Psychophysiological Imagery Assessment in Chronic Posttraumatic Stress Disorder[1]

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Abstract: Several research studies have established in the past that patients with posttraumatic stress disorder as a result of various traumatic events show a marked increase in peripheral physiological responsiveness during personalized trauma-related imagery (Orr & Roth, 2000). The present study builds on this topic by investigating responses to unpleasant (trauma-related) and neutral events within an imagery experiment in aged Romanian victims of political imprisonment, decades afterwards. Peripheral physiological indicators are examined using a Vitaport II ambulatory digital recorder – heart rate (HR) and skin conductance level (SCL) – as well as self-perceived arousal within three groups – a grup of former political detainees with chronic PTSD (N = 13), a group of former prisoners who never had such a diagnosis (N = 14), and a control group (N = 9). PTSD patients exhibited a distinctively increased HR reaction during imagery of traumatic experiences than during imagery of neutral contents. From the comparison between HR and SCL responses to traumatic and to neutral thought contents in patients without PTSD and in controls no such differences were identified. The HR response change to imagery of traumatic memories classifies individuals with highest severity of PTSD. Additionally, statistical analysis of the heart rate and skin conductance responses between persons with and without PTSD it showed that chronic PTSD patients exhibited a general heightened arousal state in that they showed a significant higher HR and SCL response than the persons who never had a PTSD diagnosis during all three personal imagery sessions. This suggests that long-term PTSD may lead over decades to an increased baseline physiological activity, generally higher physiological responsivity during all kinds of imagery contents, which may be unpleasant or neutral, trauma-related or not. These findings support the idea that the typical symptom of "hyperarousal" by four-decades-chronic PTSD patients comes to physiological expression during the mental undergoing of personal experiences and is especially highly expressed during the imagery of personal traumatic experiences.
***Key Words*:** chronic PTSD; imaginative stimuli; physiologic indicators, former political prisoners.

Introduction

According to the psychophysiological concept, PTSD has been seen as an outcome of the higher autonomic reactivity to negative stimuli. A defining feature of PTSD is the physiological reactivity elicited by exposure to cues that symbolize

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or resemble an aspect of the traumatic event (DSM-IV). Heightened responsivity during personalized trauma-related imagery has been demonstrated in individuals with PTSD for a variety of traumatic events and psychophysiological measures (Orr & Roth, 2000). This observation validates respective self-reports. Findings of experiments using personalized trauma-related imagery and exposure to trauma-related stimuli have revealed a higher reactivity of PTSD patients as compared to traumatized subjects without PTSD and to controls regarding the following measures: HR increase, SC response, blood pressure increase, muscular activity and P300 ERPs. Such results have been similarly obtained with combat veterans (Pitman et al., 1987; Orr et al., 1993; Shalev et al., 1993), with victims of childhood sexual abuse (Orr et al., 1998), and with victims of motor vehicle accidents (Blanchard et al., 1994; Blanchard et al., 1996). A study on Vietnam veterans that used script-driven imagery and standardized audio-visual cues technique in a combined manner has also showed heightened physiological reactivity in those with PTSD as compared to those without this disorder (Keane et al., 1998). A more recent comparative analysis including several PTSD samples, 72 subjects overall (Vietnam, WWII and Korean war veterans, female victims of childhood sexual abuse) showed higher heart rate increase, SC response and frontal EMG during script-driven, trauma-related, imagery as compared to during script-driven imagery of a stressful nontraumatic event, as compared to 65 traumatized persons without PTSD (Orr & Roth, 2000).

The basis of the emotional imagery paradigm has been established by Lang and colleagues for the study of anxiety (Lang, 1979; Levin et al., 1982; Lang et al., 1983). An imaginative procedure during the reading of the personalized report of the traumatic event (script-driven imagery) during the subject is solicited to imagine a situation as if he/she was reliving the real course of events, including actions, persons and emotions present during the real situation was used. *The traumatic situation imagined is compared with another standard scene.*

There is, however, increasing evidence that 30-40% of individuals with PTSD do not exhibit this phenomenon (e.g., Prins et al., 1995). While this might be due to individual differences, current observations point to the role of severity of traumatic stress, stressor characteristics and secondary disorders and symptoms. Evidence for this assumption comes from descriptions on the subjective level but little data validate such a differentiation on a behavioral and on the physiological level. Prolonged and repeated severe traumatization such as that seen in torture survivors produces a new quality of affective, cognitive and physiological avoidance (e.g. dissociation, numbing of emotion and sensations) and an overall alteration of the affective system (DSM-IV). Such differentiation has not yet been validated on the behavioural and the physiological level. However, several studies have suggested that the lack of physiological responsiveness to trauma-related stimuli may be a result of the low severity of posttraumatic symptoms (e.g., Davis et al., 1996; Keane et al., 1998) and others have demonstrated that the peripheral reactivity depends on the comorbid disorders and symptoms, such as dissociation (e.g., Griffith et al., 1997). In PTSD patients without depression, a higher startle response to reminders has been found (e.g., Metzger et al., 2000).

The present study evaluated the physiological response patterns (heart rate and skin conductance) in addition to self-reported symptoms in thirty-six individuals who were distributed within three groups: a group of former political prisoners with chronic PTSD (N = 13), a group of former prisoners who never had such a diagnosis (N = 14), and a control group (N = 9). Physiological responses were collected during three personalized imagery sessions in each individual. The main aim of the present study is to explore the characteristics of physiological responses in aged patients with chronic PTSD a long time after traumatic exposure. Other aims are to investigate the degree to which physiological parameters correctly classify distinct clinical groups and the association between physiological responses and the severity of exposure to trauma, as well as the association between physiological responses and the severity of posttraumatic, depression, anxiety, and dissociation symptoms.

Materials and Methods

Participants

The assessments were conducted within three groups, a group of former political prisoners with chronic PTSD (N = 13, mean age 68.69 ± 5.53 years, all males), a group of former prisoners who never had such a diagnosis (N = 14, mean age 71.53 ± 5.29 years, all males), and a control group (N = 9, mean age 67.7 ± 7.71 years, all males). The participants in the first two groups were former political prisoners selected from the participants in an previous study (Bichescu et al., 2005) who were available and agreed to participate at the time of the research implementation. The control group were healthy volunteers matched to the other two groups on age and gender. The measurements were conducted at one of the research laboratories of the University of Iasi, Romania. Written informed consent was given to all participants and the study was approved by the Ethics Committee of the University of Iasi.

Clinical ratings

PTSD in former political prisoners and controls was assessed by using the PTSD section of the Composite International Diagnostic Interview (CIDI; World Health Organization, 1997). An event checklist based on the Persecution and Maltreatment Checklist (Maercker & Schutzwohl, 1997; Maercker, Beauducel, & Schutzwohl, 2000) was used for the evaluation of imprisonment and torture history in former political detainees. Several other ratings were used for the clinical assessment of former political detainees. Beck Depression Inventory (BDI; Beck, 1978; Beck & Steer, 1987) was administered for the assessment of depression symptoms and State-Trait Anxiety Inventory (STAI; Spielberger & Vagg, 1984) for anxiety. Dissociative symptoms and disorders were evaluated by means of the Structured Clinical Interview for DSM-IV Dissociative Disorders (SCID-D; Steinberg, 1994).

Table 1 presents the exposure to traumatic conditions during detainment and the clinical rating among former political detainees who participated in this study. Former political detainees were exposed to an total average of 13.4 ± 3.0 maltreatment forms during imprisonment. Among maltreatment procedures, forced standing, threats/offenses, starvation, confinement in overcrowded cells, torture witnessing, unsystematic beatings, sleep deprivation, and exposure to extreme temperatures were most commonly reported. Differences were recorded between former political detainees with PTSD and those without PTSD with regard to subjection to mistreatments during imprisonment (see Table 1).

Table 1. *Traumatic exposure and clinical ratings of former political detainees with and without PTSD*

Measure	*Political detainees with PTSD* (N = 13)		*Political detainees without PTSD* (N = 14)		*Analysis*	
	Mean	SD	Mean	SD	*t*	p
Mistreatments during prison	13.4	3.0	10.6	4.4	1.9	< .07
Clinical ratings						
CIDI-PTSD	11.3	2.6	5.6	3.0	5.2	< .001
Intrusions	3.5	1.2	2.4	1.3	2.1	< .05
Arousal	3.5	1.1	1.9	1.4	3.1	< .01
Avoidance	4.4	1.6	1.3	0.9	6.2	< .001
BDI	14.1	6.2	9.4	6.2	2.0	< .07
STAI	88.8	16.1	80.3	16.9	1.3	n.s.
SCID-D	6.2	5.1	4.4	4.3	1.0	n.s.

The mean scores on other clinical scales among former political detainees were 11.6 ± 6.6 on BDI, 84.4 ± 16.8 on STAI, and 5.2 ± 4.7 on SCID-D. PTSD former political detainees and former political detainees without PTSD did not differ significantly in these respects (see Table 1). According to the CIDI interview, all controls met Criterion A.1 (the occurrence of at least one potentially traumatic event at some time during ones' life), with physical assault, sudden death of a loved one and motor vehicle accident being most common. Nevertheless, none of the controls met the criteria for current PTSD. Also, none of the them reported a history of psychiatric disease. As expected, the correlations among scales were all positive. A high amount of significant correlations were recorded among variables (see Table 2).

Table 2. *Correlations among exposure levels and clinical ratings among former political detainees (N = 27)*

	Correlations (r)						
Measure	2	3	4	5	6	7	8
1. Mistreatments pretrial	.689**	.071	.245	.143	.093	.308	.446*
2. Mistreatments posttrial		.275	.302	.428*	.136	.085	.412
3. Intrusions			.547**	.508**	.517**	.586**	.053
4. Arousal				.505**	.601**	.388*	.033
5. Avoidance					.322	.318	.223
6. BDI						.628**	.074
7. STAI							.208
8. SCID-D							

*p<0.05, **p<0.01

Imagery Contents and Experimental Design

The experiment was conceived according to the imagery paradigm (Lang, 1979; Levin et al., 1982; Lang et al., 1983). HR and SCL have been measured during three test conditions: (1) the imagery of a neutral personal event (N1), (2) the imagery of a traumatic experience (T) and (3) the imagery of a further neutral event (N2). A neutral event was defined as a personal episode that was perceived neither as particularly pleasant nor unpleasant. An unpleasant (traumatic) event was defined as an episode that was experienced as being particularly stressful, unpleasant, and life threatening. At this point, the former political prisoners were specifically instructed to recall a traumatic event during their time in imprisonment.

Self-Assessment Manikin

Self-Assessment Manikin (SAM; Lang, Bradley, et al., 1993; Lang, Greenwald, Bradley, & Ham, 1993; Bradley & Lang, 1994) is a language-free instrument for the self-rating of the emotional valence and arousal dimensions, which has been shown to be a valid and reliable instrument for the evaluation of one’s emotional state. It consists of scales for emotional valence, arousal, and dominance. Each scale is presented as a graphic figure with nine levels for self-ratings. The levels range from 1 (very unpleasant) to 9 (very pleasant) for ratings of emotional valence and from 1 (not at all) to 9 (very strong) for ratings of emotional arousal, with 5 representing an neutral rating in all dimensions. In this study, the paper-pencil version of the SAM only for the scales of valence and arousal was used.

Procedure and physiological parameters

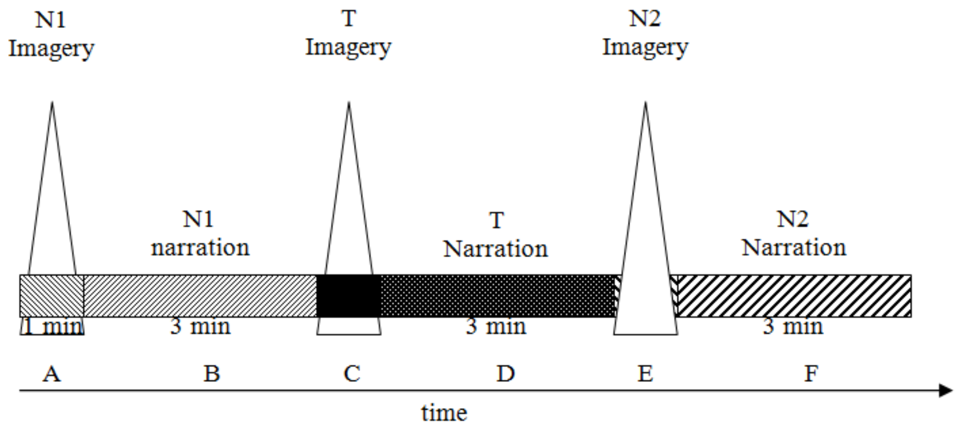
After arriving at the laboratory, participants were allowed a period of adaptation to the recording environment to ensure cooperation and to reduce possible psychological discomfort to the novel situation. Afterwards, they gave informed consent and were prepared for the physiological measurements conducted by using an ambulatory digital recorder (16-channel Vitaport 2 System, Becker Mediatec, Karlsruhe, Germany) including an amplifiers analog-to-digital converter, a microprocessor and 1 MB Memory. After informed consent, PTSD in controls was assessed by using the PTSD section of CIDI-Interwiew. Extensive clinical assessments of former political detainees have been already accomplished earlier (for details, see Bichescu et al., 2005). Participants were seated in a comfortable chair in an experimental laboratory and given a brief introduction to the procedure, followed by placement of the recording electrodes.

For the measurement of skin conductance (SC), two left palmar electrodes, one on the thenar/hypothenar eminence (active electrode) and one at the center of the palm (reference electrode) were employed. To record HR response, two electrodes were attached under the rib bent left and on the collarbone right. The control of the measurement was effectuated to assure proper functioning before the beginning of the procedure. A tape recorder was used to register the narration during the experiment.

Afterwards, the measurement procedure was employed for the physiological measurement during the recall and narration of each of the experiences. The experimental design comprised three conditions and progressed in the following manner: first neutral event (N1), traumatic event (T), and second neutral event (N2). Overall, the session consisted of 6 measurement trials. For each experience, the same procedure was used as follows: (1) standardized instructions for the autobiographic event that participants were to recall and imagine were given; (2) physiological measurement during 1 minute of experience recall was conducted; (3) participants were asked to rate their subjective feelings during the imagery session with respect to valence (pleasant/unpleasant), and arousal (arousing/neutral) (SAM Sheet); (4) standardized instructions for verbal description of the experience were given; (5) physiological measurement during 3 minutes narration of experiences was conducted. At the end of the measurement, electrodes were removed. Figure 1 offers a graphic representation of the experimental course.

As part of the instructions for recall, participants were told to silently recall the events with all the feelings and thoughts attached to them, as if the then-situation happened again. They were asked to let the experimenter know as soon as they found a suitable event. They were then instructed to relax and close their eyes and to recall and imagine this event. As part of the instructions for narration, participants were asked to provide exact descriptions of the course of the events in chronological order, as well as of the feelings, the thoughts, and the impressions that they had at that time, and to notify the experimenter when they finished their report.

Figure 1. *Graphical representation of the imagery trial used in this study: first neutral event (N1): one minute recall and three minutes narration; traumatic event (T): one minute recall and three minutes narration; second neutral event (N2): one minute recall and three minutes narration*



Data Reduction and Data Analysis

Reduction and initial processing of all artifact free data points was accomplished manually. Physiological responses during imagery and narration (i.e., heart rate and skin conductance) were averaged, within subjects and within measures, for each 1-min interval of imagery and 3-min interval of narration. Thus each subject contributed equally to subsequent analyses. Nevertheless, heart rate and skin conductance data were lost for 4 and 3 participants, respectively, due to equipment failures.

For the SAM pleasure and arousal ratings separate data analyses were performed using repeated measures analysis of variance (ANOVA) with affective category (3 levels: pleasant, neutral, unpleasant) as within subjects factor, and group (PTSD, versus no PTSD versus controls) as between factors factor.

In the present study, statistical analyses were performed only with physiological responses evoked by imagery. HR and SC data were evaluated by repeated-measures ANOVA with factors of imagery condition (3 levels: N1, T, N2) as within subjects factors and group (PTSD former political prisoners versus no PTSD former political prisoners versus healthy controls) as a between subjects factor. Further repeated-measures ANOVA were conducted for HR and SC data with imagery valence [neutral (N2) and traumatic (T)] as within subjects factors and group (PTSD former political prisoners versus no PTSD former political prisoners versus healthy controls) as a between subjects factor. Group differences for physiological responses and overall differences between responses to different imagery sessions were further evaluated by means of Student t test.

Given the matter of violation of homogeneity assumptions in repeated measures designs, the Greenhouse-Geisser (1959) (Geisser, 2003) epsilon correction was applied, where appropriate. For all analyses, a difference was considered statistically significant when the *p* value was equal or less than .05. All post-hoc comparisons were evaluated by means of Bonferroni/Dunn tests. One-group t-tests were conducted in order to test differences between responses in N1 and N2 conditions. Means and standard errors are presented.

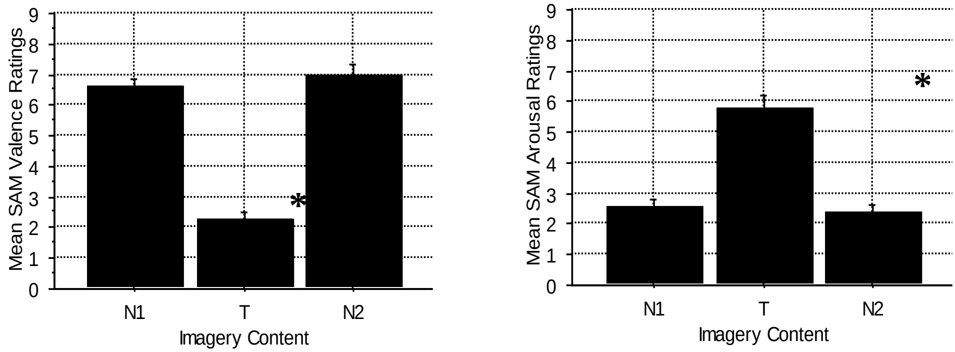
For demographic data and questionnaires, diagnostic group differences were evaluated with univariate analyses of variance (ANOVA). Pearson correlations coefficients (r) were performed among measures of traumatic exposure and clinical scales.

Discriminant analyses were used to determine the degree to which HR and SC change responses to traumatic imagery [Δ(T, N2)] differentiate between PTSD former political detainees and no PTSD subjects (controls and former political detainees without PTSD. Pearson correlation coefficients (r) were estimated and a linear regression was used to further explore the relation between physiological data and symptoms. The association between physiological parameters and clinical ratings was evaluated between heart rate and skin conductance response difference values [Δ(T, N2)] and total scores CIDI (intrusion, arousal and avoidance), STAI, BDI and SCID-D.

Results

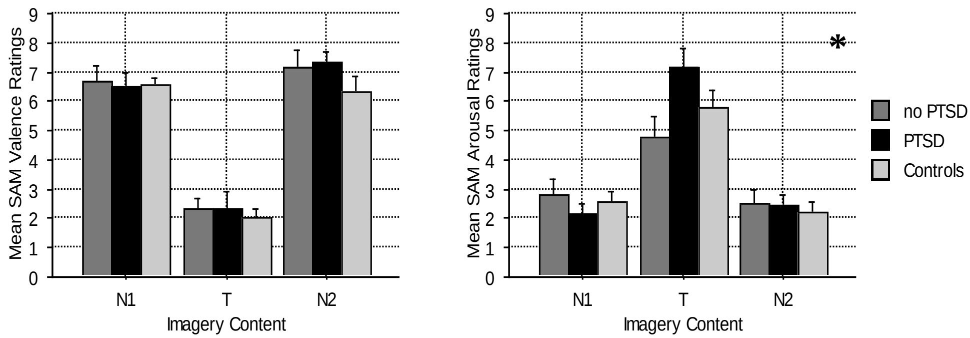
Emotional Self-Ratings (SAM). As expected, SAM valence and arousal participants' ratings significantly differed as a function of imagery content [$F(2,66) = 76.961$, $p < .001$, $\varepsilon = .97$; $F(2,66) = 35.750$, $p < .001$, $\varepsilon = .93$] with traumatic events rated as more unpleasant [mean valence ratings: 6.60 ± 1.66 (N1), 2.24 ± 1.55 (T), 7.00 ± 1.96 (N2)] and more arousing [mean arousal ratings: 2.54 ± 1.66 (N1), 5.78 ± 2.58 (T), 2.41 ± 1.44 (N2)] than the neutral ones (see Figure 2).

Figure 2. *Mean SAM ratings for valence (left) and arousal (right) and standard errors (indicated by bars) for the three imagery contents (N1, T, N2) used in the current study (N =36).*



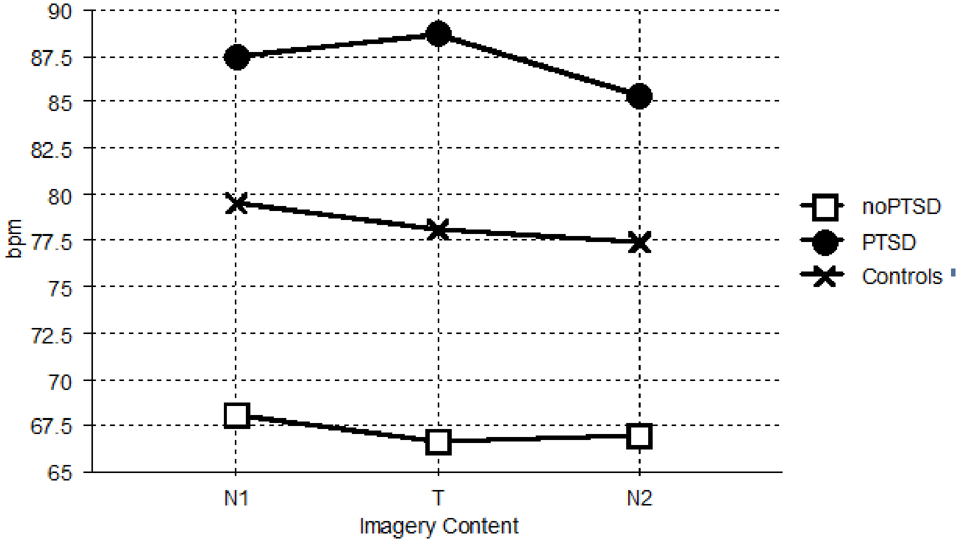
The interaction Imagery Content X Group indicated a significant effect for traumatic imagery with concern to arousal ratings [$F(4,66) = 2.647$, $p < .05$, $\varepsilon = .96$]. Former political prisoners with PTSD rated the traumatic events as more arousing [mean arousal ratings: 7.17 ± 2.17 (T)] as compared to the former political prisoners without PTSD [mean arousal ratings: 4.75 ± 2.89 (T)] and to the control subjects [mean arousal ratings: 5.78 ± 1.72 (T)] (see Figure 3). There were no significant group effects regarding valence.

Figure 3. *Mean SAM valence (left) and arousal (right) ratings and standard errors (indicated by bars) for the three imagery contents (N1, T, N 2) separately for the three groups (former political detainees without PTSD: N = 13; former political detainees with PTSD: N = 14; controls: N = 9)*



Heart Rate Responses for All Imagery Contents. The overall cardiac waveforms analysis (see Figure 4) revealed a significant main effect of the group [$F(2, 29) = 9.944$, $p < .001$] that was explained by differences between no PTSD political detainees and each of the other two groups (no PTSD-PTSD: $p < .001$; no PTSD-controls: $p < .05$). However, a trend of more increased heart rate in PTSD former detainees than in controls ($p < .07$) was also noted. The effect of the imagery content showed a trend towards significance [$F(2, 58) = 2.467$, $p = .09$, $\varepsilon = .86$] that was due to the differences between N1 and N2 ($p < .05$).

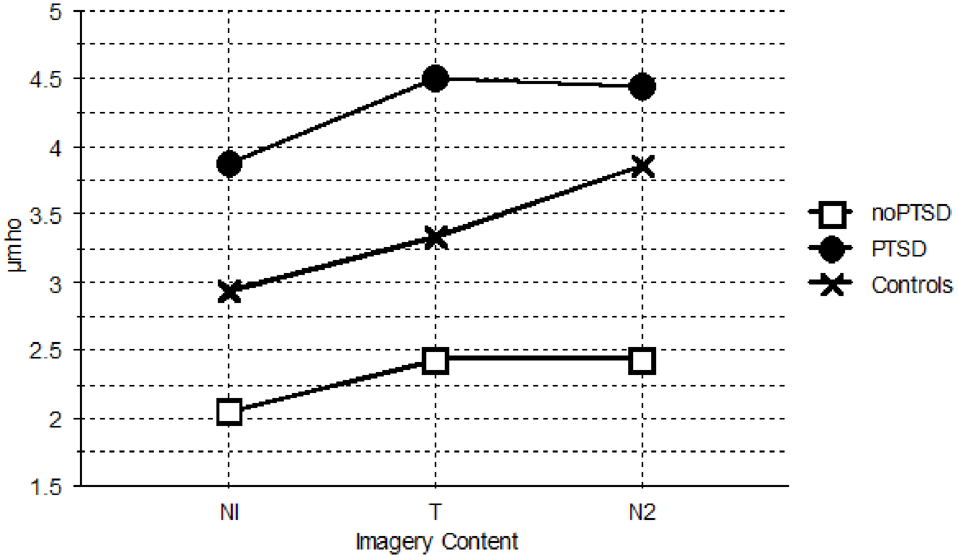
Figure 4. *Mean heart rate change [bpm] for each imagery content (neutral 1, traumatic, neutral 2) over groups.*



From the statistical comparison of the mean heart rate between former political prisoners with and without PTSD, findings show that chronic PTSD former political prisoners exhibited a general heightened arousal state in that they showed a significantly higher heart rate than the former political detainees who never had a PTSD diagnosis during all three personal imagery sessions [N1: $t(21) = 3.922$, $p < .001$; T: $t(21) = 4.756$, $p < .001$; N2: $t(21) = 3.496$, $p < .01$]. As compared to control subjects, the PTSD patients showed a significantly higher heart rate only during the imagery of traumatic events [T: $t(20) = 2.254$, $p < .05$]. By contrast, no PTSD former political detainees exhibited a significantly lower heart rate response over all imagery conditions [N1: $t(17) = -2.710$, $p < .05$; T: $t(17) = -3.281$, $p < .01$; N2: $t(17) = -2.745$, $p < .05$].

Skin Conductance Responses for All Imagery Contents. The SCL showed a similar pattern as the heart rate (see Figure 5). There was a main group effect [$F(2, 30) = 3.625$, $p < .05$] that was explained by differences between PTSD and no PTSD former political detainees ($p = .01$). The effect of imagery content was also significant ($F(2, 60) = 10.730$, $p < .01$, $\varepsilon = .60$). Post-hoc analyses demonstrated that this was due to differences between N1 condition and each of the two other imagination contents (N1-T: $p = .001$; N1-N2: $p < .001$). Former political prisoners with PTSD had a higher mean average of skin conductance level than those who never had such a diagnosis during all three experimental conditions (N1: $t(23) = 2.817$, $p < .01$; T: $t(23) = 2.721$, $p = .01$; N2: $t(23) = 2.784$, $p = .01$).

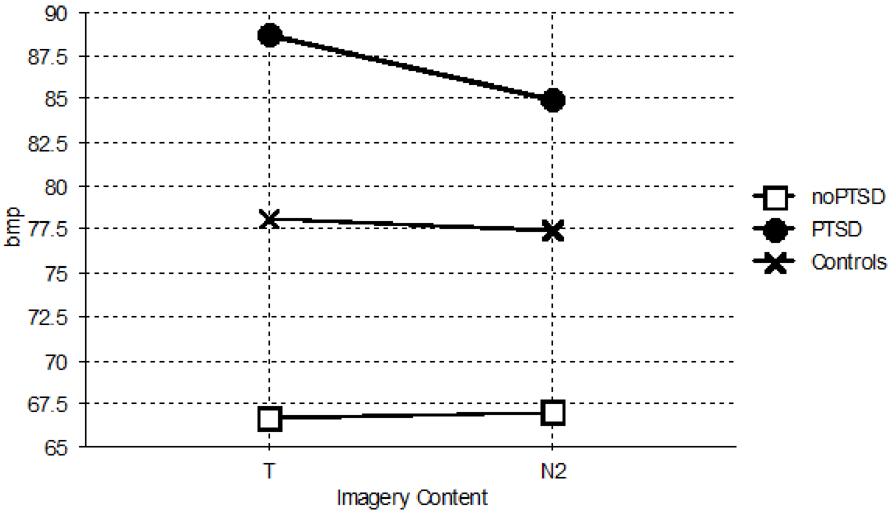
Figure 5. *Mean skin conductance change [μmho] for each imagery content (neutral 1, traumatic, neutral 2) over groups*



Heart Rate Change between T and N2 Imagery Contents. There was an overall significantly higher mean heart rate exhibited in the first neutral imagery condition N1 (79.35 ± 13.92 bpm) as compared to the N2 condition (72.21 ± 13.28 bpm) [$t(31) = 2.45$, $p < .05$]. This led us to the supposition that the high responsivity noted in N1 condition might be due to the discomfort and lack of adaptation to the recording environment at the beginning of the experiment. Additionally, PTSD patients exhibited a distinctively increased heart rate during imagery of traumatic experiences than during imagery of neutral contents (T-N2: $t(11) = 2.102$, $p < .05$). From the comparison between responses to traumatic and to neutral thought contents in former political prisoners without PTSD and controls no such differences were identified. Thus, we considered that the comparison between physiological responses to T and N2 imagery contents would be more appropriate for the examination of the heart response change during traumatic imagery.

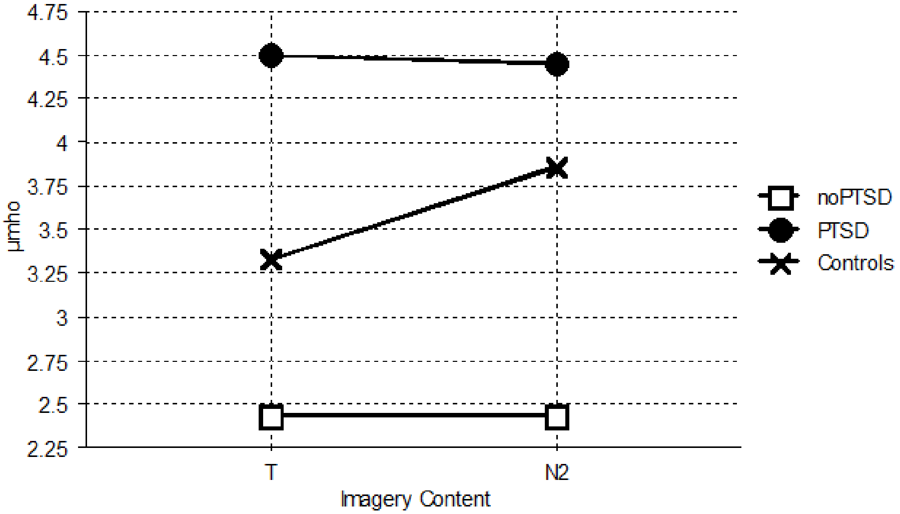
The heart rate level differed significantly between groups [$F(2,29) = 10.227$, $p < .001$] and the two imagery contents [$F(2,29) = 4.671$, $p < .05$, $\varepsilon = .78$]. The heart rate change also varied significantly between groups, as shown by the interaction between group and imagery content [$F(2,29) = 4.602$, $p < .05$]. PTSD patients responded with the greatest increases to traumatic imagery as compared to the N2 imagery [Δ(T, N2) = 3.37 ± 4.88] (see Figure 6). The other two groups were not responsive to traumatic imagery [controls: Δ(T, N2) = .57 ± 2.87; no PTSD former detainees: Δ(T, N2) = -.35 ± 1.88]. Post-hoc testing demonstrated that this effect was due to significant differences between each of the three groups (PTSD-no PTSD: $p < .001$; PTSD- controls: $p = .05$; controls-no PTSD: $p < .05$) and between imagery contents (T-N2: $p < .05$).

Figure 6. *Mean heart rate change [bpm] for traumatic and neutral 2 imagery contents over groups*



Skin Conductance Change between T and N2 Imagery Contents. The same procedure was applied for the analysis of SC responses. It was noted that the mean skin conductance in the first neutral imagery condition N1 (2.92 ± 1.77 µmho) was generally significantly lower level as compared to that exhibited in the N2 condition (3.51 ± 2.19 µmho) [$t(32) = 3.20$, $p < .01$]. The skin conductance level differed significantly over groups [F(2,30) = 3.300, p = .05]. The skin conductance change also varied significantly over groups, as shown by the interaction between group and imagery content [$F(2,30) = 3.407$, $p < .05$; see Figure 7]. Post-hoc comparisons indicated differences between PTSD and no PTSD former political detainees ($p < .05$).

Figure 7. *Mean skin conductance rate change [µmho] for traumatic and neutral 2 imagery contents over groups*



Discriminant Analyses of Physiological Response Changes to Traumatic Imagery. When HR and SC changes were submitted to a discriminant analysis, HR but not SC changes significantly predicted the correct group (see Table 3): whereas HR achieved the correct classification in 23 of 32 cases (71.9%), SC achieved the correct classification in 19 of 33 cases (57.6%). HR was better in classifying the subjects without PTSD, whereas SC classified the PTSD subjects more often correctly.

Table 3. *Results of discriminant analyses of HR and SC responses*

Parameters	Physiological Responses	
	HR	SC
Wilks' Lambda	0.823	0.932
Significance	0.017	0.144
PTSD Subjects correctly classified (Percentage)	6 (46.2)	9 (56.3)
No PTSD Subjects correctly classified (Percentage)	17 (89.5)	10 (58.8)
Total Percent Correct Classification	71.9	57.6

Correlations between Psychophysiological and Clinical Measures among Former Political Detainees. Clinical ratings were positively correlated with HR responses, except for dissociation scores. The heart rate change during traumatic imagery [Δ(T, N2)] significantly correlated with arousal (r = .440, p < .05; see Figure 8) and total CIDI-PTSD scores (r = .434, p < .05). There were no significant correlations between heart rate change and traumatic exposure scores or other clinical scores. The skin conductance change during traumatic imagery [Δ(T, N2)] correlated significantly only with the SCID-D dissociation score (r = .460, p < .05; see Figure 9).

Figure 8. *Heart rate change [bpm] difference values (T – N2) correlation with arousal score as measured by CIDI-PTSD*

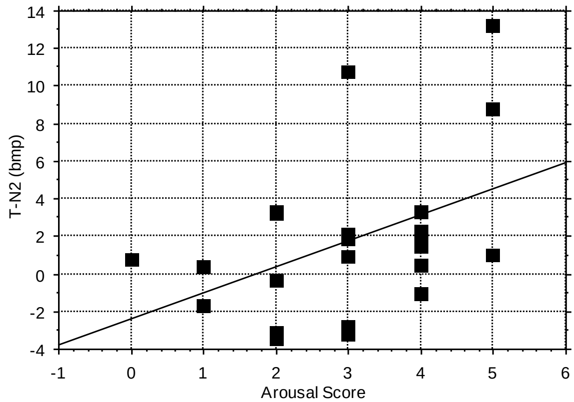
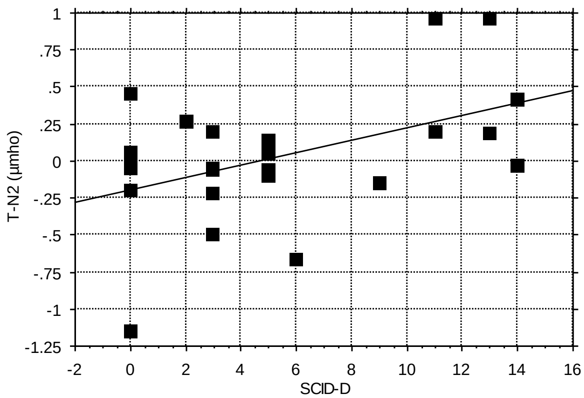


Figure 9. *Skin conductance change [μmho] difference values (T – N2) correlation with the dissociation as measured by SCID-D*



Conclusions

The aim of this study was to investigate psychophysiological responses to unpleasant (trauma-related) and neutral events in long-term survivors of political violence within an imagery paradigm. We raise the questions whether the physiological responses to trauma-related imagery in aged patients with chronic PTSD a long time after traumatic exposure correspond to the reaction pattern of high physiological arousal to trauma-related stimuli previously found in other PTSD patients (e.g., Orr & Roth, 2000) and whether there are some specificities characterizing these responses of this particular group of survivors.

The study compared three groups of participants: 27 Romanian former political prisoners of whom 13 had PTSD and 14 did not have such a diagnosis, and 9 healthy matched controls. The inclusion of a sociodemographically and culturally healthy control group delivered a point of reference for the comparison of physiological responses to imagery contents.

It appeared that personalized imagery elicited valid emotional responses from participants, with traumatic contents being rated significantly as more unpleasant and more arousing than the neutral ones. Similar effects have been reported in other studies using imagery scripts as stimulus material and subjects' ratings on the SAM as a dependent variable (e.g., Cuthbert et al., 2003). Furthermore, arousal ratings of traumatic imagery contents were higher in PTSD former political detainees than in participants of the other two groups.

The results of the heart rate responses for all imagery contents show a general tendency to increased reactions of PTSD former political detainees as compared to those without PTSD and to controls. In contrast, former political prisoners without PTSD exhibited a generally decreased pattern or reactivity as compared to controls. These findings were confirmed by further investigation by means of comparison of the mean heart rate, which showed that PTSD subjects and controls significantly differed only with respect to heart rate response during traumatic imagery. The results of the skin conductance responses for all imagery contents reproduced the differences between former political detainees with PTSD and those without PTSD. Thus, these analyses of physiological responses yielded an interesting distinction with respect to the overall level of reactivity between the PTSD and the no-PTSD groups of survivors in our study. Whereas the former political detainees with PTSD showed a general trend towards increased reactivity, those without PTSD exhibited a generally reduced pattern of reactivity as compared to healthy controls. These data suggest on the one hand that persistent posttraumatic pathology, if left untreated, may lead over decades to a chronically increased physiological activity or a generally higher physiological responsivity to all kinds of imagery contents or other stimuli, which may be unpleasant or neutral, trauma-related or not. Therefore, the arousal reactions to trauma-related contents may extend in time to other neutral contents, leading to a general and chronic state of physiological arousal. This corroborates some previous findings concerning higher resting heart rate of PTSD patients as compared to non-PTSD participants (Prins et al., 1995). It is also consistent with studies that suggested that PTSD might on the long term lead to disturbances of the physical functioning, since aged survivors frequently suffer from cardiovascular diseases and other severe physical conditions as compared to the general old population (e.g., Beebe, 1975; Hirschfield, 1977; Falger et al., 1992). Moreover, this result is in concordance with the finding from the clinical study on the same category of survivors (Bichescu et al., 2005), which showed that this group was characterized by a high level of somatic impairment.

The reduced reactivity exhibited by no-PTSD survivors compared to controls is a novel finding. Such comparisons are less frequently made. It is possible that those with low physiological arousal are less likely to develop PTSD when exposed to traumatic events. Given the assumption that cortisol mediates the development of PTSD symptoms in part, a lower stress and arousal response to traumatic experiences would include a lower cortisol secretion and hence a lesser likelihood to develop PTSD.

The significantly increased mean heart rate noted among all groups during the first imagery condition (N1) as compared to that elicited by the imagery of the second neutral event cannot possibly be attributed to the imagery contents and also did not correspond to the valence and arousal self-ratings. This led us to the hypothesis that such a response might express an anticipatory anxiety, being due to the lack of adaptation to the recording environment at the beginning of the experiment. Particularly, the physiological responses elicited at the beginning of the measurement might not correspond to the reactions to the stimulus material that we intended to measure. The heart rate responses in the N1 condition left aside, the group and imagery content interaction two-fold analysis revealed a pattern of heightened physiological arousal during personalized imagery of traumatic events in PTSD subjects, which was not exhibited by any of the other two groups. The same outcome was obtained from the similar analysis of the skin conductance responses. These results on the two physiological parameters are consistent with previous findings of studies that have employed imagery paradigms and exposure to trauma-related cues (Orr et al., 1993, 1998; Pitman et al., 1987, 1990; Shalev et al.,1993; Blanchard et al., 1996). Decades after traumatic exposure, subjects of the PTSD group still show a marked physiological reactivity to memories of their experiences. This supports the view that the central pathological characteristic of PTSD consists of a persistence of a conditioned emotional response, which has also been previously confirmed (Blanchard et al., 1982). Furthermore, this reaction seems to persist in chronic PTSD patients for decades after the traumatic events.

The discriminant analysis of the heart rate and skin conductance changes has shown that heart rate but not SC significantly differentiates PTSD from no-PTSD subjects. However, HR does not consistently identify PTSD subjects (approximately 50% in this study), but detects the majority of the subjects without PTSD. These results show that there are two classes of persons clinically diagnosed with PTSD, some who exhibit a marked increase in peripheral physiological responsiveness during personalized trauma-related imagery and some who do not produce such reactions. This corresponds to previous findings reporting that 30-40% of individuals with PTSD do not exhibit the phenomenon of high physiological arousal to the activation trauma-related memories (Prins et al., 1995) and confirms the hypothesis that there may be two subtypes of PTSD patients that respond differently to trauma-related cues, a dissociative one and a more phobic one (Griffin et al., 1997). There might be some other facts accounting for this differentiation, e.g. individual response differences, level of exposure to trauma, secondary pathological disturbances such as depressive symptoms. Further research should investigate such hypothesis by comparing subjects exposed to various types of events and degrees of traumatic severities. Nevertheless, these results suggest that the assessment of physiological parameters, although it may not offer a completely valid and reliable measure, does offer a complementary method for the study psychological disturbances. Physiological measures may to a certain extent validate clinical findings and bring additional information that could not be made available through clinical assessment. This provides valuable data that help knowledge in the clinical field advance one step further (Orr & Roth, 2000).

The correlation of clinical measures with physiological responses revealed an association between posttraumatic symptoms, particularly between arousal symptoms and heart rate increase during personalized imagery of traumatic events. This confirms the hypothesis that the heightened reaction to trauma-related memories is a reflection of the clinical symptom of arousal, and more generally, of the severity of posttraumatic symptoms. The association between heart rate responses and posttraumatic symptoms is consistent with previous findings, which showed that individuals with highest heart rate responses exhibit more posttraumatic symptoms on clinical scales (Keane et al., 1998). The positive relationship between severity of dissociative symptoms and trauma-related skin conductance change is rather confusing, since it contradicts previous findings (e.g., Griffin et al., 1997).

A main shortcoming of the present study is the lack of baseline physiological activity measurement. This is not easy to achieve as a simple resting condition would have been confounded by the expectation of later experimental procedures. Another disadvantage is the limited sample size. Larger groups would have offered a clearer image of physiological response features. Still, this did not appear to be an impediment in the elicitation of a significant reaction of physiological arousal to traumatic contents during personalized imagery within the PTSD group. This suggests consistency of the heightened physiological arousal to trauma-related imagery as a feature of this particular group. It should also be noted, that the not imagery per se but the instruction to imagine has been the independent variable, i.e., it may be possible that the groups differed in their compliance to the instruction. If that was the case, however, the PTSD group would be most likely to avoid the traumatic memories and therefore should have shown smaller rather than larger responses. On the other hand, the effort to avoid those traumatic memories in itself may have contributed to the physiological arousal. While it is not possible to exclude such influences, the SAM rating gave no indication for such an assumption. Maybe a rating of vividness of the imagined scene would add additional evidence in future such studies.

All in all the present findings support the notion that symptoms of “hyperarousal” and the severity of such posttraumatic symptoms in chronic PTSD patients can be observed in response to remembering personal experiences and is especially highly expressed during the imagery of personal traumatic experiences. This study demonstrates that aged victims of political violence with four-decades-chronic PTSD exhibit a pattern of heightened physiological arousal during personalized imagery of traumatic events that is similar to the one described by previous studies on other PTSD patients. Moreover, the general heightened responsiveness noted in this particular PTSD group may suggest the presence of a specific pattern of physiological reactivity that may be due the long-term chronic PTSD. In contrast, political victims with no PTSD exhibited a generally reduced pattern of reactivity, which might be accounted for by other psychological symptoms, such as depression and dissociation.

Results of the discriminant analyses and of the correlation analyses between clinical symptoms and physiological responses suggest that the physiological change in reaction to trauma-related memory, particularly the heart rate change, is successful in distinguishing the more severe cases of chronic PTSD. This supports the hypothesis that psychophysiological assessment of responsiveness to trauma-related cues may be useful for the PTSD diagnostic classification in that it offers information on the general presence, absence or severity of PTSD (Orr & Roth, 2000). This is an encouraging finding for further research that aims at investigating psychological disorders by means of both clinical and psychophysiological assessments.

Rezumat: Diferite studii anterioare au arătat că persoanele cu tulburare de stress post-traumatică (posttraumatic stress disorder, PTSD) ca urmare a diverselor experienţe traumatizante sunt caracterizate printr-o creştere marcantă a reactanţei fiziologice în timpul imaginării unor aspecte personale legate de aceste traume (Orr & Roth, 2000). Studiul de faţă porneşte de la rezultatele unor studii anterioare, având ca scop investigarea unor răspunsuri fiziologice la stimuli legaţi de evenimente personale neplăcute (traumatizante) sau plăcute (neutre) la foştii detinuţi politici ai regimului comunist din România în cadrul unui experiment care foloseşte technica imaginaţiei. Parametrii psihofiziologici – ritmul cardiac (heart rate, HR) şi conductanţa electrică a pielii (skin conductance, SC) – au fost măsuraţi folosind un sistem tranportabil de înregistrare digitală Vitaport II. De asemenea, a fost înregistrat gradul subiectiv de activare. Participanţii au fost distribuiţi în trei grupuri: un grup de foşti detinuţi politici diagnosticaţi cu PTSD (N = 13), un grup de foşti detinuţi politici care nu au dezvoltat această tulburare (N = 14) şi un grup de control (N = 9). În medie, participanţii cu PTSD au arătat o reacţie HR significant mai ridicată pe parcursul imaginării evenimentelor traumatice decât în timpul imaginării unor conţinuturi neutre. Aceste diferenţe nu au fost înregistate în cadrul celorlalte două grupuri. Diferenţa reacţiei HR între imaginarea unor conţinuturi traumatice şi cea a unor conţinuturi neutre diferenţiază persoanele cu simptome posttraumatice mai severe. În plus, rezultatele

analizelor statistice ale reacţiilor HR şi SCL între foştii deţinuţi cu şi fără PTSD au arătat că subiecţii din primul grup au manifestat o stare generală de activare fiziologică crescută, având reacţii HR si SCL mai ridicate decât ceilalţi deţinuti politici pe tot parcursul experimentului. Aceste rezultate sugerează că tulburarea de stress post-traumatică cronică poate conduce de-a lungul deceniilor nu numai la un nivel crescut de reactivitate fiziologică la orice tip de stimuli, dar şi la un nivel bazal ridicat de activiare vegetativă. Constatările studiului de faţă sprijină ideea că simptomele posttraumatice tipice de “hiper-activare” la persoanele care suferă de PTSD pe termen lung se reflectă pe plan fiziologic în timpul derulării mentale a unor evenimente personale şi îşi găsesc în special expresia în timpul imaginării unor evenimente personale traumatizante.
Cuvinte cheie**:** tulburare de stress post-traumatică cronică; stimuli imaginativi; parametri psihofiziologici, foştii detinuţi politici.

***Résumé* :** Les différentes études antérieures ont montré que les personnes souffrantes d’un trouble de stress post-traumatique (posttraumatic stress disorder, PTSD) consécutif à des expériences traumatisantes variées sont caractérisées par un accroissement significatif de la réactivité physiologique périphérique pendant le processus d’imagination de certains aspects personnels liés à ces traumatismes (Orr & Roth, 2000). A partir de ces résultats, cette étude vise à chercher les réponses physiologiques à des événements négatifs (liés au traumatisme) et positifs (neutres) dans le cadre d’une expérience qui utilise la technique d’imagination avec des anciennes victimes de la détention politique au cours du régime communiste en Roumanie. Les indicateurs physiologiques périphériques sont examinés par l’usage d’un système d’enregistrement numérique Vitaport II, qui nous a permis d’enregistrer le rythme cardiaque (heart rate, HR) et le niveau de la conductibilité électrique de la peau (skin conductance level, SCL), de même que le degré subjectif d’activation. Les participants à l’étude ont été répartis en trois groupes : un groupe de détenus politiques diagnostiqués avec PTSD (N = 13), un groupe de détenus politiques qui n’ont jamais développé ce trouble (N = 14), et un groupe de contrôle (N = 9). On constate que les patients avec PTSD ont enregistré une réaction HR significativement élevée aussi bien pendant les expériences traumatiques que pendant les expériences d’imagination ayant des contenus neutres. Mais on ne remarque pas de différence entre les réponses HR et SCL lorsqu’il s’agit des pensées traumatiques ou neutres dans le cas des patients sans PTSD ou ceux du groupe de contrôle. La différence des réponses HR entre les situations d’imagination des événements traumatiques et neutres permet de distinguer les personnes ayant les niveaux les plus sévères de PTSD. De plus, les analyses statistiques des réponses en terme de rythme cardiaque et de conductibilité électrique de la peau entre les personnes avec PTSD et celles qui ne manifestent pas PTSD ont montré que les sujets du premier groupe se caractérisent par un état d’activation générale accrue, ayant des niveaux de rythme cardiaque et de conductibilité électrique de la peau plus élevés en comparaison avec les autres catégories de sujets, tout au long du déroulement de l’expérience. Ces résultats suggèrent que le trouble de stress post-traumatique peut conduire, même après des décennies, à une activité végétative de base accrue, de même qu’à une réactivité physiologique générale plus élevée à plusieurs types de stimuli imaginatifs, qu’ils soient négatifs ou neutres, liés ou non au traumatisme. Les conclusions de cette recherche soutiennent l’idée que les symptômes post-traumatiques typiques de « hyper-activation » dans le cas des personnes souffrantes de PTSD chronique s’expriment au niveau

physiologique au cours du déroulement mental des expériences personnelles et surtout pendant le processus d'imagination des événements personnels traumatisants.
***Mots-clés*: trouble de stress post-traumatique chronique; stimuli imaginatifs; indicateurs physiologiques, anciennes victimes de la détention politique.**

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Figure 1. Graphical representation of the imagery trial used in this study: first neutral event (N1): one minute recall and three minutes narration; traumatic event (T): one minute recall and three minutes narration; second neutral event (N2): one minute recall and three minutes narration.

Figure 2. Mean SAM ratings for valence (left) and arousal (right) and standard errors (indicated by bars) for the three imagery contents (N1, T, N2) used in the current study (N = 36).

Figure 3. Mean SAM valence (left) and arousal (right) ratings and standard errors (indicated by bars) for the three imagery contents (N1, T, N 2) separately for the three groups (former political detainees without PTSD: N = 13; former political detainees with PTSD: N = 14; controls: N = 9).

Figure 4. Mean heart rate change [bpm] for each imagery content (neutral 1, traumatic, neutral 2) over groups.

Figure 5. Mean skin conductance change [µmho] for each imagery content (neutral 1, traumatic, neutral 2) over groups.

Figure 6. Mean heart rate change [bpm] for traumatic and neutral 2 imagery contents over groups.

Figure 7. Mean skin conductance rate change [µmho] for traumatic and neutral 2 imagery contents over groups.

Figure 8. Heart rate change [bpm] difference values (T – N2) correlation with arousal score as measured by CIDI-PTSD.

Figure 9. Skin conductance change [µmho] difference values (T – N2) correlation with the dissociation as measured by SCID-D.