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ORIGINAL ARTICLE

Disturbed subjective time experience in post-traumatic stress disorder

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Abstract
Background and objectives: Disturbance of subjective time experience in PTSD has not heretofore constituted a subject of focused empirical research, in spite of previous theoretical insights concerning the phenomenological importance of subjective time distortions in PTSD. Aim of the study was confirming the presumption that an alteration in subjective time experience is an essential feature of PTSD.
Methods: Sets of instruments for diagnostic assessment of PTSD and other psychiatric disorders, and for assessing subjective time experience, have been used to investigate the differences between the subjects with PTSD ($n = 58$), subjects with other psychiatric disorders ($n = 34$) and healthy participants ($n = 135$).
Results: On average, subjects with PTSD differ significantly from the remaining two groups in succession and goal directedness aspects of subjective time experience, while PTSD group differs from healthy group in all aspects except future and past temporal extension. As expected, the covariates adjusted means on the *Succession, Integration, Temporal Distinction* and *Goal Directedness* scales are lowest in subjects with PTSD, higher in other disorders and highest among healthy individuals.
Conclusions: Most aspects of the subjective time experience in subjects with PTSD show significant alterations compared to healthy ones. Moreover, disturbed succession and goal directedness aspects are most specific because they also significantly differentiate the group with PTSD from the group of those with other disorders. Increased intensity of PTSD symptoms is associated with stronger alteration of time experience. There is a stronger association of temporal disorganization with avoidance/numbing and hyper-arousal than with intrusions.

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Introduction

Strangely enough, a review of available literature cannot find a single empirical study specifically exploring the issue of disturbed subjective time experience in post-traumatic stress disorder, albeit that there are quite a considerable number of research papers generally addressing this subject in stress disorders. This is even more unusual considering the importance otherwise attributed to subjective time alterations in other psychiatric disorders – depression[1,2] schizophrenia,[3] during marihuana intoxication,[4] in heroin[5] and alcohol[6] addicts, in persons with personality disorders,[7] eventually with emphasis on its heuristic capacity as a possible general paradigm of psychopathology conceptualization. The Gooddy's article[8] is an early attempt to explain all ''neuropsychiatric disorders'', at least in principle, by ''disorientation'' in space–time. In one of the first comprehensive books, Gorman and Wessman[9] overviewed general results of empirical investigations of this subject. However, they justifiably noticed that simple catalogue of findings without theoretical foundation would result in storage of isolated data not likely to improve our knowledge about time.

Notwithstanding that clinical phenomena of disturbed time experience in adults and children after psychological trauma have long since been described,[10] and that powerful *theoretical* emphasis placed on temporal categories in some influential models of PTSD conceptualizations is clearly discernible,[11] e.g. accentuating that ''disturbances in a sense of reality and time characterize many psychiatric conditions, but are most prevalent and dramatic in trauma-induced disorders'',[12] empirical research of this subject in PTSD is lacking. A possible explanation for this may be given by the fact that the concept of time and its disturbances, even when appearing as a theme relative to PTSD, usually was expressed in terms of cognitive distortions caused by a traumatic experience,[13] or non-differentially included in a model of dissociation.[14,15] On the other hand, studies have described alterations of subjective time in specific populations of people exposed to various stressors – war veterans, victims of sexual violence, and fire,[16] refugees,[17] torture victims,[18] spouses of patients with severe somatic illnesses,[19] helping professionals,[20] though consistently failing to specify the PTSD diagnosis in observed samples. Van der Kolk[11] pointed out the temporal features as essential in the comprehension of PTSD, where traumatized people display a repeated tendency to get stuck in the past over and over again, experiencing current stressors with intensity of emotions that belongs to the past, and has little value in the present. *Therapeutic* implications arising from the accentuation of temporal characteristics of PTSD are that giving trauma the meaning, which is the core of therapy, should prevent it from being part of present experience and appropriately consign it to the past. The comprehensive meta-analysis[21] indicated certain advantage of therapeutic techniques focused on past (trauma-focused cognitive-behavioural therapy and EMDR), related to stress management and other therapies focused on the present. Despite such findings and theoretical standings, in practice ''...clinicians show consistently greater endorsement for present- than for past-focused PTSD treatment.''[22]

Cognitive models of time include various approaches, from Ornstein's[23] ''storage-size metaphor'', in which duration is attributed to cognitive analysis of information with no ''time basis'' postulated, to results showing that future-oriented thinking and memory draw upon shared systems mediating mental time travel.[24] Within a cognitive frame Posner tried[25] to achieve the synthesis of qualitative phenomenological and quantitative physiological functioning of psyche, in a discipline he named ''mental chronometry''. Accordingly, time was here given the role of *via regia* to the human psyche, which Freud earlier ascribed to dreams. In an attempt to integrate *neurobiological* and cognitive paradigm Wittmann explicitly evokes the classical concept of relation between succession and integration because ''perceptual mechanism seems to exist that integrates separate successive events into a unit or perceptual *gestalt*'', while ''time distortions are stress related as they are often experienced during dangerous or life-threatening situations.''[26]

In view of numerous current *theoretical* emphases laid on specificity of time-dimension in origin, phenomenology and therapy of post-traumatic stress disorder, although usually identified with dissociation, or vaguely included in cognitive phenomena, we assumed that *empirical* investigation of subjective time experience *per se* in that disorder would be justified at least as much as long-term explorations of this subject in other psychiatric disorders have been. The primary goal of this paper is to investigate differences in subjective time experience between individuals with PTSD and those with other psychiatric disorders as well as those with no disorder. A secondary goal is twofold: to explore the relationships of subjective time experience with specific clusters as well as intensity of PTSD symptoms.

Methods

Participants

The research was conducted from March 2000 till July 2002, as a separate part of a polycentric study aimed to psychological consequences of war in former Yugoslavia, which was approved by the Research Ethics Committee of the Institute of Psychiatry, King's College, University of London.[27] The sample included individuals from the following populations: people with combat experience, victims of torture, refugees, expelled and internally displaced persons from the 1991–1995 wars in former Yugoslavia and 1999 war in Kosovo and Metohija, as well as persons exposed to the 1999 bombardment in Serbia. The sample comprised subjects from clinical and general population, fulfilling the following inclusion criteria:

- age from 18 to 65 years;
- minimum 8 years of education;
- without organic mental disorder;
- without an current or former psychotic episode.

Subjects were recruited to the study via the ''snowball'' technique. The sample was preliminary closed with 237 examinees while the final number entered into statistical

Table 1 Socio-demographic characteristics and differences between PTSD group, group with other psychiatric disorder and healthy group.

Characteristics	Group			Chi-square	df	*p*
	Healthy (*n* = 135)	Other disorders (*n* = 34)	PTSD (*n* = 58)			
Gender (%)[a]				18.56	2	<0.001
Male	68.1	41.2	84.5			
Female	31.9	58.8	15.5			
Age (%)				17.06	2	<0.001
18–34	45.9	64.7	22.4			
35–65	54.1	35.3	77.6			
Marital status (%)				1.13	2	0.567
Married (or cohabiting)	60.0	50.0	56.9			
Single (or widowed, separated)	40.0	50.0	43.1			
Education (%)				7.68	4	0.104
Primary	3.0	2.9	12.1			
Secondary	71.9	70.6	60.3			
Higher or university	25.2	26.5	27.6			
Profession (%)				19.74	6	0.003
Worker	39.3	17.6	58.6			
Clerk	29.6	26.5	12.1			
Professional	13.3	26.5	13.8			
Other[b]	17.8	29.4	15.5			
Employment status (%)				6.07	4	0.194
Employed	49.6	41.2	34.5			
Unemployed	16.3	29.4	24.1			
Other[c] or retired	34.1	29.4	41.4			
Income status (%)				18.36	4	0.001
Low	43.7	32.4	70.7			
Average	48.9	52.9	27.6			
Good or very good	7.4	14.7	1.7			

[a] All percentages in the table are within respective groups.
[b] Category ''other'' refers to students, housewives, entrepreneurs/businessmen, sole proprietors and artisans.
[c] Category ''other'' refers to housewives and to the temporary and ''black economy'' job arrangements.

analysis (*N* = 227) was reached after excluding those who incompletely filled the questionnaires or gave answers with negligence, which was established by two control items in the *Time Integration Questionnaire* (*TIQ*).

Using the *Clinician Administered PTSD Scale for DSM-IV – CAPS* and *Structured Clinical Interview for DSM-IV – SCID-I/NP* (see Instruments), the subjects were initially classified in three groups: those with PTSD, with other psychiatric disorders, and without disorder (hereafter healthy). PTSD diagnosis was established based on the fulfilment of all the Criteria (A–F) from *CAPS*, with complete concordance with *SCID* PTSD module criteria. The groups of participants with other disorders and healthy ones were defined according to the *SCID*. In the group with other disorders the following diagnoses were present: mood disorders (*n* = 19), substance use disorders (*n* = 6), anxiety disorders (*n* = 27), somatoform disorders (*n* = 6), eating disorders (*n* = 3), and adjustment disorders (*n* = 3). Due to the occurrence of multiple diagnoses, the total number of diagnoses exceed the number of group participants with other disorders.

Socio-demographic characteristics of the sample and differences between the three groups of participants with respect to these characteristics are shown in Table 1. As can be seen from Table 1 the groups were significantly different with respect to gender, age, profession and income status. The three groups did not differ significantly with respect to marital and employment status. Although the chi-square statistic for education was not significant, the PTSD group was noticeably different from other two groups in terms of this characteristic.

Procedure

The instruments were individually administered to all examinees by the first author of this paper. With the approval from the principal investigator for the general polycentric study[27] the basic set of instruments was further extended by adding the questionnaires for subjective time experience assessment. Training in the application of instruments was provided over the course of two multiple-day seminars for

all the investigators taking part in the polycentric study, using ''role play'' and video-tape techniques, and additionally on ten test cases, with independent supervision. All instruments were translated from English into Serbian following comprehensive discussion with other investigators. The interviews were usually completed in one or two sessions. Written informed consent was obtained for all study procedures. Strict confidentiality was emphasized. All study participants were offered an interview fee of $10 in the dinar equivalent as compensation for participating. Psychiatric treatment was offered to every examinee with a clinical level of psychopathology established. The interviews were audio-taped for the purpose of continued supervision when informed consent could be obtained (about 60% of them). The examinees had possibility to give initials or to remain anonymous.

Instruments

Diagnostic assessment of post-traumatic stress disorder and other psychiatric disorders

The following instruments were used to establish the diagnosis of PTSD and other psychiatric disorders, to assess clusters of PTSD symptoms as well as PTSD symptoms intensity:

Semi-structured interview for survivors of war – SISOW[27]; SISOW contains 182 items, providing information on demographic characteristics, personal and family history, the *Trauma Exposure Scale* (50 war stressors, each marked as present/absent, followed by scoring disturbance and control during each present event) and the *Torture Exposure Scale* (47 forms of torture acts where presence/absence, disturbance and control were scored in the same way as for war stressors);

Structured Clinical Interview for DSM-IV – SCID-I/NP, Version 2[28];

Clinician Administered PTSD Scale for DSM-IV – CAPS[29]; the CAPS contains 17 items relating to primary PTSD symptoms and 13 associated features. The CAPS is an excellent choice for research also in clinical conditions, sometimes called ''golden standard'' for PTSD diagnosis[30];

Modified Mississippi Scale for Combat-Related PTSD[27,31]; this 35-item scale is one of the most widely used measures of PTSD, proved to be one of the best self-rating instruments assessing this disorder both as a dichotomous and dimensional measure.

Assessment of subjective time experience

Subjective time experience was assessed using the following instruments:

Time Integration Questionnaire – TIQ[32]; contains 42 items distributed in two scales: *Succession* (22 items i.e. statements, for example: ''It seems that time passes discontinuously for me'', ''My life goes on in insufficiently connected periods'') and *Integration* (18 items, for example: ''I feel that I am of full age'', ''Everything that appears in my thoughts is integrated''). The remaining two items served for revealing the negligence in answering. The items in *TIQ* reflect the examinee's attitude towards numerous terms with temporal denotations incorporated in statements. The basic structure of temporal organization implied by the questionnaire is 1) succession, coherent spontaneity of inner flow (*Succession* scale) and 2) integration, activity, conduct of psychic contents (*Integration* scale). The examinee responds choosing one answer on a five-point scale (from ''not agree at all'' to ''fully agree'' depending on how well each item described their feelings and behaviour over the last week. Higher values of the succession items indicate a clearer distinction between the dimensions of the past, the present and the future, as well as a stronger experience of the continuous internal flow of time moments from past to future. Higher scores on the integration items point to a stronger experience of the unity of the three basic time categories at the present moment of awareness, without mixing them. Reliability of the scores on both scales in our sample was good (Cronbach's alpha for *Succession* was 0.94, and for *Integration* 0.81).

Temporal Integration Inventory – TII[33]; a self-reporting instrument comprising 14 statements for assessing *Temporal Distinction* and *Goal Directedness* facets of temporal integration. Eight statements of *Temporal Distinction* relate to orderly indexing memories, perceptions and expectations as past, present and future, without confusion of these temporal categories (for example: ''When I am remembering my past or imagining my future, I still realize that I am here in the present''). Higher scores indicate clearer distinction between three basic temporal dimensions. Six statements of *Goal Directedness* relate to adjusting plans of actions to reach goals and control outcomes (for example: ''My short-term goals seem to fit my long-term goals''). Higher scores on *Goal Directedness* mean greater ability to link past and present thoughts and actions with the achievement of future goals. The examinee responds choosing one answer on a six-point scale from ''not at all'' to ''extremely'' indicating to what extent each item applies. Reliability of the scores on both subscales in our sample was modest (Cronbach's alpha for the *Temporal Distinction* subscale was 0.68 and for *Goal Directedness* 0.72).

Present Concentration Inventory – PCI[34]; a self-report instrument that measures the degree of the ones focusing on the present with the relative exclusion of past and future. It consists of five statements, for example: ''I seem to live from minute to minute, with little attention to the past or future''. The examinee responds to them in the same way as to *TII*. The more attention is focused on the present and denied to the past and future, the higher the score on present concentration. Reliability of the score on the inventory in our sample was good (Cronbach's alpha = 0.81).

Temporal Extension Inventory Future – TEIF and *Temporal Extension Inventory Past – TEIP*[34]; consists of a list of temporal categories (seconds, minutes, hours, days, weeks, months, years, and decades). The subject is asked to choose one of these categories and indicate the number of units within the category most precisely determining the focus of his temporal perspective in past (*TEIP*) and future (*TEIF*), by asking him how far back or ahead he is thinking at the time of testing. The results on the *TEIF* and *TEIP* are expressed as a logarithm of minutes.

Visual Analogue Scale – VA Scale[35]; presented by a 10 cm vertical line with the labels ''fastest possible'' (at the top of the line), ''normally'' (in the middle), and ''slowest possible'' (at the bottom of the line). The subject marks anywhere on the line the speed of his subjective time flow

''at this moment''. Given the methodological controversies associated with the use of such instruments (i.e. whether the subject considers the speed of inner time flow or outer speed of events) which might lead to opposing raw results, the result on this scale was expressed as the absolute deviation from median of the entire sample, it being a speed measure neutral in direction.

Data analysis

The data analysis was performed using IBM SPSS package (version 23). Differences between groups (PTSD, other psychiatric disorders and healthy) with respect to socio-demographic characteristics were examined by Pearson chi-square test. Due to statistically significant and noticeable differences between groups with respect to certain socio-demographic characteristics (see Table 1) an analysis of intergroup differences in mean scores on subjective time experience scales (Primary goal) was performed using One-factor MANCOVA, followed by Univariate ANCOVA's for each scale. The covariates for the MANCOVA were gender, age (in years), education, profession and income status. The last three variables were transformed for this analysis using ''dummy'' coding. To maintain overall Type I error probability at 0.05, for Univariate ANCOVA's Bonferroni correction was applied and the significance level was set at 0.006. Post hoc pairwise comparisons of estimated means were performed using *t*-test with Šidak correction for multiple comparisons. For these comparisons significance level was set at 0.05. In order to verify conditions for the use of MANCOVA, homogeneity of covariance matrices across the groups in regard to subjective time experience variables was examined using Box's test.

Bravais–Pearson correlation coefficient was used for exploring the relationship between subjective time experience and the frequency of each cluster of PTSD symptoms (intrusions, avoidance/numbing and hyperarousal) in the group with PTSD.

Also, Bravais–Pearson correlation coefficient was used to explore the relationship between subjective time experience and the intensity of PTSD symptoms in the group with PTSD. Intensity of PTSD symptoms was expressed in two ways: based on the participant's total score on the *Modified Mississippi Scale* and indicators derived from the *CAPS*. The following indicators of PTSD intensity were derived from data obtained on the *CAPS*:

1. Total PTSD symptom severity: a sum of scores on item 20 (subjective disturbances), 21 (impaired social functioning) and 22 (impaired professional functioning);
2. Overall intensity of PTSD symptoms: a sum of symptom intensity scores from subtotals of intrusions, avoidance/numbing and hyperarousal scales (Criteria B, C and D);
3. Number of PTSD symptoms: the number of items scored 2 or more for participant intrusions, avoidance/numbing and hyperarousal intensity of symptoms (items 1–17), according to the *CAPS* scoring rule for determining symptom presence or absence.

Results

Differences between groups in subjective time experience (primary goal)

Arithmetic means adjusted for differences on covariates (and standard errors) in groups of participants with PTSD, those with other psychiatric disorders, and healthy persons on subjective time experience scales and results of one-factorial univariate analyses of covariance (*F*-ratios and *p* values) are shown in Table 2.

Results of Box's test ($M = 77.51$, $p = 0.484$) cast no doubt upon the assumption of covariance matrices equality for the three analyzed groups. In the MANCOVA a statistically significant effect of group factor was obtained (Wilks' Lambda = 0.63, $F(16;416) = 6.75$, $p < 0.001$, partial eta-squared = 0.21). The Follow-up ANCOVAs (Table 2, columns *F* and *p*) show that groups differ on all scales for subjective time experience except the *TEIF* and the *TEIP* scales. Results of post hoc multiple comparisons indicate that each group statistically significantly differs from each other on the *Succession* scale. There is a statistically significant difference between the healthy group and PTSD group on the *Integration* and *Present Concentration* scales. The PTSD group statistically significantly differs from other two groups on the *Goal Directedness* scale, while the PTSD group and group with other disorders differ significantly from the healthy group on the *Temporal Distinction* scale and *Visual Analogue Scale*. Altogether (Table 2) the direction of differences as well as the adjusted arithmetic mean values in the groups on the *Succession, Integration, Temporal Distinction* and *Goal Directedness* scales are in line with expectations, i.e. adjusted arithmetic means are lowest among participants with PTSD, higher in those with other disorders and highest among healthy individuals. In addition, the *Succession* scale is the most discriminative because it shows statistically significant differences between all the three groups. The differences between groups are largest on *Succession* ($\eta^2_{partial} = 0.29$), *Goal Directedness* ($\eta^2_{partial} = 0.22$) and *Temporal Distinction* ($\eta^2_{partial} = 0.21$) scales. The differences between groups are substantially lower on *Present Concentration* ($\eta^2_{partial} = 0.11$), *Visual Analogue* ($\eta^2_{partial} = 0.07$) and *Integration* ($\eta^2_{partial} = 0.05$) scales whereas the differences on *Temporal Extension – Future* ($\eta^2_{partial} = 0.02$) and *Temporal Extension – Past* ($\eta^2_{partial} = <0.01$) scales are negligible.

Subjective time experience and frequency of different post-traumatic stress disorder symptom clusters (Secondary goal 1)

The linear correlation coefficients between the scores on the subjective time experience scales and frequency of different PTSD symptoms clusters in the group with PTSD are shown in Table 3. The results of the correlation analysis indicate that the frequency of intrusion symptoms and that of avoidance/numbing symptoms significantly positively correlated with the *TEIF* while the frequency of hyperarousal symptoms significantly negatively correlated with the scores on a *Succession* scale.

Table 2 Means adjusted for covariates (and standard errors) of individual groups of participants on the scales of subjective time experience and the results of statistical analysis (F and p) of differences between groups.

Scale	Group			F^*	p
	Healthy ($n = 135$)	Other disorders ($n = 34$)	PTSD ($n = 58$)		
Succession	$3.56^{a\dagger}$ (0.05)	3.03^{b} (0.11)	2.64^{c} (0.09)	44.01	<0.0001
Integration	3.62^{a} (0.04)	$3.53^{a,b}$ (0.08)	3.37^{b} (0.06)	5.74	0.004
Temporal Distinction	4.63^{a} (0.06)	4.10^{b} (0.12)	3.83^{b} (0.10)	28.60	<0.0001
Goal Directedness	4.24^{a} (0.07)	3.97^{a} (0.14)	3.24^{b} (0.11)	29.94	<0.0001
Present Concentration	2.66^{a} (0.09)	$3.06^{a,b}$ (0.20)	3.57^{b} (0.15)	13.43	<0.0001
Temporal Extension – Future	12.18^{a} (0.24)	12.91^{a} (0.51)	11.56^{a} (0.40)	2.04	0.133
Temporal extension – Past	13.91^{a} (0.24)	14.03^{a} (0.49)	13.99^{a} (0.38)	0.03	0.967
Visual Analogue Scale – absolute deviations from median	12.22^{a} (1.37)	19.85^{b} (2.87)	21.94^{b} (2.21)	8.49	<0.001

* For all F-ratios in the table the degrees of freedom are: $df_1 = 2$, $df_2 = 215$.

† *Note*: Means within the same row that are marked with the same superscript letter are not significantly different. For example: within the first row each mean has different letter (a, b or c) as superscripts: each mean is significantly different from each other. Within the second raw means are marked with a, (a,b), and b, respectively: therefore, the first and the third means are significantly different, but the second one was not significantly different both from the first and the third one.

Table 3 Linear correlation coefficients of frequency of intrusion, avoidance/numbing and hyperarousal symptoms with particular aspects of subjective time experience in the group of subjects with current PTSD ($n = 58$).

Scale	Frequency of intrusive symptoms	Frequency of avoidance/ numbing symptoms	Frequency of hyper-arousal symptoms
Succession	−0.03	−0.17	−0.33**
Integration	0.18	−0.12	−0.18
Temporal Distinction	−0.13	−0.15	−0.23
Goal Directedness	−0.12	−0.14	−0.20
Present Concentration	0.03	0.21	0.14
Temporal Extension – Future	0.29*	0.34**	0.03
Temporal Extension – Past	−0.14	−0.01	−0.10
Visual Analogue Scale – absolute deviations from median	−0.06	0.002	−0.01

Note: Significance level was set at 0.05. Due to exploratory nature of the Secondary research goal no adjustment of the significance level for multiple tests in this table was made.

* $p < 0.05$.

** $p < 0.01$.

Subjective time experience and intensity of post-traumatic stress disorder symptoms (Secondary goal 2)

The linear correlation coefficients between the scores on the subjective time experience scales and measures of the intensity of PTSD symptoms in the group with PTSD are shown in Table 4. As can be seen from Table 4, most aspects of subjective time experience, with the exception of the one assessed by the *VA Scale*, show a weak to moderate linear relationship with certain indicators of PTSD severity: the total PTSD symptom severity score significantly correlated with scores on the *Succession*, *Goal Directedness* and *Present Concentration* scales; also, statistically significant correlations of the *Mississippi Scale* with *Succession*, *Temporal Distinction*, *Goal Directedness*, *Present Concentration* and *TEIP* were obtained; the number of PTSD symptoms significantly correlated with the *Present Concentration* and overall intensity of PTSD symptoms with *TEIF*.

At the same time, the correlations of subjective time experience scales with the *Mississippi Scale* (dimensional measure for the intensity of PTSD symptoms) are somewhat higher than those obtained between subjective time experience scales and measures of the PTSD symptoms intensity derived from the *CAPS*. Of all the subjective time experience scales, the *Succession*, *Goal Directedness* and *Present Concentration* scales were found to have statistically significant correlations with at least two criteria for intensity of PTSD symptoms.

Discussion

Previous theoretical insights concerning the phenomenological importance of subjective time distortions in PTSD were empirically corroborated in the presented research. Irregularity of succession and unsuccessful time integration, showed to be the important aspects of subjective time alterations in PTSD, instead of the former impressionistic expectations that past perspective would be the prominent

Table 4 The coefficients of linear correlation between the measures of the intensity of PTSD symptoms and particular aspects of subjective time experience in the group of subjects with current PTSD ($n = 58$).

Scale	Total PTSD symptom severity	Overall intensity of PTSD symptoms	Number of PTSD symptoms	Mississippi – total score
Succession	−0.30*	−0.26	−0.23	−0.52**
Integration	−0.10	−0.08	−0.01	−0.24
Temporal Distinction	0.02	−0.19	−0.18	−0.29*
Goal Directedness	−0.30*	−0.20	−0.17	−0.42**
Present Concentration	0.28*	0.26	0.27*	0.29*
Temporal Extension – Future	−0.004	0.28*	0.24	0.16
Temporal Extension – Past	−0.09	−0.09	−0.15	0.28*
Visual Analogue Scale – absolute deviations from median	−0.14	−0.005	−0.04	0.19

Note: Significance level was set at 0.05. Due to exploratory nature of the Secondary research goal no adjustment of the significance level for multiple tests in this table was made.

* $p < 0.05$.

** $p < 0.01$.

temporal feature of this disorder. Consistent results of the study show that aspects of the disturbed subjective experience of time are not merely picturesque epiphenomena of PTSD clinical manifestations, but could be conceived as specific and empirically measurable features of the inner temporal organization of psychic acts in people with PTSD. Moreover, it was shown that the disturbances of subjective time are more specific for subjects with PTSD than in group of individuals with other disorders, taken together.

Often authors scrutinizing the problem of subjective time, when developing this concept, have come to the pairs of opposites which expressed the essential moments of dialectical tension. While Ornstein[23] regarded the opposite of *succession* and *simultaneity* as a matter of concern only for psychologically oriented philosophers such as Bergson, it is commonly accepted[36] that Janet distinguished between two different ways in which mind functions: activities that preserve and *reproduce* the past and activities which are directed towards *synthesis* and creation. In that sense, a theoretical framework of our paper is based on the distinction between two main aspects of time, expressed as *succession* and *integration*. The succession aspect corresponds to a natural intuitive experience of time which, in the stream of contents of consciousness (perceptions, performances, memories, concepts, words, feelings etc.) differs, without mixing, three basic temporal dimensions, past, present and future, and a straight line flow from the past to the future is perceived as balanced and continuous through consecutive present moments. Another aspect, integration, retains and at the same time exceeds the simple advancing current of time, and represents the unique ability of human beings which has been described as ''mental time travel'',[37] which intends contents that belong to the past and the future in the present moment of awareness, uniting them unmixed as a whole. In addition, unlike the common misconceptions reducing time to the succession, it is necessary to accept that both aspects of time express its essential determination. Upon theoretical considerations of temporal characteristics of PTSD, it was revealed that the organization of mental life and self-perception of that organization are essentially defined as a disturbed experience of *succession* and damage to the *integration* of mental acts in the whole of subjective experience, as indicated by the picturesque expressions of ''the tyranny of the past'', ''past as present''.[11] The traumatic experience phenomenologically appears in consciousness, through intrusions, as a present experience, with immediate sensory and emotional qualities in the form of actual *perception*, instead in the form of the *representation* or memory, that would belong to the past and thus give a sense of safeness set by its impression of the proper time distance. This distortion of the natural succession of mental acts also leads to the disturbance of their integration which would, contrary to the ''tyranny'', accomplish the free control over them as a whole of experience. In this respect, PTSD is really a ''timeless condition'', but not in terms of timelessness that the disorder ''... existed before it was codified in modern diagnostic classifications...''.[38]

The primary goal of our study was to investigate *differences in subjective time experience* between individuals with PTSD, those with other psychiatric disorders as well as healthy individuals. The results showed that subjective time experience is significantly altered in the subjects with PTSD relative to healthy individuals at all the time scales except the *TEIF* and the *TEIP*. Also, there are significant differences in the subjective time experience between the patients with PTSD and those with other disorders in certain aspects measured by the administered time questionnaires (Table 2), which demonstrates the specificity of PTSD in respect of those subjective time distortions assessed by these scales. With the inclusion of relevant socio-demographic characteristics as covariates in the statistical analysis of the differences between groups regarding the subjective experience of time, the observed differences could not be attributed to differences in the socio-demographic structure of three groups. Not only are the differences obtained on the scales used fully consistent with the expectations, but also the *directions* of the differences, suggesting that the subjective time experience is more disturbed in those with PTSD than in the group of people with other psychiatric disorders.

On the other hand, the mean values on the *Present Concentration* scale show the opposite trend: the subjects with PTSD have significantly greater focus on the present than the healthy ones, while it is higher (although not significantly) than in the group with other disorders. This finding is also in line with expectations, regarding the theoretical assumptions and research findings linking the pronounced focus on the present with a higher level of psychopathology.[39]

Results of previous *temporal extension* studies in psychiatric disorders, being obtained in different populations and using different methods and terminology are inconsequential and hard to compare.[40] Our study found no significant differences between the groups on the *TEIF* and *TEIP* scales, although statistical significance appears to be in correlation of these time scales with individual clusters of PTSD, and dimensionally, with the intensity of the symptoms, as will be discussed. For the group with other disorders this finding could come from the impact of conflicting changes of time extension in a variety of disorders within the group. Our results demonstrate that intuitive expectation of significantly greater extension of the past is not met in the PTSD group.

In terms of *speed* of subjective passage of time, it was revealed that the size of the deviation from the typical or average results on *VA Scale*, though present in relation to the healthy subjects, is not specifically related to PTSD compared to the subjects with mixed psychopathology.

The correlations between PTSD individual clusters (B, C and D) and the subjective time experience in PTSD (Secondary goal 1) show that the *Succession* scale is significantly related to hyperarousal (Table 3). Though the time scale correlations could be *prima facie* expected to be significant with the intrusions cluster, it is not the case here. A likely explanation for this finding could lie in the fact that only one symptom is required to meet Criterion B, as it was the case with a lot of our examinees, which therefore resulted in a shift of frequency distributions of intrusive symptoms towards the lower values reducing the *linear* correlation coefficient. The scale which otherwise shows no significant intergroup differences, *TEIF*, in this analysis, quite unexpectedly, showed up to be significantly associated with intrusions and avoidance/numbing clusters, a finding possibly resulting from polymorphism of PTSD symptoms, they being divided into three clusters.

In order to additionally substantiate the thesis about the alteration of subjective time experience in PTSD we analyzed a further assumption (Secondary goal 2), that an alteration is in proportion to the increasing intensity of PTSD symptoms (Table 4). Taken together, in our study changes in certain aspects of subjective time experience, especially on a *Succession* scale, were more pronounced with an increase in PTSD intensity, while the *Mississippi Scale* was somewhat more discriminatory than intensity criteria derived from the *CAPS*. In accordance with expectations and results of Primary goal investigation, increased PTSD intensity was associated with lower scores on the time scales in which higher scores reflect ''healthier'' subjective time experience (*Succession, Temporal Distinction and Goal Directedness*), while conversely, as before, stands for *Present Concentration*. Thus, a higher degree of pathology of this disorder can be expressed by an increased degree of subjective-time alteration. None of the PTSD intensity measures showed any correlation with an increased deviation from the ''normal'' speed of subjective time flow on the *VA Scale*, in accordance with the findings in the investigation of Primary goal. *TEIF* and *TEIP* are associated with higher scores of PTSD intensity derived from the *CAPS* and from the *Mississippi Scale*, respectively, a finding that may be interpretable insofar as measures of intensity here are more sensitive than categorical measures.

Conclusions

Results of the study show that aspects of the disturbed subjective experience of time are not merely picturesque epiphenomena of PTSD clinical manifestations, but could be conceived as specific and empirically measurable features of the inner temporal organization of psychic acts in people with PTSD. Most measured aspects of subjective time are disturbed in PTSD compared to the healthy individuals, and furthermore, alterations of succession and goal directedness aspects showed up as more prominent and specific disturbances in subjects with PTSD compared to those with other disorders taken together. Therefore, the application of the time questionnaires, and particularly TIQ, can be a useful additional diagnostic tool for the assessment of PTSD diagnosis and intensity, the latter in accordance with our finding that the increased intensity of PTSD symptoms is associated with stronger alterations of time experience. In therapy, such a reliance on empirical investigation and particular results could also represent the more accurate support for working through the specific subjective time disturbances in PTSD than staying at vague descriptions of those phenomena. Furthermore, staying with common intuitive expectations such as the pronounced past temporal perspective in this disorder, which was not confirmed in our research, could interfere with the more significant topics of therapy. Likewise, our contra-intuitive finding of a stronger association of the subjective time disturbances with avoidance/numbing than with the cluster of intrusions, could also be important for the proper direction of therapy.

Limitations and strengths

The discussion of the results of our study is limited by the fact that there are no previous *empirical* findings *directly* related to this subject, a circumstance that could also appear as a major strength of our approach. The conclusions derived from this study might be regarded as limited if applied to post-traumatic stress disorder in general, due to the sample wherein mainly war stressors were identified as traumatic events meeting Criterion A for PTSD diagnosis. However, the aim of the study was not epidemiological, and the results obtained specifically appertain to essential phenomenological manifestations of PTSD. Thus, further subjective time experience investigations in individuals with PTSD caused by other stressors might generate comparable results. The methodological limitations of the research are primarily related to the manner of forming the sample (on a ''snowball'' basis). Additional limitations include the diagnostically very heterogeneous sub-sample of individuals with other psychiatric disorders, and the retrospective character of the study. Yet, regardless of the limitations, this study, in

addition to interesting theoretical consequences, suggests potential usefulness of the investigation of subjective time experience disturbances for the diagnosis and treatment of PTSD.

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Conflicts of interest

None.

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