Original Paper

Development and Testing of a Modified Version of Stroop Test for the Assessment of Sexual Functioning: A Modified Sexual Stroop Test in Persian Language (MSST-Persian)

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Abstract

Aim: Modified versions of the Stroop task have been used in various kinds of clinical conditions. The aim of this study was to develop a Sexual Stroop Task.

Method: This study consists of two phases. First phase included designing the sexual Stroop task after searching and selecting Persian sexual and neutral words, and the second phase was related to the pilot study. For finding Persian sexual words, we used four different methods but for neutral words we used the words used in other Stroop studies. Then, we came up with 2 general categories as neutral and sexual words which were randomly specified as green and red colors. The developed computerized version of the Sexual Stroop Task was run on 69 participants as a pilot study.

Results: Participants (N=69) had longer response times for words related to sex in comparison to neutral words. And the total time which was spent on sexual words was more than the total time for neutral words. The percentage of the correct neutral words was also higher than correct neutral words.

Conclusion: This preliminary study presented a new version of emotional Stoop test that seems to be a promising instrument to study the neuropsychological aspects of sexuality.

Keywords

modified version of stroop test, persian language, sexual functioning

1. Introduction

The Stroop Test (Task) also known as the Stroop Color-Word Test (Task) or Stroop Effect Test (Task) is a neuropsychological test used to assess and measure inhibition of cognitive interference, directed attention, and cognitive flexibility associated to the frontal lobe functioning (Heflin et al., 2011; Puglisi et al., 2019).

The Stroop Test in its original form was developed and devised by John Ridley Stroop in 1935. Based on several experiments conducted by Stroop for his dissertation, he came up with a phenomenon called the "interfering effect" which has been described and explained in a paper published in the *Journal of Experimental Psychology* (1935). In its original version, a subject is given three lists to read them aloud as fast as possible. Series number one is the color names printed in black ink, series number 2 is colored squares and the subject is asked to name the color, and series number 3 consists of a series of color words printed in colors different than the color name. The score is based on the number of correct answers produced in 45 seconds (Stroop, 1935).

For nearly ninety years this test with different formats has been used extensively in many areas of cognitive assessment including brain damage (Demakis, 2004; Golden, 1976), dementia (Amieva et al., 2004), ADHD (dos Santos Assef, Capovilla, & Capovilla, 2007), schizophrenia (Krabbendam et al., 2009), depression (Fallon, 2013), and other common mental disorders. The most important outcome has been the fact that for identifying word colors, an inhibitory mechanism happens in the brain to read the word which leads to a longer time response than when the color and the word corresponds to each other (GREEN written in color green). This slowed or delayed response time is called the "Stroop effect". In simple terms, the subject needs purposely focus on only one aspect of the stimulus (i.e. color) while ignoring the other aspect of it (reading the word which is usually processed automatically). The general term for such an effortful action is cognitive interference. It has been suggested that the task of focusing on the "right" answer in a conflictual situation is related to a part of the brain called anterior cingulate, a region located in the frontal lobe. It is involved in many higher cortical processes including attention and executive functioning (Banich, 2019; Ménétré & Laganaro, 2019).

Attention and the Stroop effect

Several theories have been proposed for the explanation of Stroop effect including automaticity theory (MacLeod, 2015), speed of processing theory (MacLeod, 1991), parallel distributed processing (Cohen, Dunbar, & McClelland, 1990) and selective attention or directed theory (Shalev & Algom, 2000). According to the automaticity theory, two types of cognitive processing happen in the brain: automatic and controlled. Based on such a dichotomy reading the words is easier to recognize than color of the words (MacLeod, 2015). Speed of processing theory simply says that the processing of written words happens faster than the processing of colors (MacLeod, 1991). According to parallel distributed processing there are different pathways for different tasks in the brain. Depending on the importance and strength of the stimuli, the pathways are activated (Cohen et al., 1990).

It seems the most important mechanism involved in Stroop effect is directed attention which provides the brain with an active resource by inhibiting one behavior in order to respond to another pattern of behavior. Therefore, the main mechanism in this explanation is related to an inhibitory process (Kaplan, Şengör, Gürvit, & Güzeliş, 2007).

The attentional system "includes several distinct networks of the brain areas that perform the functions of acquiring the alert state (alerting network), orienting to sensory events (orienting network) and maintaining continuity of behavior in accordance with goals when conflicting responses could be called for(executive network)" (Posner & Rothbart, 2007a). The executive function of attention manifests itself mostly in the process of prioritizing particular stimuli for a dedicated purpose (Ghassemzadeh, Rothbart, & Posner, 2019).

Based on the capacity of directed attention, we can manage our energy to focus on an aspect of the stimulus that requires more effort and concentration. For this purpose, an inhibition is required in the automatic and salient processing which leads to an increase in the reaction time. It has been found that reading times were longer for erotic sentences than neutral sentences (Siegrist, 1995). Cognitive processes play an important role in the perception and evaluation of sexual stimuli and are important correlates of sexual problems such as low desire for sex, arousal difficulties, or problems with reaching orgasm. Such cognitions have been found to be associated with sexual problems in women and men (Velten, Blackwell, Margraf, & Woud, 2019). In this study we plan to develop and provide Modified Version of Stroop Test for the assessment of sexual functioning.

2. Method

This study has been consisted of two phases. First phase included designing the sexual Stroop task after searching and selecting Persian sexual and neutral words and the second phase was related to the pilot study.

2.1 The First Phase

The first phase of the study included three stages as below (Figure 1).
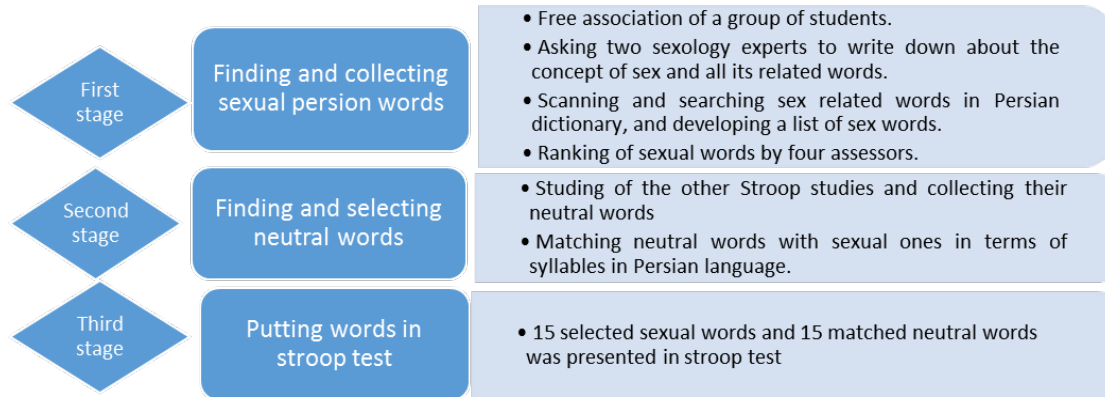
Figure 1. Step by Step Procedures of the Study

2.1.1 The First Stage

The aim of this stage was finding and collecting Persian sexual words. Persian words related to sex were collected using the following methods: 1) Free association of a group of students including psychology students, medical students and psychiatric residents. 165 Participants (88 females and 77 males) were invited to an experimental room and were asked to pick up the anonymous papers. They were given one-minute time for free association and writing down whatever they can remember about the concept of sex. Then, the frequency of words related to sex was calculated and the words with the most frequency were selected at this step. Totally, 135 sexual words were written that pleasure (female=26%, male=32.5%), love (female=20%, male=17%), peace (female=14%, male=19.5%), intercourse (female=16%, male=9%) and marriage (female=10%, male=5.2%) were the most frequent associated words. Some other words were consisted as breast, penis, warmth, emotion, masturbation, rape, mother, taboo, impulse, shame, candle, girl, beauty and porn movies. 2) Asking two sexology experts to write down about the concept of sex and all its related words. The free association consisted of 196 words related to sex such as fantasy, intercourse, penis, kiss, breast, desire, erection, satisfaction, make love, hymen, orgasm, penetration, love and touch. 3) Scanning and searching sex related words in Persian dictionary, and developing a list of sex words was the third step of this stage which was done by two psychologists. 463 sex- related words were identified and listed such as sexual intercourse, hug, marriage, sperm, lust, orgasm, ejaculation, semen, sexual position, virgin, bed, prostitute, rape, love and attraction. 4) After deleting of repetitions, the remained words were rated in 1-5 Likert scale from the most to the least arousing by four assessors separately (two psychiatrists and two psychologists) and words with more than 3 score were selected that were finally 80 words. Then, eighty words were listed

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and ranked by four assessors in a 1-5 Likert scale. Each word that was got score 4 and 5 by at least three assessors was considered as a sexual word. Finally, a list of 15 sexual words was developed.

2.1.2 The Second Stage

The aim of this stage was finding and selecting neutral words. In this case, other Stroop studies such as Stroop test in sex offenders, in anxiety disorders and also in addiction were studied and their neutral words collected. Those words that were matched with the selected sex words in terms of the number of syllables in Persian language (Table 1) were considered as relevant to our study. Some sexual and neutral words have been presented as an examples (Figure 2).

Table 1. Sexual and Neutral Words

Sexual	Neutral
Intercourse	Cupboard
Satisfaction	Wrench
Orgasm	Radiator
Hip	Paper
Nude	Wood
Kiss	Cloth
Breast	Book
Sex	Wheel
Bra	Knob
Foreplay	Car
Pleasure	Glasses
Erection	Land
Condom	Chandelier
Passion	Forest
Lust	Cage
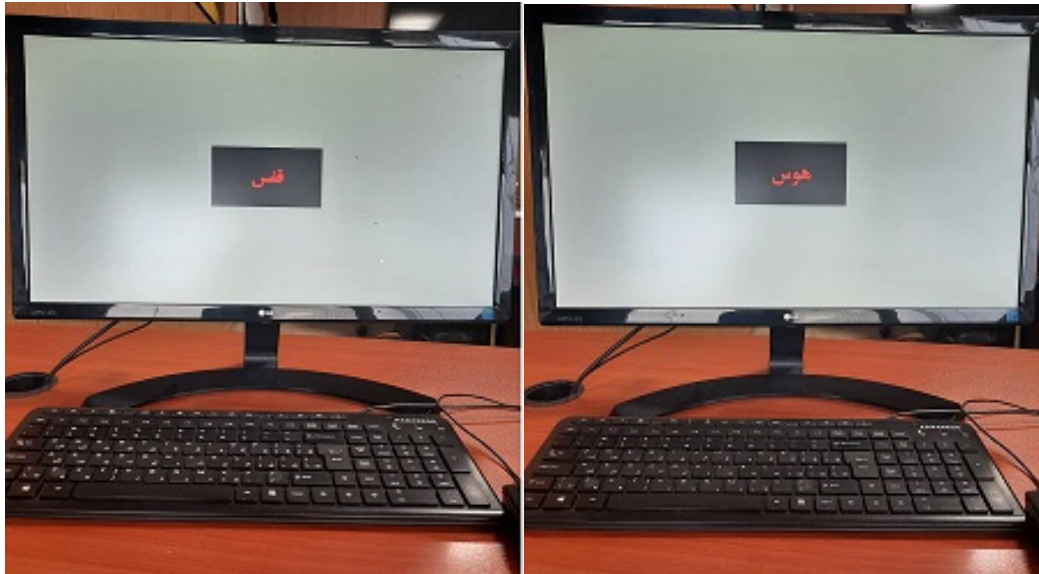
Figure 2. Right Word in English Means "Lust" and Left Word in English Means "Cage"

2.1.3 The Third Stage

The aim of this stage was designing the sexual Stroop task by the selected sexual and neutral words. At this stage, 15 sexual words and 15 neutral words were used (Each word was presented three times randomly) and time intervals (i.e., the time between two stimulants was 0.800 second). The words were showed with different colors (green and red) as appeared on the screen of a computerized version of the sexual Stroop task developed by Ravan Tajhiz Sina Company.

2.2 Measure

The procedure to assess the applicability of the current test includes three steps. In the first step, the participants were asked to choose the color of the mentioned picture. (For example, they were asked to select the color of the circle which had been shown in two colors of red and green. The participants were able to select the color by pressing the keys which were covered with the colorful labels (e.g., "Z" (for red) and "?" (for green)) on the keyboard. This step which took five seconds for all the participants had been designed for the purpose of practicing, perceiving the colors and learning about the keys. In fact, we wanted to make sure that the participants were familiar with the process of computerized test implementation.

The second and the third steps are the same except that the purpose for the second step was preparing the participants to know the main task in the third step. Some words in two red and green colors were shown and the participants were supposed to specify the color of the words regardless of their meaning. The third step was the main implementation step in which 15 sexual words and 15 neutral words were repeated three times (totally 45 sexual words and 45 neutral words) with red and green colors in random order. The participants were asked to itemize the color of the words regardless of their meaning. The representation time for each stimulant on pageant was two seconds and the time between two

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stimulants was 0.800 second. The output of software has been presented as Table 2.

Table 2. Output of the Software

Neutral correct percent

Sexual correct percent

Neutral response time (ms)

Sexual response time (ms)

Neutral trial time (s)

Sexual trial time (s)

2.3 The Second Phase

2.3.1 The Pilot Study

After designing and implementing sexual and neutral words in the sexual Stroop task, a main study was conducted. The convenience sampling was used for the study and one of the members of our team was available for all participants to explain the questions if the participants needed. Approval for the study was obtained from the Research Ethics Committee of Tehran University of Medical Sciences.

2.3.2 Subjects

In this study, 69 participants (26 male and 43 female) (Mean age=33.10; SD = 5.33) performed the task. Participants were selected from non-clinical population that didn't have any previous history of medical and psychiatric disorder and were able to cooperate in a computer task. The criteria for inclusion was age 18 or more, and being a native speaker of Farsi. They also did not declare any substance or illegal drug dependency

2.3.3 Procedure

The study was conducted on a PC in an experimental room. Study instructions were explained for participants carefully. After recording of participants' age, gender and education in the software, participants started the sexual Stroop task. Before the starting the actual test, the participants were asked to complete the experimental part in which they instructed to press the appropriate key corresponding to the font color of 7 presented items. The words in two red and green colors were presented and asked the participants to notice the color of the words regardless of their meaning. After the completing the training sections as explained, the actual task was started in which 45 sexual words and 45 neutral words were shown randomly. The subjects were supposed to refer to the color without considering word's meaning as soon as possible.

3. Result

Based on detailed explanation of resources, a list of 30 words (15 sexual and 15 neutral) was developed and implemented in the Stroop task. The pilot group consisted of 26 males (Mean age=34.20, SD=4.99)

and 43 females (Mean age=32.46, SD=5.47). The obtained results in a pilot group (N=69) demonstrated that participants had longer response times for words related to sex in comparison to neutral words. The trial time (total time) spent for sexual words was statistically higher than the total time for neutral items. The results also showed the percentage of the correct neutral words were higher than correct sexual words (Table 3).

Table 3. Comparison of Sexual and Neutral Words Means

	t	df	Sig. (2-tailed)	Mean Difference
Neutral correct percent	459.812	68	0.00	98.47
Sexual correct percent	464.442	68	0.00	98.40
Neutral response time (ms)	43.33	68	0.00	552.79
Sexual response time (ms)	33.972	68	0.00	568.33
Neutral trial time (ms)	101.016	68	0.00	77.72
Sexual trial time (ms)	78.504	68	0.00	78.62

4. Discussion

The main purpose of this study was designing and developing a modified version of Stroop Test for the assessment of sexual functioning in a non-clinical sample for the first time in Iran (a modified Sexual Stroop Test in Persian Language (MSST-Persian). The obtained results in a demonstrated that participants had longer response times for words related to sex in comparison to neutral words and the trial time which was spent to sexual words was more than the total time spent for neutral items. The percentage of the correct neutral words was higher than sexual neutral words.

The results are in agreement to the results of the attentional bias captured by the Emotional Stroop Test (Cisler & Koster, 2010; Phaf & Kan, 2007). A significant trend was observed in the present study is in concordance with some researches that show cognitive processes play an important role in the perception and evaluation of sexual stimuli (Velten et al., 2019). We believe that this modified task could measure cognitive function, alike to the original one (MacLeod, 1991; Stroop, 1935). It seems that the emotional/sexual Stroop test could be a kind of measurement for the attitudes and cognitive processes in general, as well.

These findings are consistent with a research regarding attention bias and recognition of sexual images that shows cognitive attention to sexual stimuli has been reliably established with respect to the phenomenon of Sexual Content-Induced Delay (SCID), which describes a general slowing in cognitive tasks when sexual stimulus is present (Geer & Bellard, 1996). The SCID effect causes slightly longer response times in every trial where sexual stimulus is present. That is why researchers find consistently slower responses in trials with sexual content than in trials with neutral content in the modified Stroop task or parallel decision task. Also, the mean reaction time to emotion words presentation and the

accurate measurement of the answers are two of the requirements that have supported the implementation of the Stroop test by computer programs (Andersson, Westöö, Johansson, & Carlbring, 2006).

In our study participants had longer response times for words related to sex in comparison to neutral words. Additionally, the total time which was spent to sexual words was more than the trial time for neutral time. The above findings could be explained by the several overviews that suggest sexual stimuli have a high potential to attract and capture attention and this has been related to their appetitive and rewarding properties so it is widely assumed that sexual stimuli capture attention.

In consistence with our findings a recent meta-analysis showed the SCID (sexual content-induced delay) effect of a general slowing in reaction times has been observed across various studies employing sex-related stimuli (Strahler, Baranowski, Walter, Huebner, & Stark, 2019).

Moreover, various rating scales have been designed to assess different aspects of sexual behavior and function, but there are some limitations such problems related to self-report measures in general, and the paucity of culturally sensitive and valid quantitative/qualitative questionnaires which don't necessarily allow the expression of idiosyncratic appraisals. To overcome some of the shortcomings of direct measures, this measurement can be very helpful suggestion (Grover & Shouan, 2020; Velten et al., 2019). We strongly believe that with further validation of this task the clinicians and researchers may equip themselves with a measure appropriate for the purpose of any screening sexual functioning—even probably for diagnostic purposes.

Theoretically, the executive function of attention is responsible for prioritizing particular aspects of the stimulus in the task (Posner & Rothbart, 2007b; Posner, Rothbart, & Ghassemzadeh, 2019). On the other hand, for the purpose of managing energy to focus on an aspect of the stimulus and disregarding the other aspects, a mechanism called inhibition happens in the brain, leading to an increase in the reaction time.

The authors anticipate that in the clinical groups such as patients with sexual dysfunction the time necessary to detect and identify the color of words with sexual themes would be greater than neutral words in comparison with nonclinical groups. This hypothesis could be consistent with some results indicating that participants with poor sexual functioning would show an attention bias toward sexual words (Amir, Beard, Burns, & Bomyea, 2009).

5. Limitation

The limitations of this study were a small sample size. Additionally, in this study all sexual words were obtained from non-clinical group who did not suffer from sexual disorder. Therefore, it seems that an assessment of words conducted by a group of the patients could be helpful. Another limitation of this study is insufficient psychometric indicators.

6. Conclusion

This preliminary study presented a new of emotional Stoop test and introduces its application in a small study sample. We believe that using this test allows multiple possibilities for further research. The development and elaboration of such a task can help us in screening individuals with sexual concerns and probably in evaluating outcome of the treatment in patients with sexual problems.

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