

ORIGINAL ARTICLE

Depressed mood and cognitive deficits as distinct mechanisms of subjective memory and executive complaints

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BACKGROUND

Subjective cognitive decline (SCD) is the sense of deterioration in cognitive functioning in terms of memory, executive function, attention, etc. SCD is reported by nearly 70% of the population. Very intensive research on the predictive role of SCD in the development of dementia and determinants SCD did not bring common solutions. For exploration of the phenomenon, studies were undertaken in order to identify: a) on the basis of which factors a high level of SCD can be predicted, and b) whether these factors have similar prognostic value for two types of SCD, i.e. concerning executive function (SED) and memory (SMD).

PARTICIPANTS AND PROCEDURE

The study involved 274 Polish people aged 18 to 84 years ($M = 53.23$, $SD = 16.8$). For the evaluation of SCD three methods were used: memory self-assessment scales (ProCog and MARS), and an executive functions self-assessment scale (DEX-S). Subtests of the WAIS-PL to assess cognitive function were used, and GDS-15 or BECK II to assess the severity of depressive mood. In the first stage, two separate cluster analyses (k-means method) were

performed: the first related to the results of the memory self-assessment scale (ProCog and MARS), the second to the subjective difficulty of executive functions (DEX-S). In step II a logistic regression analysis of the forward selection with the likelihood ratio and interaction effects was performed – separately for the two types of self-reports.

RESULTS

The results indicate that higher depressed mood increases the likelihood of both the SMD and SED. Higher efficiency attentional processes reduce the possibility of formulating the SED, and higher efficiency of the delayed memory, abstract thinking, or certain aspects of language functions reduces the possibility of SMD.

CONCLUSIONS

There are two independent mechanisms of SCD – emotional and cognitive.

KEY WORDS

subjective memory; executive complaints; depression; cognitive deficits

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BACKGROUND

In many areas of their professional activities, particularly in clinical psychology and neuropsychology, a psychologist has to deal with a sense of cognitive difficulties reported by the patient/client. The subjective feeling of cognitive difficulties (SCD – subjective cognitive decline; SCI – subjective cognitive impairment; SCC – subjective cognitive complaints) is defined as the belief in a general or selective weakening of cognitive functioning compared to earlier own capabilities (Jessen et al., 2014). SCD may refer to (different types) memory (SMD – subjective memory decline), executive functions (SED – subjective executive dysfunctions), language difficulties (SLD – subjective language deficits), attentional (SAD – subjective attentional deficits), but rarely to the other aspects of cognitive function (Rabin et al., 2015). The list of terms proposed in the literature does not cover all types of complaints encountered in clinical practice, but data indicate that SCD turnout is high and affects from 25-50% of adults (Jonker, Geerlings, & Schmand, 2000) up to 67% (Begum, Morgan, Chiu, Tylee, & Stewart, 2012). Status phenomenon is intriguing not only because of its universality but also the fact that it concerns both individuals with neurological diseases and healthy persons, well functioning in everyday life, so many countries have undertaken extensive research exploration of the phenomenon (Chan, 2001; Langlois & Belleville, 2014; Burmester, Leathem, & Merrick, 2016). SCD reported in contact with a psychologist/doctor starts the procedure for diagnosis, medical care and social services, inappropriate and often expensive (Mendonça, Alves, & Bugalho, 2016).

From the point of view of clinical practice, being able to identify at least two reasons for SCD is the leading problem of current scientific analysis. The first concerns the predictive value of SCD for the development of MCI (mild cognitive impairment) or dementia in people who perform cognitive tasks well or slightly lower than the normal level, reporting at the same time a feeling of deep difficulties (Ávila-Villanueva & Fernández-Blázquez, 2017). Therefore, links between SCD and biochemical markers, gray matter, white matter, or hippocampal volumes are analyzed (Fyock & Hampstead, 2015). Uiterwijk et al. (2014) disclosed the relation between the intensity of SCD in individuals with hypertension and cognitive deficits and the presence of diffuse cerebral microhaemorrhage. Hohman et al. (2011) showed that more severe complaints of seniors was associated with increased regional blood flow in the area of the cerebellum while performing memory tasks, interpreted as compensatory brain activity. Kryscio et al. (2016) based on the assessment of cognitive function of 154 volunteers separated two groups: with dementia and without dementia. They analyzed retrospectively, among others, complaints formulated during the various stages

of research. Only in some of the “complainers” had dementia symptoms developed, which, according to the authors, testifies to the heterogeneity of complaints and the uncertainty of their predictive value. Other data have shown the relation between SCD and the biomarkers of brain pathology, i.e. amyloid (Perrotin, Mormino, Madison, Hayenga, & Jagust, 2012), A β 42-CSF, CSF-Tau/CSF-pTau181 (a marker of neuronal degeneration associated with the presence of tau protein) in the cerebrospinal fluid (Visser et al., 2009). The inconclusiveness of data on the predictive value of complaints may be related to, among others, the use of their different definitions and terminology, evaluation methods, content items, which relate broadly defined cognitive or restrict it to the area of the memory (Stewart, 2012; Snitz et al., 2012; Gifford et al., 2015), and to the influence of many variables (e.g. the level of education, where the predictive value of SCD for the development of dementia was higher in patients with higher levels of education and good cognition) (van Oijen, de Jong, Koudstaal, & Breteler, 2007). Because of inconclusive data SCD attempts to recognize as one of the criteria of MCI or dementia in the early stages, they are currently being criticized (Edmonds et al., 2014; Lenehan, Klekociuk, & Summers, 2012).

The second reason for making the analysis, in connection with the confused status of SCD in clinical diagnosis, is its determinants. The most important issue is its relationship to the actual level of cognitive functioning. The way in which a man assesses his capabilities against actual results and/or opinions of loved ones is considered as an indicator of self-awareness – the adequacy or interference (Homskaya, 2017). This approach is important in clinical diagnosis. A plurality of individual reports and meta-analyses (Burmester, Leathem, & Merrick, 2016) did not provide conclusive results about the relationship between SCD and actual cognitive functioning, especially with regard to persons not treated so far neurologically. For example, Szepietowska and Kuzaka (2017) in studies of 118 people with different demographic and clinical characteristics showed that on the basis of complaints one cannot predict the level of overall cognitive function test assessed by Montreal Cognitive Assessment (MoCA). An important factor to report complaints of various contents can be lower cognitive abilities of older people, with diseases of the brain and risk groups of cognitive dysfunction (e.g. as a result of hypertension) (Vogel, Bhattacharya, Larsen, & Jacobsen, 2011; Liik, Vahter, Gross-Paju, & Haldre, 2009; Gass & Apple, 1997). However, in this case the relationship between SCD patterns and cognitive efficiency is varied.

Factors moderating severity of SCD are gender (female), level of education (low) and personality factors (Caramelli & Beato, 2008; Fritsch, McClendon, Wallendal, & Larsen, 2014). SCD may involve different factors in women (i.e. emotional) and men (clearly linked to actual abilities) (Tomita et al., 2014). It also looks at

the relationship of SCD with age, severity of depression, a sense of social support, the demand for social care, health or social activities. SCD often occurs in older people and increases with age (Stewart, 2012). They promote them as depressed mood, a higher level of anxiety and somatic symptoms, but may not be the cause of SCD and rather their effect (Cooper et al., 2011). This is well illustrated by a study conducted by Tandetnik et al. (2017) in a group of seniors showing that negative beliefs about sense of autonomy and efficiency are the cause of SCD. But complaints are also formulated by young adults. Significant increases in SMD and SCD prevalence across survey years (14 years) were found within the 25-34 and 45-54 years age groups, and more constant or decreasing prevalence in the 55-74 age years group (Begum et al., 2014).

Among emotional factors, depression is considered to be the most important determinant of SCD. This effect has been shown by many studies. For example, seniors with a history of depressive episodes are characterized by greater current severity of SCD (Chu et al., 2017). Depressive symptomatology and self-focused attention significantly contributed to the severity of subjective memory complaints in healthy older adults (Chin, Oh, Seo, & Na, 2014). The influence of depression on SCD has also been demonstrated in clinical groups. Post-stroke depressive symptoms, regardless of anxiety and fatigue, are associated with more SCD (van Rijsbergen, Mark, Kop, de Kort, & Sitskoorn, 2018). Patients with Parkinson disease (PD) with subclinical depression (SubD) and depressed PD patients reported more cognitive complaints than non-depressed PD patients (Santangelo et al., 2014). A meta-analysis (Brigola et al., 2015) indicated that depression may be, independently of other factors (anxiety, brain pathology, cognitive deficits), a determinant of SCD.

The inconclusiveness of the results is an effect not only of the complexity of the phenomenon itself and its determinants, but also methods of SCD assessment (usually short questionnaire technique or a single question in the interview) (Rabin et al., 2015; Rabin, Smart, & Amariglio, 2017).

PARTICIPANTS AND PROCEDURE

Due to the prevalence of SCD and their different determinants, studies were undertaken in order to identify: a) on the basis of which factors a high level of SCD can be predicted, and b) whether these factors have similar prognostic value for two types of SCD, i.e. concerning executive function and memory. The study was approved by the local Bioethics Committee. The inclusion criteria for participation in the study, conducted in the years 2016-2017, were: consent to participate in the study, the level of language function, perception and motivation, which guarantee the correct realiza-

tion of tests. These competencies are assessed by clinical psychological screening tasks (Łucki, 1995). Data on the state of health were obtained from the medical documentation of the participants. People with a history of psychiatric disease (schizophrenia, depression, bipolar disorder, addiction) or severe somatic diseases requiring long-term treatment (chronic renal failure, different types of cancer) were not included in the analyses. The final analysis enrolled 274 Polish people aged 18 to 84 years ($M = 53.23$, $SD = 16.0$). The proportion of female ($N = 149$, 54.4%) and male ($N = 125$, 45.6%) subjects was similar. 46.7% of subjects ($N = 128$) revealed the presence of neurological diseases (hypertension, history of head trauma or stroke) and 146 (53.3%) participants were healthy. Most of the participants had a secondary education (54.7%), the remainder higher (30.3%) or primary (15.0%).

The following techniques were used (taken in this order):

1. To evaluate the cognitive complaints: a) ProCog Questionnaire (*Patient Reported Outcomes in Cognitive Impairment*) (Frank et al., 2006). It consists of 55 items concerning memory, concentration, thinking, emotional reaction to the difficulties, a sense of loss of acquired skills and social constraints associated with the conviction of memory deficits. Due to the lack of a Polish adaptation of the tool the procedure's translation into Polish and then back-translation to the original language was used. The responses were expressed on a Likert scale from 0 points (*never*) to 4 points (*always*); lower results suggest the lack of a sense of difficulty, higher – more conviction about their intensity. The result ranges from 0 points (*no difficulty*) to 220 points (*a sense of very large memory disorders*); b) MARS Questionnaire (*Memory Awareness Rating Scale*) (Clare, Wilson, Carter, Roth, & Hodges, 2002; Clare, Whitaker, & Nelis, 2010). The self-reported part of MARS was used. The task of the study is to select answers on a Likert scale (from 0 to 4 points) in response to questions about various situations involving memory. The result is between 0 points (*no feeling of difficulty*) and 52 points (*the belief in such difficulties*). For the purpose of the study, the sum of the results from both methods (range 0-272 points) was calculated, and the result was converted into a percentage rate. Higher means greater sense of the severity of deficits; c) The questionnaire DEX-S (*Dysexecutive Questionnaire – Self*) for subjective assessment of the executive functioning in everyday life (Wilson, Alderman, Burgess, Emslie, & Evans, 1996). DEX-S consists of 20 questions relating to behavior involving executive functions. The test (in the Self version) involves selecting a point on the Likert scale from 0 (*never*) to 4 (*very often*). The maximum score (range 0-80 points) testifies to the perception at home of great difficulty in carrying out tasks involving executive functions.

2. To assess cognitive performance: a) MoCA (*Montreal Cognitive Assessment*) (Nasreddine et al., 2005), recommended and used in Poland in the diagnosis of neuropsychological disorders (Gierus et al., 2015). MoCA is used to assess short-term memory, visual-spatial function, executive, language, verbal fluency, attention, naming, abstract thinking and allopsychic orientation. The overall result (max. 30 points) indicates the general level of cognitive abilities; b) Subtests of the WAIS-scale: Digits forward, Digits backwards, and Vocabulary (Brzeziński et al., 2004).
3. To assess the severity of depressive mood: GDS-15 (Geriatric Depression Scale) (Yesavage et al., 1983) or BDI 2 (Beck Depression Inventory II) (Beck, Steer, & Brown, 1996). Each of these techniques assesses the intensity of the depressive mood of the last 2 weeks. Jefferson, Powers, and Pope (2008) indicate that the BDI-II positively correlated with the GDS ($r = .71$) and both instruments demonstrated good internal consistency. However, GDS-15 is more often used in the study of older people. Due to the different of assessment techniques in the analysis relative indicator was included.

Quantitative analyses were performed using IBM-SPSS version 24. Parametric tests were used when the variables had distributions closer to normal (Shapiro-Wilk test). In other cases non-parametric tests were used. In step 1, two separate cluster analyses were performed (cluster k-means): the first related to the memory self-assessment (on the basis of results in ProCog and MARS), the second to the executive function self-assessment (DEX-S). In step II logistic regression analysis forward selection of the likelihood ratio effects and interactions was performed separately for the two types of self-report.

RESULTS

SUBJECTIVE MEMORY DECLINE (SMD)

There were 2 clusters (cluster analysis) ($F = 354.51$, $p = .001$). Cluster 1 ($N = 31$) included people with higher complaints of memory (HSMD: $M = 50.80$, $SD = 9.16$), while cluster 2 ($N = 243$) included people with lower intensity SMD (LSMD: $M = 16.80$, $SD = 9.45$) ($t = 18.83$, $p = .001$). The characteristics of both groups are shown

Table 1

Characteristics of people with higher (HSMD) and lower (LSMD) intensity of subjective memory decline and comparisons between groups (Student's t test, Pearson's χ^2)

Variables	Subjective memory decline		
	HSMD ($n = 31$) M (SD)	LSMD ($n = 243$) M (SD)	t (p)
Age	61.03 (18.07)	52.20 (16.40)	2.78** (.006)
Intensity of depressive mood (%)	50.93 (26.82)	24.58 (18.43)	5.31*** (.001)
Vocabulary (WAIS-PL)	26.81 (17.30)	41.91 (15.31)	-5.12*** (.001)
Digits forward (WAIS-PL)	4.77 (2.06)	6.28 (1.96)	-3.99*** (.001)
Digits backwards (WAIS-PL)	4.29 (1.86)	5.52 (2.33)	-3.36** (.002)
MoCA	21.16 (5.16)	26.09 (3.50)	-5.16*** (.001)
Demographic data			
Neurological disease			
yes	25	103	χ^2 with Yates' correction = 14.72*** ($p = .001$)
no	6	140	
Gender			
female	19	130	$\chi^2 = 0.67$ ($p = .451$)
male	12	113	
Education			
basic	7	34	$\chi^2 = 5.45$ ($p = .081$)
secondary	20	130	
higher	4	79	

Note. ** $p \leq .01$, *** $p \leq .001$.

Table 2

Multivariate logistic regression model (forward selection of likelihood ratio), and odds ratio (OR) for the result of SMD (a lower level of SMD = 0, a higher level of SMD = 1)

Factors	B	Wald (Z)	Odds ratio Exp(B)	95% CI (confidence interval)	p
Intensity of depressive mood	0.04	14.4	1.04	< 1.02-1.06 >	.001***
MoCA delayed recall	-0.35	5.64	0.71	< 0.53-0.94 >	.020*
MoCA naming	-1.55	8.57	0.21	< 0.07-0.59 >	.003**
MoCA abstract thinking	-0.64	4.13	0.53	< 0.28-0.97 >	.040*

χ^2 for the model = 65.77, $p = .001$; -2 logarithm of likelihood = 127.68; $R^2_{\text{Cox \& Snell}} = 0.210$; $R^2_{\text{Nagelkerke}} = 0.42$;
 $\chi^2_{\text{Hosmer and Lemeshow test}} = 6.18$, $p = .620$; percentage of correct classifications 90.5.

Note. * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

in Table 1. Compared to LSMD, HSMD are significantly older, they obtain lower scores in cognitive tests/subtests, are characterized by elevated depressed mood, and most of them have neurological conditions (mainly hypertension). In the LSMD group there were differences in the severity of SMD between people with neurological history and healthy people ($M_{\text{healthy}} = 15.39$, $SD = 8.54$; $M_{\text{neurological disease}} = 18.90$, $SD = 10.26$; $Z = -2.55$, $p = .012$), whereas in HSMD such differences were not recorded ($Z = -1.5$, $p = .130$). In LSMD, females ($M = 17.90$, $SD = 9.70$) and males ($M = 15.70$, $SD = 9.00$) did not significantly differ in severity of SMD ($t = 1.9$, $p = .081$). In the HSMD group, there were no gender differences (females: $M = 49.40$, $SD = 6.70$, males: $M = 52.90$, $SD = 12.10$, $t = -1.01$, $p = .321$).

In logistic regression analysis the following variables were included: qualitative (gender, type of education, neurological condition), and quantitative: severity of depression, age and the results of the MoCA test subscales (Table 2).

The factor that about 1.1-fold increases the likelihood of reporting SMD is higher severity of depression, while greater efficiency of delayed recall, abstract thinking and naming reduce the likelihood of reporting such complaints. There was no interaction of depression with cognitive variables. Other variables were not predictors of higher intensity SMD.

SUBJECTIVE EXECUTIVE DYSFUNCTIONS

On the basis of the cluster analysis (result in DEX-S) 2 groups were separated. Group 1 ($N = 67$) obtained a higher DEX-S score (HSED: $M = 38.70$, $SD = 7.57$), while group 2 ($N = 207$) obtained a lower score (LSED: $M = 15.20$, $SD = 8.04$, $t = 21.15$, $p = .001$). Characteristics of HSED and LSED are presented in Table 3. Group HSED was characterized by a significantly higher intensity of depression, and a lower result in MoCA sum and Digits backwards from WAIS. Other variables do not differentiate groups.

In the LSED group, gender ($t = 0.89$, $p = .382$) and neurological status ($t = 0.09$, $p = .931$) did not differentiate the severity of complaints, and also in the HSED group gender ($t = -0.16$, $p = .882$) or neurological status ($t = 1.68$, $p = .122$) did not differentiate the severity of SED.

Just as before, the logistic regression analysis included qualitative variables (gender, education, neurological condition), and quantitative: the severity of depression, age and the results of the test MoCA subscales (Table 4). Among them, the higher the severity of depressive mood approx. 1 time increases, while better efficiency of attentional processes reduces the probability of formulating complaints about the executives functions. There was no interaction between depressive mood and attentional functioning, and other variables are not taken into account in the model.

DISCUSSION

The results are interesting in the context of very intense discussions on the determinants and predictive role of SCD. First of all, we noted that higher severity of a subjective dysexecutive problem is reported more often than memory deficits. A similar trend has been highlighted in other studies (e.g. Chan, 2001). This effect should be associated with a wide range of phenomena included in the DEX-S, some of which are closely related to the (dys) function and/or refer to a phenomena not related to EF (Chan, Shum, Toulopoulou, & Chen, 2008). Lower frequency of SMD can be the result of the use of targeted self-description techniques relating to various aspects of memory. In future research, it should be considered whether reporting of such high frequency of SED does not result from the use of techniques that treat the SCD too broadly.

It has been shown that a higher depressive mood increases the likelihood of both SMD and SED. It

Table 3

Characteristics of people with higher (HSED) and lower (LSED) intensity of subjective executive dysfunctions and comparisons between groups (Student's *t* test, Pearson's χ^2)

Variables	Subjective executive dysfunctions		
	HSED (<i>n</i> = 67) <i>M</i> (<i>SD</i>)	LSED (<i>n</i> = 207) <i>M</i> (<i>SD</i>)	<i>t</i> (<i>p</i>)
Age	53.60 (17.22)	52.93 (16.72)	0.41 (.661)
Intensity of depressive mood (%)	36.21 (24.26)	24.66 (19.34)	3.62*** (.001)
Vocabulary (WAIS-PL)	37.42 (16.12)	41.22 (16.23)	0.80 (.091)
Digits forward (WAIS-PL)	5.82 (1.93)	6.23 (2.06)	0.43 (.130)
Digits backwards (WAIS-PL)	4.91 (2.12)	5.54 (2.35)	0.27* (.031)
MoCA	24.70 (4.21)	25.80 (3.91)	0.47* (.042)
Demographic data			
Neurological disease			
yes	38	90	$\chi^2 = 3.56, p = .091$
no	29	117	
Gender			
female	42	107	$\chi^2 = 2.46, p = .121$
male	25	100	
Education			
basic	15	26	$\chi^2 = 5.12, p = .091$
secondary	37	113	
higher	15	68	

Note. **p* ≤ .05. ****p* ≤ .001.

Table 4

Multivariate logistic regression model (forward selection of likelihood ratio), and odds ratio (OR) for the result of SED (a lower level of SED = 0, a higher level of SED = 1)

Factors	B	Wald (Z)	Odds ratio Exp(B)	95% CI (confidence interval)	<i>p</i>
Intensity of depressive mood	0.03	11.25	1.02	< 1.01-1.04 >	.001***
MoCA attention	-0.25	5.39	0.78	< 0.63-0.96 >	.001***

$\chi^2 = 20.47, p = .001, -2$ logarithm of likelihood = 284.34, $R^2_{\text{Cox \& Snell}} = 0.090, R^2_{\text{Nagelkerke}} = 0.121, \chi^2_{\text{Hosmer \& Lemeshow}} = 3.89, p = .270$, percentage of correct qualifications 78%.

Note. ****p* ≤ .001.

causes an increase in beliefs about the difficulties in planning and controlling behavior, memory, recall delayed or current facts of life, and increased belief in the loss of acquired skills and social relationships. This result, indicating the role of depression in SCD, is consistent with many reports concerning both healthy people and different clinical groups (Dux et al., 2008; Singh-Manoux et al., 2014; Santangelo et al., 2014). However, this probability is not high (odds ratio ≈ 1), and this is related to the low values

of depressed mood in the subjects. The result shows a tendency that is also discussed in the literature.

The results suggest that higher efficiency of cognitive processes may play a protective role in the formation of complaints, but, depending on the type of SCD, the importance of protective will perform another type of cognitive functions. A low sense of executive difficulty is the result of better efficiency of attentional processes (Szepietowska & Kuzaka, 2018), and low sense of memory difficulty – higher efficien-

cy of delayed memory, abstract thinking, or certain aspects of language functions (Balash et al., 2013). It can be assumed that the deficits of these functions will favor SCD. This result is consistent with the meta-analyses that showed both the negative relationship between SCD and cognitive function level and the need to search for specific cognitive (Singh-Manoux et al., 2014) and psychosocial predictors (Lubitz, Eid, & Niedeggen, 2018) for different types of complaints. Moreover, various types of complaints may have different meaning for the development of predictive subtypes of MCI or dementia (Gu, Fischer, Saposnik, & Schweizer, 2013). Regarding the importance of data in clinical practice, it has been shown that cognitive function training reduces the severity of SCD in healthy older adults (Kwok, Bai, Li, Ho, & Lee, 2013), especially in adults with SCD (López-Higes et al., 2018) and after stroke (van de Ven et al., 2017).

It was not shown that demographic and clinical variables (presence/absence of CNS pathology) and the interaction between the severity of depressive mood and cognitive levels significantly shaped the probability of occurrence of SCD. Taking into account the results of regression analyses one can talk about two separate mechanisms of sense of cognitive deficits. One of them, of a non-specific nature, is a depressed mood, and the second – level of selected cognitive function. In among people with SCD are both so those that exhibit depressed mood, and people with cognitive deficits – generalized or selective. Many other studies have shown that depressed mood and anxiety are better predictors of SCD than slightly severe cognitive deficits (Yates, Clare, & Woods, 2017). Snitz et al. (2015) noted that the relationship between the variables, especially the real possibilities, and SCD are complex and dynamic; therefore, one should consider changes in the described relationships.

Referring to the discussions outlined in the introduction, whether the SCD can be considered as an indicator of actual cognitive difficulties or depressive mood, we have reason to indicate two mechanisms of SCD – emotional and/or cognitive. Stimulation of cognitive functions and/or prevention of depression (treatment) are effective in reducing complaints in people without dementia (Kwok et al., 2013; López-Higes et al., 2018; van de Ven et al., 2017). However, these techniques may not be effective when complaints are part of developing dementia. Further research should aim to improve the methods of the questionnaire addressed to narrow aspects of SCD.

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