucker-Lewis index; CFI = comparative fit index. *p < .05, **p < .01, ***p<.001

constrained factor loading, fit significantly better the data then the configural model (for women $\Delta\chi^2$=8.265, p=.603 and for men $\Delta\chi^2$=12.312, p=.265). This means that independently for both sexes the items belonging to each factor are answered consistently by members of the two groups (stratified and chance samples). The results of the following step, the test for scalar invariance, are similar for both sexes: the model with constrained intercepts do not fit the data better than the model with constrained factor loading (for women $\Delta\chi^2$=39.472, p<.001 and for men $\Delta\chi^2$=48.176, p<.001), meaning that the items loaded similarly in the two groups but the measure of the constructs (SES, SIS1 and SIS2) is not equivalent.

Correlations

The relationship between questionnaires was analyzed separately for men and women in each of the stratified and chance samples. Controlling for age limits the impact of age differences in the samples and allowing for a direct comparison with the results of Bártová et al. (2021).

The total coverage of the correlation analysis results for women can be found in Table 3 and for men in Table 4.

Table 3 Results correlations for stratified and chance sample of women

	BAS Drive	BAS Fun Seeking	BAS Reward Responsiveness	BIS	SOI-R Behavior	SOI-R Attitude	SOI-R Desire	SOI-R Total
Stratified sample – Women								
SES	.384***	.441***	.491***	.122	0.226***	0.289***	0.477***	0.428***
SIS1	0.018	-0.057	0.038	0.166*	-0.109	-0.089	-0.068	-0.118
SIS2	-0.179**	-0.162**	-0.021	0.187**	-0.179**	-0.179**	-0.079	-0.198**
Chance sample – Women								
SES	0.273***	0.242***	0.420***	0.137*	0.192***	0.287***	0.555***	0.444***
SIS1	0.012	-0.079	-0.044	0.033	-0.129*	-.234***	-.190***	-.251***
SIS2	-0.065	-0.104	-0.066	0.113*	-.188***	-.317***	-.224***	-.332***

*p < .05, **p < .01, ***p<.001

Table 4 Results correlations for stratified and chance sample of men

	BAS Drive	BAS Fun Seeking	BAS Reward Responsiveness	BIS	SOI-R Behavior	SOI-R Attitude	SOI-R Desire	SOI-R Total
Stratified sample – Men								
SES	0.176***	0.258***	0.322***	0.119	0.159*	0.355***	0.501***	0.440***
SIS1	-0.039	-0.101	0.052	0.222***	0.039	-0.097	-0.010	-0.037
SIS2	-0.098	-0.238***	-0.046	0.113	-0.030	-0.182**	-0.005	-0.101
Chance sample – Men								
SES	0.111	0.237**	0.333***	0.214**	0.247***	0.305***	0.592***	0.504***
SIS1	-0.035	-0.191*	-0.098	0.161*	-0.051	-0.367***	-0.234**	-0.298***
SIS2	-0.213**	-0.213**	-0.098	0.166*	-0.159*	-0.250***	-0.113	-0.229***

*p < .05, **p < .01, ***p<.001

The results of the correlation analysis for the women samples showed significant positive correlations between SES and BAS-D, BAS-FS and BAS-RR in both groups (stratified and chance sample), confirming the hypothesis 1.

Our data confirm the hypothesis 4 for the women's groups, with significant positive correlations between SES and all the subscales and the total score of SOI-R in both samples.

The results also confirm the hypothesis 5 for the chance sample of women, with significant negative correlations between SIS1 and SIS2 and the SOI-R's subscales and total score. In the stratified sample we only partially confirm the hypothesis 5, since significant negative correlations were only found between SIS2 and SOI-R attitude subscale and SOI-R total score.

In men we also confirm the hypothesis 1 in both samples, with exception of the correlation between SES and BAS-D that was not significant in the chance sample.

The hypothesized (H2) negative significant correlations between SIS1 and SIS2 with BAS-FS in men was confirmed in the chance sample and for SIS2 but not for SIS1 also in the stratified group.

The third hypothesis regarding significant positive correlations between SIS1 and SIS2 with BIS in men was fully confirmed in the chance sample but again, for the stratified sample, we only partially corroborate the finding with SIS1 but not with SIS2.

The significant positive correlations hypothesized (H4) between SES and SOI-R (the three subscales and the total score) in men, was confirmed in both samples.

The last hypothesis (significant negative correlations between SIS1 and SIS2 with SOI-R, the subscales and the total score) was confirmed in the chance sample with two exceptions: the negative correlations between SIS1 and SOI-R Behaviour and between SIS2 and SOI-R Desire were not significant. In the stratified sample we only confirmed the significant negative correlation between SIS2 and SOI-R Attitude, but none of the remaining hypothesized correlations (H5).

Summarized predictions and results can be found in Table 5.

Table 5 Report of significant correlations between subscales

	BAS Drive	BAS Fun Seeking	BAS Reward Responsiveness	BIS	SOI-R Behavior	SOI-R Attitude	SOI-R Desire	SOI-R Total
Women								
SES	S C	S C	S C		S C	S C	S C	S C
SIS1					C	C	C	C
SIS2					SC	SC	C	SC
Men								
SES	S	SC	SC		SC	S C	S C	S C
SIS1		C		SC		C	C	C
SIS2		SC		C	C	SC	C	C

Note. Significant correlation ($p<.05$) was found between questionnaire's subscales based on the hypotheses – visible non-darkened area – and found in the stratified – marked S – and chance – marked C – samples of women and men.

DISCUSSION

We investigated the relationship between psychometric measures of excitation and inhibition in two samples (stratified and chance sample). Data were collected simultaneously, therefore any discrepancy between our results and previous research can be reasonably attributed to the sampling process and not differences in time. The chance sample was found to be significantly different from the stratified sample in age, the size of the inhabited area, and education in both, men and women. The differences found in the scales can therefore be attributed to these characteristics of the sample, and special attention should be drawn to these variables in future studies.

The correlation analyses were also controlled for age to limit the possibility of differences in sexual behavior between samples. For example, it is understood that sexual motivation changes over the lifespan (Bártová et al., 2021; Binter et al., 2012). As such, any difference between samples is likely to stem from demographic aspects such as socioeconomic status or geographic location.

The psychometric proprieties of the questionnaires provide us with three important findings. Firstly, that there was necessity of modification of the SIS/SES-SF questionnaires. This modification, dropping of one item is the same as in the German translation (Velten et al., 2018). The reasoning stands for the Czech version also – the readers probably focus on first half of the sentence only.

Secondly, all of the questionnaires are sufficiently consistent for the scientific use but the application in clinical work should be limited in case of SIS/SES-SF, and BIS/BAS questionnaires. The SOI-R questionnaire is much more recent in its development and the outcomes meet all criteria necessary for clinical work.

The BIS/BAS and SIS/SES-SF questionnaires were developed in the 1990s and early 2000s when the criteria necessary for clinical work were less restrictive and both psychological tools are used by this day because they bring important insights. More focused and scoring wise better tools exist for clinical work shall one need those (Sánchez et al., 2004). Yet the original and shortened versions will be applied in scientific work in future without a doubt.

Since one of the main aims of this article was to provide information regarding the difference of outcomes if the tools are used for data collection in stratified and chance samples we tested, using the Structural Equation Model methodology, for the invariance between the two samples. The results provide us with confirmation that in all cases the factor structure was comparable between the two groups. Neverthless, when testing for scalar invariance, we found out the two groups are in no case comparable using the tools provided, because of the individual items prediction of the observed variable differs in the two samples.

The results for metric invariance suggest that the tested latent variables of sociosexuality are not comparable. The same result we obtained for BIS/BAS questionnaire in men. Whereas for women we confirmed that the two groups do share the latent variables sufficiently. The adjusted (one question removed) SIS/SES-SF questionnaire was also found to be driven by comparable latent variables in both groups.

Therefore should be corroborated that even though the factor structure doesn't vary between the samples, the two groups differ in terms of latent variables and in how the items are answered.

A positive correlation between sexual excitation and the three behavioral activation dimensions was predicted (H1) in both men and women. This relationship was found in women and men in both samples. These results validate the sexual excitation construct as a specific domain of the general behavioral activation system theorized by the Reinforcement Sensitivity Theory (Bancroft, 1999).

A negative relationship between both SIS1 (sexual inhibition due to threat of performance failure), SIS2 (sexual inhibition due to threat of performance consequences) and BAS-FS was predicted (H2) in men. However, we only found a negative correlation between SIS1 and BAS-FS in the chance sample. Both SIS1 and SIS2 concern sexual inhibition; specifically, SIS1 concerns performance anxiety and SIS2 concerns fear of performance consequences. As such, inhibition in this context was anticipated to be opposed to proneness to seek novel sensations or excitement. Validation of the SIS/SES-SF scale in Polish also found no significant relationship between SIS and BAS (Nowosielski et al., 2021). It was suggested that socio-cultural factors might influence the context of sexual encounters (Nowosielski et al., 2016), thus predicting arousal rather than threat of consequences for example.

In men, a positive relationship between both SIS1 and SIS2 and BIS (behavioral inhibition) was predicted (H3). A relationship between SIS1 and BIS was shown in both samples of men. This is congruent with some previous research that showed a relationship between SIS1 and BIS (Carpenter et al. 2011; van Lankveld et al. 2015). The relationship between SIS2 and BIS was also confirmed in the chance sample of men, as other authors previously found (Carpenter at al., 2008, 2011; Janssen et al., 2002), but not in the stratified sample.

We predicted (H4) positive correlations between SES and SOI-R (the three subscales and total score of sociosexual orientation) in both men and women, which was confirmed in both samples. These relationships in the expected direction validate the SES construct. Individuals with a more casual attitude to sexual relations exhibit greater sexual excitation. Conversely, a negative correlation was predicted (H5) between sexual inhibition measures (SIS1 and SIS2) and SOI-R (the three subscale and the total score) in men and women. In the chance sample, the relationships between SIS1 (Bártová et al., 2021), SIS2 (Bártová et al., 2021; Carpenter at al., 2008, 2011; Janssen et al., 2002) and SOI-R subscales (with the exception of SOI-R Behavior) are congruent with previous research with exception of SIS1 and SOI-R behavior. Individuals with a more casual attitude to sexual relations are less likely to be inhibited by the threat of performance failure and consequences. However, there was no relationship between measures of sexual inhibition due to threat of performance failure (SIS1) in the stratified samples of men or women. For the SIS2 we confirmed the hypothesis in women's stratified sample, with exception of the subscale SOI-R desire. In men's stratified sample we found only a significant negative correlation between SIS2 and SOI-R attitude. The pattern of results matches research conducted in Poland (Nowosielski et al., 2021); while the relationship between sexual excitation and sociosexuality appears robust, further research is required to determine the role of sexual inhibition within the broader population.

Findings from the chance sample were generally similar to results of previous studies (Bártová et al., 2021; Carpenter at al., 2008, 2011; Janssen et al., 2002; van Lankveld et al., 2015). Czech Republic is considered as part of Central Europe and does not arguably fit in the WEIRD categorization. Despite the different historical and cultural background the findings from our self-selected sample are highly similar to the previous studies conducted in western countries.

The data indicate that sexual excitation is predictive of sociosexuality across both men and women irrespective of the sample demographic and sampling process. An overlap between general domain of behavioral activation and specific domain of sexual excitation is consistent in both sexes.

The relationship between sexual inhibition and SOI-R dimensions appear robust only in the chance samples of both men and women. For the stratified samples, only SIS2 showed significant negative correlations with SOI-R's subscales, with differences in terms of specific subscale for women and men. The overlap between general domain of activation/inhibition and sexual inhibition construct appears to be more complex. It is important to clarify that correlation analysis is not the ideal statistical tool to explore the presence of associations between scales, thus used in majority of the studies to evaluate the concurrent validity (van Lankveld et al., 2015). Correlation can only capture the simplest type of association and the presence of subgroups within a sample may create artefacts. Nevertheless, the self-selection of participants can bias sex research; the most conservative or sexually insecure people are less likely to be included. Furthermore, targeted broad population samples are more likely to influence results. Previous cross-cultural research found gender equality, economic income, and life expectancy, for example, to be related to socio-sexual orientation. While there is an abundance of support for the sexual excitation and inhibition model, the validity of predictions may be less reliable when applied to sections of the population.

CONCLUSION

The study was designed to evaluate the impact of sample choice on the correlational analyses of concurrent validity. Concretely we have focused on SIS/SES-SF, which is

based in Dual Control Model of Sexual Response and BIS/BAS questionnaire which is broader measure of tendency to motivation to avoid aversive outcomes (Behavioral Inhibition System) and motivation to approach goal-oriented outcomes (Behavioral Activation System) based in Reward Sensitivity Theory. As the third questionnaire we have included the SOI-R that maps socio-sexual orientation, a tendency and willingness to uncommitted sexual activity. As expected, we have found different results in case of the stratified and chance sample. We also found that our chance sample resembled the outcomes in other western countries whereas the stratified sample results deviated from expectations (Table 5). We find these results to be important for future research design adjustment, namely national surveys and probabilistic sample collections, and interpretation of results involving human sexuality.

Limitations and further directions

The two samples were collected during the first half of year 2021 when COVID-19 pandemic was going through the world and there may be an effect of the pandemic state on the result.

There are inequalities in the amounts of the numbers of individuals of each sex tested. The women are present in higher amount in the chance sample. Even though this is common for chance sample collections, it should be considered a limitation.

Generally, the samples collected, even though sufficient according to literature relying on modeling of the results and comparable studies, could be higher which would allow for further differentiation and sub-sample analysis.

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SOUHRN

Korelace skórů dotazníků BIS/BAS, SIS/SES-SF a SOI-R ve dvou českých vzorcích: Implikace pro budoucí národní studie

Cíl výzkumu. Výzkum lidské sexuality je obvykle prováděn na vzorcích populace složených z těch osob, které si zvolí účast ve výzkumu a souhlasí s absolvováním výzkumných procedur. Takový vzorek populace (studenti a samovybraní nadšenci) však nemusí odrážet složení populace, ani reprezentovat náhodně vybrané jedince. I přesto jsou výsledky studií považované za univerzální. Cílem prezentovaného výzkumu bylo měření specifické a obecné tendence k aktivaci a inhibici na dvou vzorcích (jednom reprezentativním a jednom nereprezentativním).
Výběr vzorku a metod. Autoři nasbírali data od asi 400 osob z České republiky díky využití služeb specializované agentury, aby získali data od stratifikovaného vzorku populace. Další, srovnatelně rozsáhlý nestratifikovaný vzorek dat, byl získán od populace díky online rekla-

mě a současnému sběru formou sněhové koule. Účastníci byli požádáni o vyplnění dvou dotazníků užívaných pro výzkum lidské sexuality (zkrácené verze Dotazníku sexuální inhibice a excitace a revidované verze Dotazníku sociosexuality). Dále pak dotazníku zaměřeného na obecné tendence snižovat negativní dopady a být motivovaný pozitivními výsledky (Dotazník behaviorální inhibice a aktivace).

Hypotézy. Autoři očekávali částečné či úplné potvrzení předchozích výsledků u všech tří dotazníků. Také očekávali, že míra potvrzení výsledků bude závislá na výběru zkoumaného vzorku.

Statistické analýzy. Aby se autoři blížili metodami možnosti replikace, zvolili stejné metodické postupy jako předcházející studie. Užili tedy korelačních analýz kontrolovaných pro věk participantů.

Výsledky. Výsledky analýz nestratifikovaného vzorku se ve velké míře shodovaly s výsledky předchozích studií. Výsledky stratifikovaného vzorku participantů se od publikovaných výsledků výrazně odkláněly. Výsledky studie ukazují, že při použití nejrozšířenější formy analýz, korelací, jsou výsledky významně ovlivněné výběrem vzorku. Za použití strukturálních modelů bylo možné ještě více odkrýt nesrovnatelnost výsledků založených na datech získaných od vzorků s různou mírou reprezentativity.

Limity. Velikost sebraných vzorků by mohla být vyšší, přestože byl vzorek početnější než u srovnatelných studií.