Symptom Validity Testing and Its Underlying Psychophysiological Response Pattern: A Preliminary Study

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Abstract

Very little is known about the autonomic psychophysiological responses while individuals are executing a Symptom Validity Test. Therefore, the aim of this study is to analyze the peripheral psychophysiological correlates (electrodermal conductance and heart rate) during the performance of the Victoria Symptom Validity Test (VSVT). The sample of this study was composed of 30 participants who underwent the VSVT under two conditions: Exaggeration of cognitive deficits (ECD) and normal effort. Our results showed differences on skin conductance between correct answers and errors limited to the decision-making phase of the ECD condition. Those differences found in the maximum conductance value when participants decide to simulate their deficits could be related to emotional activation. No differences were found on the variable heart rate between the two conditions of the study. Implications of these results are discussed.

Keywords: Malingering; Victoria Symptom Validity Test; Poor effort; Psychophysiology; Autonomous response

Introduction

Forensic neuropsychology has experienced an enormous growth during the last few decades (Bigler, 2006; Sweet, Peck, Abramowitz, & Etzweiler, 2002), the exaggeration of cognitive deficits (ECD) being the most studied topic (Sweet et al., 2002). This prolific research is due both to the enormous economical consequences related to nondetected poor effort cases (Gouvier, Lees-Haley, & Hammer, 2003) and to the high prevalence (30%–40%) of exaggerated deficits reported (Larrabee, 2003; Mittenberg, Aguilí-Puentes, Patton, Canyock, & Heilbroner, 2002).

Symptom Validity Testing (SVT) is the most widely studied method to detect feigned cognitive impairments (Gervais, Rohling, Green, & Ford, 2004; for a review, see Bianchini, Mathias, & Greeve, 2001) and has shown high sensitivity levels (Slick, Sherman, & Iverson, 1999; Willison & Tombaugh, 2006). According to the National Academy of Neuropsychology (Bush et al., 2005) and the American Academy of Clinical Neuropsychology (Heilbroner et al., 2009), the use of SVT measures is an essential part of a neuropsychological evaluation.

One of the tests that follow the SVT procedure is the Victoria Symptom Validity Test (VSVT; Slick, Hopp, Strauss, & Thompson, 1997). This computer-administered test is not affected by variables such as age, sex, or education, and its performance is not impaired in patients with documented brain damage (Macciocchi, Seel, Alderson, & Godsall, 2006). Also, VSVT is insensitive to diverse neuropsychological and psychiatric disorders, such as anterograde amnesia and severe memory problems (Slick et al., 2003), epilepsy (Grote et al., 2000), and acute traumatic brain injury (Macciocchi et al., 2006). In contrast, the VSVT is sensitive to litigation status (Grote et al., 2000; Loring, Larrabee, Lee, & Meadow, 2007; Slick, Hopp, Strauss, Hunter, & Pinch, 1994; Slick, Hopp, Strauss, & Spellacy, 1996) and detects high percentages of analog malingerers.
Test–retest reliability after 1 month has proven to be good (Slick et al., 1999), as well as the discriminative validity (Doss, Chelune, & Naugle, 1999; Grote et al., 2000). In sum, this test is considered to have a good capacity for detecting ECD.

Despite the adequate classification rates that are frequently reported when using SVT measures, it is important to consider that both the specificity and especially the sensitivity of tests designed to detect exaggerated cognitive deficits are far from being perfect (Bianchini et al., 2001). Thus, opting for a multimethodological strategy is highly recommended (Bush et al., 2005).

A very interesting and potentially useful proposal combines neuropsychological procedures and polygraphic psychophysiological techniques. There is an extensive literature on the questionable validity of the polygraphic measures in detecting deception (see reviews by Grubin and Madsen, 2005; Iacono, 2000). Nevertheless, combining psychophysiological and neuropsychological measures seems to improve detection. Specifically, forced-choice tests and P300 were combined to detect the exaggeration of deficits. Studies showed that even when individuals pretend not to recognize the target, the P300 is greater in the presence of an old item (match) than in the presence of new (or mismatched) items (Ellwagner, Tenhula, Rosenfeld, & Sweet, 1999; Rosenfeld et al., 1999; Tardiff, Barry, Fox, & Johnstone, 2000; van Hooff, Sargeant, Foster, & Schmand, 2009). Also, differences were found in the evoked potentials of control and simulated malingering conditions, so honest and deceptive responding could imply different cognitive processes (Rosenfeld et al., 1999; Tardiff, Barry, & Johnstone, 2002; Tardiff et al., 2000). For example, Tardiff and colleagues (2002) found that the old–new item effect appeared earlier and broadly distributed across the scalp under the simulated malingering condition compared with the control condition, in which this positivity is restricted to frontal areas. The authors suggest that this could reflect different processes related to the inhibition of the correct responses and planning to maintain a mental tally of previous responses to present a believable deficit under the simulated malingering condition.

Regarding autonomous responses, the accuracy of the Concealed Information Test to detect feigned memory amnesia was increased by considering the scores on an SVT (Meijer, Smulders, Johnston, & Merckelbach, 2007). Nevertheless, the autonomic responses underlying the execution of SVT have never been explored. Thus, the present research aims to study the peripheral psychophysiological response pattern of participants that are instructed to simulate a cognitive deficit during the execution of a forced-choice test. Particularly, we want to focus on the heart rate and skin conductance when participants decide to respond incorrectly to the items of the VSVT. Our hypothesis is that autonomic psychophysiological responses will be different when the individuals make their best effort compared with when they are faking a cognitive deficit during the execution of the VSVT. If this hypothesis is verified, this could be a very first step to establish the potential usefulness of autonomous responses to detect the ECD in the clinical setting.

**Methodology**

**Participants**

Thirty Psychology students (15 men and 15 women), all of them Hispanic, participated in this study. Exclusion criteria included any history of brain injury or other neurological disorder, psychopathological disorders, and drug use (more than casual alcohol use). Due to their lack of involvement in performing the experiment, 3 participants were excluded from the study and data from 27 subjects were finally considered. These participants had a mean age of 20.92 years ($SD = 3.08$; range 17–25), and a mean of 13.92 years of formal education ($SD = 2.35$; range 11–16).

This research was approved by the ethic committee from the Hospital Universitario Virgen de las Nieves of Granada (Spain), and informed consent was obtained from all participants.

**Instruments**

**Victoria Symptom Validity Test.** The VSVT (Slick et al., 1997) is a computerized test in which three blocks of 16 numbers each are presented. For each item, the subject must memorize a five-digit number that appears on the screen. Then, there is a retention interval followed by the presentation of two stimuli: A distracter and the target. The subject must indicate as quickly as possible the number s/he has seen previously.

**Polygraph:** The polygraph used was a PowerLab 800 with a three channel Cybertec Biosig preamplifier. Electrodermal conductance was registered by the Conductance PGR preamplifier and the heart rate with the Frequency CFR. To register the electrodermal activity, two standard-sized In Vivo Metrics electrodes were fixed to the skin with two-sided adhesive disks and
electrolyte gel (salinic hypoconductor gel Johnson and Johnson’s K-Y Jelly, with a concentration of sodium chloride of around 0.29 and 100 g of water). To register the pulse, a photoelectric transducer was used.

**Computerized system:** The computerized registering was carried out with a digital analog card. The card was connected to a PC-Pentium computer that controlled the polygraph. The program used to record the variables was Chart v3.4.2. for Windows. For the analysis of the variables, we used Chart v5 for Windows.

**Procedure**

Participants performed the VSVT under two conditions: ECD (in which participants followed the instructions of simulating cognitive deficits) and normal effort (NE) condition (participants were asked to respond the VSVT to the best of their ability). In this second performance of the test, the participants only completed the first block of trials because these items are enough to obtain their psychophysiological response when performing their best in the task.

Participants were recruited based on their voluntary participation. We followed the recommendations proposed by Rogers (1997) for the instructions (comprehensibility, specificity, contextuality, relevance, motivation, and believability), preparation of the participants, coaching, and incentives (magnitude, type, probability, and negative incentives), and the debriefing in order to maximize the generalizability of the results. The proposed scenario involved a motor vehicle accident caused by another driver, and participants were instructed to simulate cognitive deficits due to mild-traumatic brain injury as a consequence of the accident. We took into account imaginary (monetary reward vs. going to jail) and real incentives, both positive (extra academic credits and 60 euros for participating in the experiment) and negative (social embarrassment following public listing of the names of the worst participants). The instructions indicated that deception had to be believable enough to avoid detection, and mentioned some of the most common symptoms after a motor vehicle accident (i.e., headaches, blurred vision, memory and concentration problems, etc.) as well as some specific methods used by effort tests (i.e., “poor effort will be detected if you fail more easy than difficult items”) (see Appendix 1 for the verbatim instructions provided to participants). Also, instructions about the placing of the polygraph were provided (electrolytic gel, adhesives, electrodes, etc.).

Participants were encouraged to read the instructions thoroughly and carefully. Thus, no time limit was imposed for reading and understanding the instructions or for designing a strategy to follow during the evaluation. When the participants decided they were ready, they were brought to the experimental room, where the electrodes were placed, and the psychophysiological recordings were verified to ensure that data were being gathered accurately. Then, the VSVT was administered on a laptop computer (Acer brand, TravelMate 291LMI model). Every time the participants selected a response, the mouse sent a 5 V signal that was registered in channel number 3 of the polygraph.

After the assessment, the participants completed a debriefing (see Appendix 2) to make sure they had properly understood the instructions and had performed the test accordingly. The involvement of three students was unsatisfactory, as they admitted they had “never” or “hardly ever” followed the instructions during the evaluation. Therefore, these three subjects were excluded from the study.

The duration of the whole process (instructions, evaluation, and later questionnaire) was approximately 1 h.

**Measures**

**Victoria Symptom Validity Test.**

1. Number of correct answers in the easy items,
2. number of correct answers in the difficult items, and
3. total number of correct answers (correct answers in all easy and difficult items).

**Electrodermal conductance:** In order to measure electrodermal conductance, a small continuous external current and constant voltage is applied through two electrodes located in the hypothenar prominence of the nondominant hand (a zone in the palm of the hand where there is sweating activity of the eccrine glands) and expressed in microSiemens (µS). The sampling was 1000 samples/s. The variable used for the conductance analysis was the mean of the maximum value registered in two periods:

1. Phase prior to the response: From the appearance of the response alternatives until the participant responds. This period corresponds to the subject’s reaction time (RT).
2. Phase subsequent to the response: From the moment the participant responds until the next stimulus appears. This period is set by the test itself at 2 s. Given that these two periods did not have the same duration, the mean of the
maximum value of the conductance was used as the dependent variable (DV), which is independent from the duration of the analysis period.

**Heart rate**: The heart rate was registered with a photoelectric transducer placed on the distal phalange of the index finger of the nondominant hand. The sampling rate was 1000 samples/s. The intervals selected for analysis were the same as those for the conductance (prior and subsequent periods to the individuals’ response). The variable used for heart rate analysis was the average rate (beats per minute, bpm) of the cycles from the selection.

In order to facilitate the understanding of the intervals selected for the variable analysis, Fig. 1 shows a complete trial of the VSVT, with the different intervals we considered for the analysis (Fig. 1).

### Results

**Behavioral Analysis of the Participants’ Responses in the VSVT**

In order to determine whether participants were truly faking under the ECD condition, we first examined the scores obtained in the different variables from the VSVT (easy items: mean = 21.03, SD = 4.08; difficult items: mean = 10.37, SD = 5.14; total items: mean = 31.40, SD = 7.32; RT easy items: mean = 3.03, SD = 1.40; RT difficult items: mean = 4.63, SD = 2.52). The means obtained were under the cut-off point indicative of insufficient effort, which is congruent with the instructions provided. Specifically, the mean of correctly answered difficult items, which is considered the most reliable index of this test (Strauss et al., 2000, 2002) fell within the range considered “questionable” according to the manual, with 23 of the 27 participants (85.18%) classified out of the valid range. The mean of RT for both the easy and the difficult items fell within the “invalid” range. Furthermore, considering a performance inferior to 90% on the total number of correct answers in the test as the cut-off point (Grote et al., 2000; Inman et al., 1998; Macciooci et al., 2006), 96.3% of the sample (26 of the 27 participants) failed the VSVT under the ECD condition.

To determine whether the participants faked impairment in the ECD condition and not in the NE condition, we examined whether there were differences between the test variables in the NE condition (in which only the first block of the test was administered) and the first block of the test in the ECD condition. For this purpose, we performed three ANOVAs with a repeated-measures factor (ECD condition and NE condition), with the DV being the number of difficult items/easy items/total items correct (Table 1).

The results showed that there were statistically significant differences between the NE and ECD conditions for all the variables studied: Easy items $F(1,26) = 11.60, p < .002$; difficult items $F(1,26) = 58.06, p < .001$; and total items $F(1,26) = 68.25, p < .001$.

### Table 1. ANOVAs between the ECD and NE conditions for the different variables in the first block of the VSVT

<table>
<thead>
<tr>
<th></th>
<th>ECD Condition Mean (SD)</th>
<th>NE condition Mean (SD)</th>
<th>$F$-value</th>
<th>$p$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy items</td>
<td>7.03 (1.53)</td>
<td>7.96 (0.19)</td>
<td>11.60</td>
<td>.002</td>
</tr>
<tr>
<td>Difficult items</td>
<td>3.51 (2.17)</td>
<td>7.25 (1.40)</td>
<td>58.06</td>
<td>.000</td>
</tr>
<tr>
<td>Total items</td>
<td>10.55 (2.90)</td>
<td>15.22 (1.52)</td>
<td>68.25</td>
<td>.000</td>
</tr>
</tbody>
</table>

**Notes**: ANOVA = analysis of variance; ECD = exaggeration of cognitive deficits; NE = normal effort; VSVT = Victoria Symptom Validity Test; SD = standard deviation.

Fig. 1. Example of a complete trial of the VSVT. Intervals analyzed in this study are in bold.
Analysis of the RTs of the Participants on the VSVT

In order to find out whether there were differences in the RTs of the individuals when presented with the items in the NE condition, the correctly answered items in the ECD condition, and the items they decided to miss (errors in the ECD condition), a repeated-measures analysis with one factor was performed. The results showed that there were statistically significant differences between the three conditions—\( F(2,54) = 42.50, p = .000 \). Also, a posteriori analyses indicated that the participants in the NE condition responded more quickly (mean = 1.47; SD = 0.52). This RT was significantly lower than the mean RT for correct responses in the ECD condition (mean = 3.51; SD = 1.54), which was significantly lower than the RT for incorrect responses in the ECD condition (mean = 4.61; SD = 2.50).

Analysis of the Psychophysiological Responses of the Participants While Taking the VSVT

We examined the psychophysiological responses of the participants during the performance of the VSVT. For this purpose, we made a comparison of the psychophysiological responses (electrodermal conductance and heart rate) for the correct answers and errors in the ECD condition and for the trials in the NE condition. In order to get a better comprehension of the psychophysiological response, we analyzed the electrodermal and heart variables before and after the participants’ responses.

Phase prior to the response. We performed a repeated-measures ANOVA (correct answers-ECD vs. errors-ECD vs. NE responses) of the electrodermal conductance and the participants’ heart rate before giving the response (prior phase). The results showed statistically significant differences for the three conditions during the RT interval on the maximum value of the electrodermal conductance variable—\( F(2,54) = 13.43, p < .000 \) (Table 2 and Fig. 2), but not on the heart rate variable (bpm)—\( F(2,52) = 1.21, p = .289 \) (Table 2).

Phase posterior to the response. In order to verify whether these differences were related to the decision to deceive, the same analysis was performed after the participant’s response (subsequent phase). The results showed that there were no statistically significant differences between correct answers, errors, and NE responses on either of the two variables: Maximum value of conductance and heart rate (Table 2).

Intentionality of the Errors in the ECD Condition

Finally, in order to examine the intentionality of the errors in the ECD condition, both conductance and RT were analyzed making a comparison, first, of the correct answers and the errors in the NE condition and, second, of the errors in the ECD condition and the errors in the NE condition. Given that the participants were asked to do the task to the best of their ability in the NE condition and that the test is very simple, only 9 of the 27 participants made at least one error during this condition. Therefore, the variances of the two conditions were not equal (the Levine test), and nonparametric analyses were performed using the Wilcoxon statistic.

The first step was to find out whether there were differences in these nine participants on the maximum conductance and the RT between the correct answers and the errors in the NE condition (as was shown to occur in the ECD condition). For this purpose, two nonparametric tests were performed for the related samples: Maximum conductance obtained on the correct answers and on the errors in the NE condition; and the RT obtained on the correct answers and on the errors in the NE condition. In order to assess whether these differences were related to the decision to deceive, the same analysis was performed after the participant’s response (subsequent phase). The results showed that there were no statistically significant differences between correct answers, errors, and NE responses on either of the two variables: Maximum value of conductance and heart rate (Table 2).

Table 2. Means, standard deviations, and a posteriori analyses of the psychophysiological variables for the correct responses, incorrect responses, and normal effort responses measured on the phases prior and posterior to the subjects’ responses

<table>
<thead>
<tr>
<th>Interval to the response</th>
<th>Variable</th>
<th>Correct answers (mean [SD])</th>
<th>Errors (mean [SD])</th>
<th>Normal effort responses (mean [SD])</th>
<th>( F )-value</th>
<th>( p )-value</th>
<th>A posteriori analyses (Bonferroni)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase prior to the response</td>
<td>Maximum conductance (( \mu \text{S} ))</td>
<td>0.1890 (0.13865)</td>
<td>0.2684 (0.26293)</td>
<td>0.0956 (0.05803)</td>
<td>13.43</td>
<td>.000</td>
<td>Errors &gt; correct answers &gt; normal effort responses</td>
</tr>
<tr>
<td>Phase posterior to the response</td>
<td>Heart rate (bpm)</td>
<td>76.0775 (10.22149)</td>
<td>76.4946 (9.97003)</td>
<td>75.0858 (12.37456)</td>
<td>1.21</td>
<td>.289</td>
<td></td>
</tr>
<tr>
<td>Phase posterior to the response</td>
<td>Maximum conductance (( \mu \text{S} ))</td>
<td>0.1576 (0.11772)</td>
<td>0.2090 (0.23168)</td>
<td>0.1725 (0.12281)</td>
<td>1.80</td>
<td>.181</td>
<td></td>
</tr>
<tr>
<td>Phase posterior to the response</td>
<td>Heart rate (bpm)</td>
<td>76.1431 (10.13131)</td>
<td>76.2132 (10.42190)</td>
<td>71.6051 (17.49257)</td>
<td>2.40</td>
<td>.132</td>
<td></td>
</tr>
</tbody>
</table>

Note: SD = standard deviation.
condition. The results showed that there were no statistically significant differences in the NE condition between the two types of responses: Correct answers (mean = 0.07; SD = 0.04) and errors (mean = 0.13; SD = 0.17) on the maximum value of conductance, $Z(1) = -0.652$, $p = .515$, and RT—$Z(1) = -0.770$, $p = .441$ (correct answers mean = 1.79, SD = 0.81, and errors mean = 2.15, SD = 1.23).

In order to examine the intentionality of the errors during the ECD condition, our second step was to verify whether the responses registered during the errors made in the ECD condition were different from those registered during the errors made in the NE condition. For this purpose, two nonparametric tests were performed for the two related samples: Maximum conductance for the errors in the NE condition and for the errors in the ECD condition, and RT for the errors in the NE condition and for the errors in the ECD condition. The results showed that there were no significant differences in the maximum conductance registered between the two types of errors (those of the ECD condition (mean = 0.23; SD = 0.24) and those of the NE condition (mean = 0.13; SD = 0.17)), although a tendency toward significance was observed—$Z(1) = -1.718$, $p = .086$. On the other hand, the results showed that there were statistically significant differences between the RTs of the two types of errors—$Z(1) = -2.666$, $p = .008$ (ECD condition mean = 4.63, SD = 2.43, and NE condition mean = 2.15, SD = 1.23).

**Discussion**

In this preliminary study, we explored the peripheral psychophysiological response (skin conductance and heart rate) during the performance of the VSVT under two conditions: ECD and NE. The most important finding of this study was the determination of differences on the electrodermal conductance during the performance of the VSVT when the individuals fake compared with when they do their best. The results showed an increase in the skin conductance when participants ECD in comparison to responses in the NE condition. Specifically, skin conductance registered during erroneous responses was found to be significantly higher than conductance obtained during correct responses in the ECD condition, but not in the NE condition. Furthermore, those differences were restricted to the decision-making phase and disappeared after the execution of the response.

In the first place, the results showed that the participants simulated cognitive deficits in the ECD condition, but not in the NE condition, so instructions provided were effective.

On the ECD condition, more errors were committed and participants had longer RTs in responding to these items compared with the NE condition. Errors are very scarce when participants make an effort to perform the VSVT (Grote et al., 2000; Macciocchi et al., 2006; Slick et al., 2003). According to this, the average number of errors in our sample was less than that in the NE condition. RT in the NE condition was lower than that for correct responses in the ECD condition, which was lower than the RT for incorrect responses in the ECD condition. Also, RT for errors was greater in the ECD condition than in the NE condition. Therefore, it could be hypothesized that errors in the NE condition are mistakes in choosing an...
alternative due to brief RTs, whereas in the ECD condition, these errors were intentional or motivational (i.e., the participant knew the correct answer and intentionally chose the incorrect one), not due to mistakes.

With regard to the psychophysiological response, we found statistically significant differences in the maximum value of the skin conductance when comparing correct answers, errors, and NE responses. Dermal conductance is a Sympathetic Nervous System measure that provides us with an index of activation of the organism related to arousal, which is one of the two basic dimensions for measuring emotions (Amrhein, Mühlberger, & Wiedemann, 2004; Bernat, Patrick, Benning, & Tellegen, 2006; Lang, Greenwald, Bradley, & Hamm, 1993). Thus, the activation registered when participants decide to intentionally fail items could reflect an emotional activation linked to this decision. The importance of emotional involvement in decision-making measured through electrodermal conductance is strongly defended by some authors (Bechara, Damasio, & Damasio, 2000). This hypothesis is supported by the fact that differences in the activation found between correct answers and errors are restricted to the decision-making period in the ECD condition, since these differences are not observed in the NE condition. Moreover, differences between correct answers and errors regarding electrodermal conductance appear only when the participants produce deceptive responses (ECD condition) and not when the participants make a mistake (NE condition). Further support for our proposal comes from the neuroimaging studies in which activation of areas related to decision-making and motivational response regulation has been found during the feigning of cognitive impairments when performing a forced-choice task (Browndyke et al., 2008; Lee et al., 2005).

Nevertheless, we did not find statistical differences in conductance between errors in the ECE and NE conditions (although a tendency toward significance can be observed), but this was probably due to the small number of errors found in the NE condition. Also, correct responses showed higher conductance in the ECD than in the NE condition. This could reflect an emotional activation during the entire period in which participants are exaggerating their deficits and this activation would be higher and statistically different in the specific items in which participants decide to deceive.

Finally, no differences were found between correct answers, errors, and NE responses in the heart rate variable, in either the phase prior or subsequent to the response. This lack of differences may be due to the fact that the intervals analyzed in this study are limited to only a few seconds and may not be long enough to appreciate variations in the heart rate, as the DVs are out of synchrony. Also, the lack of differences may be an artifact of small sample size, given that mean heart rates appeared to be lower in the post-response phase (but not the phase prior to the response) in the NE condition versus the ECD condition. This would suggest that heart rate always increases with readiness to provide a response, but that after a response, heart rate decreases in the NE condition, whereas participants exaggerating their deficits continue to be “anxious” or in a “state of alert” awaiting the next item, hence the continuously elevated heart rate. Thus, heart rate requires additional examination with a larger sample size.

When interpreting the results of the VSVT we can base our decision about the validity of the symptoms on the “below-chance” performance criterion, a method that has shown excellent specificity but poor sensitivity (Bender & Rogers, 2004; Gervais et al., 2004; Holmquist & Wanlass, 2002; Inman et al., 1998; Slick et al., 1994; Tan et al., 2002). In order to increase that sensitivity various authors have proposed cut-off points (i.e., Grote et al., 2000; Macciochi et al., 2006), generally leading to a decrease in specificity. In the future, psychophysiological measures could help to increase specificity while maintaining sensitivity. Even if increased emotional arousal can be easily faked, we consider it really difficult to control those increments and limit them to certain periods lasting only a few seconds, while controlling the level of errors and correct responses on a symptom validity measure. In order to explore the potential usefulness of SVT combined with psychophysiological measures, future studies should test the sensitivity, specificity, positive and negative predictive power, reliability, and validity of using such a method. This may demonstrate that these results are better than those obtained with the SVT alone. Given the preliminary nature of our study, and to its limitations that are discussed in detail below, we did not consider relevant and adequate to analyze such measures in this study. Nevertheless, confidence intervals at 95% for the maximum conductance value in the phase prior to the participants’ response (correct answers = 10.46–23.59; errors = 14.39–39.04; NE responses = 5.38–12.48) show promising results regarding the potential sensitivity of conductance, as there was no overlap between NE and errors committed under instructions of ECD in this measure.

Among the main limitations of our study, the small number of participants stands out. Future research should include replicating our study with a larger sample and should study more variables of the psychophysiological response. More importantly, this study was carried out in students instructed to fake a cognitive deficit and not with real patients suspected of poor effort. In these cases, the activation responses would probably be different from those found in this study. In this sense, it is necessary to study people suspected of malingering in order to find out the real usefulness of the psychophysiological response measures registered during the performance of specific neuropsychological tests in the detection of exaggerated cognitive deficits. That said, it is noteworthy that most studies in the field of insufficient effort or exaggeration of deficits have used students as analog malingerers (Brennan & Gouvier, 2006; Haines & Norris, 2001), and those types of studies
continue to be a very common practice (i.e., Demakis, 2004; Swihart, Harris, & Hatcher, 2008). Research shows that analog malingering experiments have provided valuable information to detect ECD in real situations (Brenan & Gouvier, 2006) and have allowed for the development of new measures (Erdal, 2004), so an analog design could be the most appropriate for a preliminary study.

Also, using two instruction sets for the same individuals instead of two different groups can be considered a flaw in the study, because there may be some unpredictable carryover effect from the ECD condition to the NE condition.

Finally, familiarity with the task and with the items may systematically affect performance in the NE condition, confounding the interpretation of the data. Specifically, higher skin conductance in the ECD condition could be considered as an artifact created by some increased anxiety due to the novelty or unfamiliarity with the task because NE and ECD conditions were not counterbalanced. Nonetheless, this effect could not explain the differences found on skin conductance between correct and failed answers in the ECD condition. Moreover, it is important to consider that the VSVT lasts approximately 20 min and is composed of 48 items. Therefore, the effects of novelty or unfamiliarity are likely to be restricted to the first trial and minutes of the task, and thus they could not be strong enough to substantially and significantly change the overall results.

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Conflict of Interest

None declared.

Appendix 1: Instructions given to participants

Imagine you had a motor vehicle accident caused by another driver. Try to perform the following assessment to convince the examiner you sustained a mild traumatic brain injury as a consequence of that accident. To make it convincingly, you should try to make problems as credible as you can. People who sustained a mild traumatic brain injury generally experiment a “post-conmotional syndrome”: Headache, blurred vision, fatigue, dizziness, anxiety, irritability, and concentration and memory problems. In most cases, these symptoms do not last longer than 1 month, but some people have symptoms 6 months or 1 year after the accident. These people have problems to concentrate, remember things, and learn new material. Also, their thinking speed is slower than it used to be.

Your role consists of performing the tests so that you will convince the examiner that you have a chronic brain injury due to the accident. You should fake your problems as severely as you can without making them too obvious to the examiner. This means your brain damage should be credible. Some “over-exaggerated” symptoms, such as remembering nothing at all, are easily detected. If the examiner detects you are faking your symptoms, you may lose the trial and even go to jail. On the other hand, if you are able to deceive the examiner, you will win the trial and you will receive a generous compensation.

Note: Some tests have methods to detect people who are malingering. Some of these methods are:

1. to detect if you fail more easy than difficult items
2. to detect how many time you need to respond each item and compare it with the difficulty of the item
3. detect if you perform particular errors, especially on very easy items
4. detect if you errors coincide with those made by most people
5. detect if you fail more items than expected by chance

Remember that if you perform your role successfully you will obtain double credits and 60 Euros for your participation in this experiment. Also, the names of the worst participant (the one whose symptoms are less credible) will be publicly listed in office number 386.
Appendix 2: Debriefing

- What were you asked to do in this experiment? What were the instructions?

- What did these instructions mean to you?

- What percentage of time did you carefully followed the instructions?

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<tbody>
<tr>
<td>1= all the time (100%)</td>
<td>2= almost all the time (75%)</td>
<td>3= sometimes (50%)</td>
<td>4= almost never (25%)</td>
<td>5= never (0%)</td>
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- Do you believe you have deceived the examiner?

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<td>1= I am sure I have deceive the examiner</td>
<td>2= I am almost sure I have deceived the examiner</td>
<td>3= I do not know</td>
<td>4= I do not think I have deceived the examiner</td>
<td>5= I am sure I have not deceived the examiner</td>
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- What did you do to simulate your cognitive deficits?

References


