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Emotion regulation choice in female patients with borderline personality disorder: Findings from self-reports and experimental measures

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ABSTRACT

Emotion dysregulation is a core feature of borderline personality disorder (BPD). So far, many studies have tested the consequences of the implementation of certain emotion regulation (ER) strategies, but there have been no investigations about ER choices in BPD. Thus, the aim of this study was to investigate habitual ER choices by self-report questionnaires and experimentally by testing the preference to select between distraction and reappraisal when facing different emotional intensities (high vs. low) and contents (borderline-specific vs. unspecific negative) in patients with BPD ($n=24$) compared with clinical controls (patients with major depression, $n=19$) and a healthy control group ($n=32$). Additionally, heart rate (HR) responses were continuously assessed. Main results revealed that both patient groups showed maladaptive self-reported ER choice profiles compared with HC. We found, however, no differences between the groups in the choice of distraction and reappraisal on the behavioral level and in HR responses. In BPD, within-group analyses revealed a positive correlation between symptom severity and the preference for distraction under high-intensity borderline-specific stimuli. Our findings provide preliminary evidence of ER choices in BPD and show the robustness of the choice effect in patients with affective disorders.

1. Introduction

Borderline Personality Disorder (BPD) is characterized by a pervasive pattern of emotional, cognitive and behavioral disturbances. According to biosocial theory (Linehan, 1993a), emotion dysregulation is a core feature of BPD, and characterized by heightened emotional sensitivity and reactivity, increased negative affect and slow return to emotional baseline (for a review see Carpenter and Trull, 2013). It is of note, though, that most of the studies showing emotion regulation (ER) deficits in patients with BPD have used self-report questionnaires which assess the *subjective* report of habitual ER use (e.g., Svaldi et al., 2012b; Scherer et al., 2013). Despite its importance, questionnaires bear several methodological complexities including their susceptibility to demand characteristics together with a hypothetical and retrospective report. Therefore, studies which assess possible ER deficits in BPD at a *behavioral* and *physiological* level are additionally needed.

Previous experimental studies have almost exclusively investigated the consequences of implementing certain ER strategies in patients with BPD without considering the context in which strategies are applied (e.g., Schulze et al., 2011; Svaldi et al., 2012a). These studies examined the efficacy of ER strategies, which is important for the development and improvement of therapy protocols for BPD. As a next step, research is needed that respects contextual demands when investigating the implementation of ER strategies (e.g., Aldao and Dixon Gordon, 2014), as nascent literature suggests that the adaptiveness of a certain strategy depends on the context as well as the flexibility of ER strategy use (for reviews see Bonanno and Burton, 2013; Aldao et al., 2014).

Furthermore, little is known about context-dependent emotion regulatory *choices* in patients with BPD. *ER choice* is defined as 'the choices individuals make as to how they should regulate their

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emotions in a particular context when regulation is warranted and more than one regulatory option is active' (Sheppes, 2014, p. 126). To investigate major determinants and the underlying mechanisms of ER choices, Sheppes and colleagues recently tested the contextual influence of emotional intensity on the choices of different ER strategies in healthy individuals (Sheppes et al., 2011, 2014). In their studies, distraction was contrasted with reappraisal in situations of high versus low negative intensity. Distraction involves focusing attention on non-emotional aspects of the situation (Van Dillen and Koole, 2007) or on something entirely different. Thereby, stimuli with high and low emotional intensity can be regulated before the emotional information is processed (Sheppes et al., 2011). In contrast, reappraisal involves a cognitive transformation of the situation so as to alter its emotional impact (Gross, 1998). This strategy is only effective in the regulating of low-intensive information, as the regulation of high-intensive information would require too much cognitive resources (Sheppes and Meiran, 2007, 2008). In view of this *cost-benefit trade-off* it was shown that healthy individuals choose reappraisal when the intensity of negative emotions is low, and distraction when the intensity of aversive emotions is high (Sheppes et al., 2011, 2014).

Given these emotional intensity dependent effects of ER choice, the question arises whether patients with BPD deviate from healthy controls (HC) in the adequate timing of its application. Against the background of biosocial theory (Linehan, 1993a) and plenty of studies evidencing ER skill deficits in BPD (e. g., Glenn and Klonsky, 2009) as well as maladaptive regulatory preferences via self-reports in BPD (e. g., Salsman and Linehan, 2012), it can be assumed that patients with BPD have a rigid and context-insensitive ER style. For instance, rumination is associated with borderline symptom severity and borderline features (e. g., Smith et al., 2006; Baer and Sauer, 2011). According to the "emotional cascade model" (Selby and Joiner, 2009), ruminative processes lead to a vicious cycle resulting in an extreme aversive state of heightened negative affect and requiring salient forms of distraction, i. e., dysregulated behaviors like non-suicidal self-injury, substance abuse or binge eating (Selby et al., 2009; Selby and Joiner, 2013). Furthermore, other studies indicate a lower availability of functional ER strategies in BPD (e.g., the use of self-inflicted injuries as a maladaptive problem-using strategy; for an overview see Neacsiu, Bohus and Linehan, 2014), which might impair functional ER choices. So far, however, no study has tested ER choices directly in patients with BPD.

The aim of the present study was to investigate ER choices in patients with BPD. A multi-method approach was used to test ER choices on different levels and in different contexts. At the *subjective level*, we examined subjective ER choices via questionnaires assessing the frequency of use of different strategies across situations. At the *behavioral level*, ER choices were directly assessed in diverse contexts (i.e., both in low vs. high intensive emotional stimuli, and in borderline-specific vs. unspecific stimuli). Because of possible differences in emotion generation between groups, we also conducted *within-group analyses* and correlated differential scores of symptom severity with the choice preferences. At the *physiological level*, transient heart rate (HR) responses were obtained to measure the course of physiological stress during the emotion induction and regulation phase.

To test whether the findings are specifically related to BPD, to affective disturbances or to psychopathology in general, we included not only a HC group, but also a clinical control group with patients with major depressive disorder (MDD). Because patients with MDD are characterized by emotion dysregulation (for a review see Barnow et al., 2013), too, and depressive disorders are among the most frequent comorbid disorders in BPD (e.g. Kaess et al., 2013), the selection of this control group was considered to be crucial in terms of etiological differentiation between both disorders.

To broaden the aspect of context, we varied not only the intensity of negative emotions, but also the content of the stimuli. Against the background of recent findings evidencing a specific emotional hyper-reactivity in response to borderline relevant themes like rejection and abandonment (Hazlett et al., 2007; Limberg et al., 2011), interpersonal triggers (Dixon-Gordon et al., 2013), trauma- (Lobbestael and Arntz, 2010) or schema-related topics (Sauer et al., 2014) in BPD, we applied two sets of stimuli: Unspecific negative pictures from the International Affective Picture System (IAPS; Lang et al., 2008) and borderline-relevant pictures (Sauer et al., 2014).

Furthermore, it is yet to be studied whether ER deficits in BPD also result from an unsuccessful application of more adaptive ER strategies. Therefore, we assessed subjective effectiveness ratings in our experimental paradigm. Thus, not only the choice of ER strategies in certain contexts was assessed but also the subjectively perceived effectiveness of ER strategy implementation. To the best of our knowledge, no study has tested the link between ER implementation and subjective effectiveness of implementation yet.

Considering the findings mentioned above, we had the following hypotheses. First, we expected that at the subjective level, patients with BPD would show a maladaptive ER choice profile (i.e., significant less use of adaptive ER strategies like reappraisal and distraction, more use of maladaptive strategies like rumination, catastrophizing, and self-blame) in self-report questionnaires compared with patients with MDD and HC. At the behavioral level, we hypothesized that patients with BPD differ in their choice behavior from MDD and HC. In light of emotional cascades (Selby and Joiner, 2009) and emotional hyper-reactivity in BPD, we expected a preference for distraction in patients with BPD compared with MDD and HC, especially in response to borderline-specific pictures. Further, we hypothesized a modulation of the choice behavior by borderline symptom severity. At the physiological level, we predicted that patients with BPD would show higher physiological stress during the ER choice paradigm compared with MDD and HC.

2. Methods

2.1. Subjects

Patients with BPD and MDD were recruited through two outpatient clinics of Heidelberg University, Germany, as well as newspaper announcements. HC were recruited by postings and newspaper announcements. We tested exclusively women because of sex differences in emotion processing and ER (Nolen-Hoeksema, 2012). The BPD group consisted of women meeting at least five criteria for BPD of the *Diagnostic and statistical manual of mental disorders* (DSM-5; American Psychiatric Association, 2013). In the MDD group, all patients fulfilled the criteria of an affective disorder (major depression disorder or dysthymia, current or remitted) and had no post-traumatic stress disorder or Cluster B Personality Disorder.[1] Exclusion criteria for all participants were the presence of current substance abuse or addiction, bipolar disorder, current or past psychosis, schizophrenia, acute suicidality as well as the intake of antipsychotics or benzodiazepines. In the HC group, a further exclusion criterion was the presence of a current or lifetime diagnosis of a mental or personality disorder.

[1] Patients with MDD either did not fulfill the cut-off of five criteria in the SCID-II questionnaire or showed not more than two BPD criteria in the SCID-II interview (data missing for three outpatient cases).

All participants had to have an age between 18 and 45 years. All Axis I diagnoses were determined by the Structured Clinical Interview for DSM-IV Axis I (SCID-I; First et al., 1997a; German version: Wittchen et al., 1997) and Axis II (SCID-II; First et al., 1997b; German version: Fydrich et al., 1997), conducted by trained psychologists.[2] To clarify personality disorder diagnoses, all participants were screened with the SCID-II (First et al., 1997b; German version: Fydrich et al., 1997) questionnaire, and diagnoses were confirmed by conducting the SCID-II interview.

All participants gave informed consent and were compensated for their time (course credit or 30–50€). The study was approved by the ethical board of Heidelberg University according to the Declaration of Helsinki.

In total, 78 women participated in the study. Two women of the HC had to be excluded due to clinically relevant scores in the Beck Depression Inventory II (14) and the Borderline Symptom List 23 (1.17). One woman of the BPD group had to be excluded from the analysis due to technical problems at the time of measurement. Finally, $n=24$ BPD patients, $n=19$ depressive patients, and $n=32$ HC were left for data analyses. Post-hoc power analysis (calculated with gpower 3.1.5.) suggests that our sample size of $N=75$ had a power of 0.98 to detect a medium effect size (i. e., $\eta^2=0.06$).

Two patients of the MDD group had to be excluded from the psychophysiological analyses due to technical problems with the psychophysiological measurement. See Table 1 for comorbidities, medication and psychotherapy experience.

Comorbidity in patients with BPD is mainly consistent with other studies (Kaess et al., 2013) except that only one patient with BPD was diagnosed with a comorbid PTSD. Patients with BPD and MDD did not differ significantly in terms of the rate of comorbid Axis I or II disorders (see Table 1).

Table 1
Comorbidities, medication and psychotherapy experience of the clinical groups.

	BPD $n=24$		MDD $n=19$		*Statistics* χ^2	p
	n (%)/	*M (SD)*	*n (%)/*	*M (SD)*	(1)	
Substance Abuse Disorder (lifetime)	4	(16.6)	1	(5.6)	1.34	0.363
Affective Disorders						
- Major Depression	3	(12.5)	5	(26.3)	6.19	0.185
- Major Depression partly remitted	0	(0.0)	1	(5.3)		
- Rec. Depressive Disorder	9	(37.5)	6	(31.6)		
- Rec. Depressive Disorder remitted	5	(20.8)	6	(31.6)		
- Dysthymia	1	(4.2)	5	(26.3)	4.33	0.072
Panic Disorder	2	(8.3)	2	(10.5)	0.06	1.000
Phobic Disorder	3	(12.5)	2	(10.5)	0.04	1.000
OCD	1	(4.2)	0	(0.0)	0.81	1.000
Posttraumatic Stress Disorder	1	(4.2)	0	(0.0)	0.81	1.000
Eating Disorder	9	(37.5)	4	(21.1)	1.36	0.324
Comorbid Personality Disorders[1]						
Cluster A	4	(16.7)	2	(10.5)	0.33	0.678
Cluster C	2	(8.3)	0	(0.0)	1.66	0.495
Medication						
Antidepressants	8	(33.3)	8	(42.1)	0.35	0.621
Psychotherapy experience atleast one inpatient PT	9	(37.5)	5	(26.3)	0.60	0.523
Outpatient PT in month	43.83	(43.1)	18.21	(22.7)	2.51[a]	0.017*

Note: BPD=Borderline Personality Disorder; MDD=Major Depressive Disorder; OCD=Obsessive Compulsive Disorders; PT=psychotherapy.

[a] *d.f.* =36.22.

[1] There were no comorbid Cluster B personality disorders.

* $p < 0.05$.

2.2. Materials

2.2.1. Questionnaires

The following questionnaires were completed online at home during the week prior to the experimental session to assess psychopathology and habitual ER: (1) The Borderline Symptom List, short version (BSL-23; Bohus et al., 2009) consists of a visual analogue scale for well-being and 23 items which quantitatively assess the severity of borderline symptoms. All items and the well-being scale are related to the past 7 days. The BSL-23 displays very good psychometric properties (Bohus et al., 2009). Internal consistency in our sample was excellent (Cronbach's $\alpha=0.96$). (2) To assess the severity of depression over the last two weeks we used the Beck Depression Inventory-II (BDI-II; Hautzinger et al., 2006), a dimensional self-report measure consisting of 21 items. The questionnaire has been validated in different clinical and non-clinical samples. Its psychometric properties are good to excellent (Kühner et al., 2007a). Internal consistency in our study was $\alpha=0.94$. (3) The Symptom Checklist 9 (SCL-9; Klaghofer and Brahler, 2001), a German short version of the revised symptom checklist (SCL-90-R; Derogatis, 1977), is a self-report questionnaire assessing the global distress level. The correlation with the global severity index (GSI) of the SCL-90-R is high ($r=0.93$, Prinz et al., 2008). The 9 items are rated on a five-point-Likert scale ranging from 0 (=*not at all*) to 4 (=*very much*). Internal consistency in our study was very good (Cronbach's $\alpha=0.91$). (4) The German version of the Cognitive Emotion Regulation Questionnaire (CERQ; Garnefski and Kraaij, 2007; Loch et al., 2011) consists of 27 items, which assess the degree to which individuals habitually use 9 different cognitive ER strategies to regulate negative emotions. Next to the subscales for acceptance, catastrophizing, other-blame and self-blame, the questionnaire includes three subscales which assess different forms of cognitive reappraisal (positive reappraisal, refocusing on planning, putting into perspective) and one for positive refocusing/distraction. Items are rated on a five-point Likert scale ranging from 0 (=*almost never*) and 4 (=*almost always*). The questionnaire demonstrates good internal consistencies, retest-reliability and construct validity (Loch et al., 2011). In our sample, the internal consistencies of the subscales ranged from Cronbach's $\alpha=0.62$ (catastrophizing) to from Cronbach's $\alpha=0.86$ (positive refocusing). (5) The German short version of the Response Styles Questionnaire (RSQ-D; Kühner et al., 2007b) assesses how people typically respond to sad or depressed mood. The three subscales (symptom-focused rumination, self-focused rumination, distraction) demonstrate good internal consistency, retest reliability and construct validity (Bürger and Kühner, 2007). The internal consistency of all three subscales was good ($0.80 \leq$ Cronbach's $\alpha \leq 0.85$).

2.2.2. Cognitive Tests

Multiple Choice Vocabulary Test - B (MWT-B). The MWT-B (German version: Lehrl, 2005) is an economic and valid measurement to estimate verbal intelligence (Lehrl et al., 1995; Satzger et al., 2002). In this paper-pencil-test, participants are presented with 37 lines with 5 words each, of which only one is a correct German word. The participants have to mark the correct word. The number of correct answers can be used as an indicator of verbal intelligence level.

2.2.3. Stimuli

Stimuli used in the ER choice paradigm consisted of 30 borderline-specific pictures (for detailed description of the selection and rating process of the pictures see Sauer et al., 2014) and 20

[2] Because videotapes of the diagnostic sessions were not available, interrater reliability cannot be provided.

unspecific photos from the IAPS (Lang et al., 2008). Both sets consisted of negative pictures, but differed in self-relevance for patients with BPD. The BPD pictures (BPD_{pics}) revealed BPD-relevant topics (e.g., quarrels between a couple, non-suicidal self-injury and sexual abuse), whereas the IAPS pictures ($IAPS_{pics}$) displayed negative events like emergency or war scenes.[3] Based on their normative ratings from female undergraduates for arousal (1=*low*; 9=*high*) and valence (1= very unpleasant; 9=very pleasant; Lang et al., 2005), the BPD_{pics} and the IAPS set were divided into two categories with different intensity level. The IAPS set consisted of 10 pictures with low (mean arousal=4.72; mean valence=3.50) and 10 pictures with high intensity (mean arousal=6.15; mean valence=1.76). High and low pictures differed in their level of intensity for arousal and valence, $F(1, 18) > 15.67$, $p \leq .001$.[4]

The 30 BPD_{pics} comprised 14 low-intensity pictures and 16 high-intensity pictures, which differed in their level of intensity for arousal and valence, $ts(28, 21.13) \geq 8.62$, $p \leq 0.001$ (see Supplement A for means of valence and arousal for each group). As heightened emotional reactivity is a symptom of BPD, and decreased emotional reactivity to negative stimuli characterizes MDD (Bylsma et al., 2008; Rottenberg et al., 2002), the three groups differ in valence and arousal ratings in high-intensive pictures and arousal ratings in low-intensive pictures in the BPD_{pics} (see Supplement A).

2.2.4. Effectiveness ratings

To assess the subjective effectiveness of the ER strategy employment, participants had to rate one question, i.e., how successful they could employ the strategy, on a five-point Likert-scale (*1*=I totally could not employ the strategy successfully; *5*=I totally could employ the strategy successfully) after each trial.

2.2.5. Psychophysiology

For the physiological measurements we assessed HR responses during the ER choice paradigm. Additional physiological data were obtained for purposes not related to the present research question. For each trial, the data in the time window beginning 1 s before picture onset and ending 6 s after picture onset were analyzed in 1 s time frames.

2.3. Experimental paradigm and procedure of the ER choice

All participants were tested individually and passed two experimental sessions, with an interval of one week between the appointments. At the first session they received study information and signed informed consent before diagnostic interviews were conducted. The second session comprised the experimental paradigm. It took place in a dimly lit laboratory room with a separated space where the experimenter sat. Upon arrival, participants were told that they were going to accomplish an experiment involving negative pictures, with the aim of better understanding ER deficits in BPD. Following that, participants completed questions about medication and drug intake (caffeine, nicotine, alcohol). All participants were asked to take no caffeine and nicotine at least 2 h prior to the experiment and no antihistamines on the day of the experiment because of their effects on physiological arousal (Genovese and Spadaro, 1997; Quinlan et al., 2000; Grillon et al., 2007; Nater et al., 2010).

Following the procedure and instructions of Sheppes et al. (2011), all participants completed a four-trial training phase. During this, they looked at negative pictures and were instructed either to think about something that was emotionally neutral (distraction) or to think about each picture in a way that reduces its negative meaning (reappraisal). The training phase consisted of four distraction trials (with high negative pictures) and four reappraisal trials (with low negative pictures).[5] The participants were not told that these pictures differed in their emotional intensities. During an eight-trial practice part, participants could freely choose which strategy they want to apply. They were instructed to choose the strategy that would be most effective to regulate their negative emotions. To ensure that all participants understood and adhered to the instructed regulation strategies, they had to talk out loud about their chosen strategies during the training phase and the first four practice trials.

After the training phase, there was a five minute baseline for the psychophysiological parameters. Following this, the 50 trials of the ER choice paradigm succeeded, interrupted by a one minute break after 25 trials. On each trial, participants previewed a stimulus for 500 ms and then chose between reappraisal and distraction by pressing one of two buttons. The assignment of reappraisal and distraction (depicted on the left or right side of the slide) was counterbalanced across all subjects. After the choice of the strategy, the picture stimulus was presented for 6000 ms again while participants applied the chosen strategy, followed by the assessment of the subjective ER effectiveness.

Following the 50 trials, all participants were asked to write down freely which strategies they had used when employing reappraisal and distraction (for different reappraisal categories see McRae, Ciesielski, and Gross, 2012; for different distraction strategies see Webb, Miles, & Sheeran, 2012).[6] For instance, participants reported to use the reappraisal strategy *change future consequences* ("The situation will improve with time."), or to use *active neutral distraction*, i.e., thinking about neutral thinks, e.g., work or all day situations.

Our dependent measures in the choice task were the distraction proportions for four categories: Distraction in low intensive borderline-specific pictures ($distraction_{low\text{-}BPDpics}$), distraction in high intensive borderline-specific pictures ($distraction_{high\text{-}BPDpics}$), distraction in low intensive IAPS pictures ($distraction_{low\text{-}IAPSpics}$), and distraction in high intensive IAPS pictures ($distraction_{high\text{-}IAPSpics}$).

2.4. Physiological data reduction for transient HR responses: immediate responses to picture presentation

Placement of electrodes as well as data recording and reduction were implemented according published guidelines for psychophysiological research (Cacioppo et al., 2007). HR measurements were recorded continuously using the multichannel recorder *Varioport* (Becker Meditec, Karlsruhe, Germany) at 256 Hz (single-lead ECG according to Einthoven II), respectively. The data were displayed on a laptop monitor to ensure signal quality and streamed to disk for further signal processing.

To obtain the HR time course with equidistant time steps, beat-to-beat HR values were re-sampled with 4 Hz using piecewise cubic spline interpolation after artifact correction. Single artifacts were replaced by interpolation. The data in the time window beginning 1 s before picture onset and ending 6 s after picture onset were analyzed in 1 s time frames [t1, t2, t3, t4, t5, t6; from picture onset (t1) to the end of the regulation phase (t6)]. Subsequently,

[3] We explicitly did not use pictures from the BPD-relevant IAPS picture set from Sloan et al. (2010).

[4] The IAPS identification number of the selected pictures were the following: for *low*: 2480, 2700, 2695, 2692, 3216, 9341, 9046, 9270, 3302, 6010; for *high*: 2375.1, 2683, 2095, 3051, 3261, 6212, 9253, 9410, 9423, 9921.

[5] As we also assessed strategy implementation effectiveness as a dependent variable, we trained the strategies in the most effective way.

[6] We qualitatively analyzed the answers (two raters independently, $0.75 \leq$ Cohen's $\kappa \leq 1.00$) and found no differences between the groups.

Table 2
Sample characteristics.

	BPD (n = 24)		MDD (n = 19)		HC (n = 32)		*Statistics*	
							F/χ^2	p
Age[1]	29.54	(7.38)	29.26	(5.75)	27.53	(6.89)	0.72	0.491
Years of education[1]	16.41	(2.54)	17.63	(3.09)	17.94	(3.53)	1.70	0.189
Level of education[2]							5.03	0.081
- low education	5	(20.8%)	4	(21.1%)	1	(3.1%)		
- high education	19	(79.2%)	15	(78.9%)	31	(96.9%)		
Marital status[2]							5.44	0.209
- single	17	(70.8%)	17	(89.5%)	27	(84.4%)		
- married	4	(16.7%)	1	(5.3%)	5	(15.6%)		
- divorced	3	(12.5%)	1	(5.3%)	0	(0.0%)		
BDI-II[1]	25.96[a]	(9.16)	23.42[a]	(10.18)	2.63[b]	(2.54)	82.18	≤ 0.001***
BSL-23 (Score)[1]	1.69[a]	(0.71)	1.26[b]	(0.78)	0.13[c]	(0.14)	57.54	≤ 0.001***
GSI[1]	2.02[a]	(0.72)	1.71[a]	(0.80)	0.31[b]	(0.28)	61.64	≤ 0.001***
MWT-B[1]	30.38[a]	(3.13)	30.84[a]	(2.59)	32.31[b]	(2.10)	4.27	0.018*

Note: BPD = Borderline Personality Disorder; MDD = Major Depressive Disorder; HC = Healthy Controls; BDI-II = Beck Depression Inventory-II; BSL-23 = Borderline Symptom List, short version; GSI = General Severity Index, measured with the symptom check list 9 (SCL-9); MWT-B = Multiple Choice Vocabulary Test-B.
[3]Statistics: $F_{(2,71)}$; one missing value in the HC group.

[1] Means (standard deviations); Statistics: $F_{(2,72)}$.
[2] Frequencies (percentages); Statistics: χ^2/Fisher's exact test.
[a,b,c] Different subscripts denote significant differences between groups.
* $p < 0.05$
*** $p < 0.001$.

for each participant, the changes of HR responses were averaged, synchronized at picture onset, across all trials of low and high intensity, respectively (see Lackner et al., 2013; Papousek et al., 2013).

2.5. Statistical analysis

Statistical analyses were calculated with SPSS 21. Demographic and diagnostic group differences were analyzed with chi-square-tests (χ^2) and t-tests (all two-tailed). If cell size was < 5, Fisher's exact test was used instead of χ^2-test because of its sensitivity to sample size. Hypotheses were tested using multivariate analyses of variance (MANOVAs) and covariance (MANCOVAs), repeated measures analyses of variance (ANOVAs) and covariance (ANCOVAs), paired t-tests and Multiple Regression Analyses (forced entry). If the assumptions of variance homogeneity or sphericity were not met (Levene's or Mauchly's Sphericity test < 0.05), degrees of freedom were corrected by Greenhouse Geisser. Significant effects were followed by Games-Howell post-hoc pairwise comparisons, which are recommended because of their good power when group variances differ (Field, 2009). Effect sizes of the group differences and interactions are reported by partial eta squared (η_p^2), whereby values up to 0.01 are classified as small, 0.06 as moderate and 0.14 as large effect sizes (Cohen, 1988).

2. Results

2.1. Sample characteristics

There were no significant differences between the three groups with regard to age, educational level, years of education and marital status (see Table 2 for means, standard deviations and statistics).

As expected, patients with BPD and MDD showed more depressive symptoms and higher stress level (GSI) compared with healthy women. Patients with BPD reported significantly more borderline symptoms than depressive and healthy women. Regarding verbal intelligence assessed with the MWT-B, we found higher scores in HC compared with the two clinical groups. As we studied cognitive ER strategies in particular, we controlled our results for MWT-B (centered) as a covariate.

2.2. Group differences in ER choices (subjective level)

Results of (M)ANOVAs revealed highly significant group differences with regard to habitual self-reported ER choices. Means (M), standard deviations (SD) and statistics are displayed in Table 3. Patients with BPD and MDD reported to use significantly more maladaptive and less adaptive ER strategies in the CERQ. Both patient groups chose less reappraisal (exception in MDD: *refocusing on planning*) and distraction than HC, but significantly more rumination, catastrophizing and self-blame. No group differences were found regarding the use of acceptance and other blame.

As we found differences in verbal intelligence, we controlled the results of the self-report questionnaires for MWT-B (centered) as a covariate, which revealed no significant effects of the covariate, $ps > 0.10$ (exceptions: RSQ subscale positive refocusing, $p = 0.029$, no changes in group effect, $p < 0.001$) and did not change the reported results (exception: CERQ subscale refocusing in planning, $p = 0.071$, ns).

2.3. ER choices (behavioral level)

Results clearly replicate previous findings regarding the choices in healthy individuals (Sheppes et al., 2011, 2014). Contrary to our prediction, there were no significant main effects of group, $Fs(2, 72) > 0.08$, $ps > 0.79$, ns. Fig. 1 shows that participants in all three groups did not differ in their choice behavior regarding all stimulus categories, $F(8, 140) < 1$. Most of the participants chose reappraisal to regulate negative emotions in low-intensive BPD_{pics}, and chose distraction in high-intensive BPD_{pics} $F(1, 72) = 180.12$, $p < 0.001$, $\eta_p^2 = 0.72$. Further, participants preferred reappraisal in low-intensive $IAPS_{pics}$, and distraction in high-intensive $IAPS_{pics}$, $F(1, 72) = 204.52$, $p < 0.001$, $\eta_p^2 = 0.74$. Overall, there was a tendency to use more reappraisal in all three groups. There was no difference between the picture categories (BPD_{pics} vs. $IAPS_{pics}$), $F(1, 72) < 1$.

We controlled these results for MWT-B (centered) as a

Table 3
Means, standard deviations and group contrasts in self-reported emotion regulation.

	BPD $n=24$		MDD $n=19$		HC $n=32$		*(M)Anova*	
	M	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*F (2, 72)*	*p*
Habitual ER								
$CERQ_{maladaptive\ ER}$	1.79_a	(0.55)	1.63_a	(0.53)	0.98_b	(0.37)	22.53	$\leq 0.001^{***}$
$CERQ_{adaptive\ ER}$	1.71_a	(0.64)	1.68_a	(0.70)	2.34_b	(0.62)	9.18	$\leq 0.001^{***}$
Reappraisal							3.21[a]	0.006^{**}
$CERQ_{positive\ reappraisal}$	3.92_a	(2.69)	4.00_a	(2.60)	6.25_b	(2.97)	6.21	$\leq 0.001^{***}$
$CERQ_{refocusing\ on\ planning}$	6.67_a	(2.66)	$7.05_{a,b}$	(3.31)	8.63_b	(2.78)	8.82	$\leq 0.001^{***}$
$CERQ_{putting\ into\ perspective}$	5.67_a	(2.70)	5.00_a	(2.89)	8.00_b	(2.48)	9.33	$\leq 0.001^{***}$
Distraction							7.50[b]	$\leq 0.001^{***}$
$CERQ_{positive\ refocusing}$	3.23_a	(2.47)	3.11_a	(2.13)	5.56_b	(2.58)	7.81	$\leq 0.001^{***}$
$RSQ_{distraction}$	16.46_a	(4.59)	14.74_a	(4.15)	21.50_b	(4.15)	17.60	$\leq 0.001^{***}$
Rumination							10.36	$\leq 0.001^{***}$
$CERQ_{rumination}$	7.88_a	(2.77)	6.95_a	(2.90)	5.34_b	(2.52)	45.84	0.003^{**}
$RSQ_{symptom}$	22.25_a	(3.91)	21.63_a	(4.09)	14.06_b	(2.87)	45.68	$\leq 0.001^{***}$
RSQ_{self}	19.54_a	(3.66)	19.05_a	(3.69)	13.31_b	(4.17)	21.96	$\leq 0.001^{***}$
Other ER Strategies								
$CERQ_{acceptance}$	6.17	(2.81)	6.05	(3.05)	6.72	(2.54)	0.45	0.642
$CERQ_{catastrophizing}$	4.33_a	(2.10)	4.00_a	(2.60)	1.41_b	(0.98)	20.34	$\leq 0.001^{***}$
$CERQ_{self\text{-}blame}$	6.04_a	(2.88)	6.32_a	(3.03)	2.97_b	(2.11)	13.64	$\leq 0.001^{***}$
$CERQ_{other\text{-}blame}$	3.17_a	(2.26)	2.32_{ab}	(1.77)	2.06_b	(1.44)	2.64	0.078
ER strategy effectiveness in								
high BPD_{pics}	3.09_a	(0.53)	3.35_a	(0.54)	3.73_b	(0.41)	12.33	$\leq 0.001^{***}$
low BPD_{pics}	3.95_{ab}	(0.55)	3.89_a	(0.46)	4.27_b	(0.40)	5.14	$\leq 0.01^{**}$
high $IAPS_{pics}$	3.05_a	(0.51)	3.15_a	(0.51)	3.55_b	(0.49)	8.34	$\leq 0.001^{***}$
low $IAPS_{pics}$	4.00_{ab}	(0.47)	3.85_a	(0.44)	4.25_b	(0.41)	5.35	$\leq 0.01^{**}$

Note: BPD=Borderline Personality Disorder; MDD=Major Depressive Disorder; HC=Healthy Controls; ER=emotion regulation; $CERQ_{maladaptive\ ER}$=Cognitive Emotion Regulation Questionnaire, aggregated score for maladaptive ER; $CERQ_{adaptive\ ER}$=CERQ, aggregated score for adaptive ER; RSQ=Response Styles Questionnaire; ER strategy effectiveness in high BPDpics, low BPDpics, high IAPSpics, low IAPSpics=ratings of subjective emotion regulation effectiveness in the experimental paradigm.
$_{a.b}$Different subscripts denote significant differences between groups.

[a] *d.f.*=6142
[b] *d.f.*=4144.
** $p<0.01$
*** $p<0.001$.

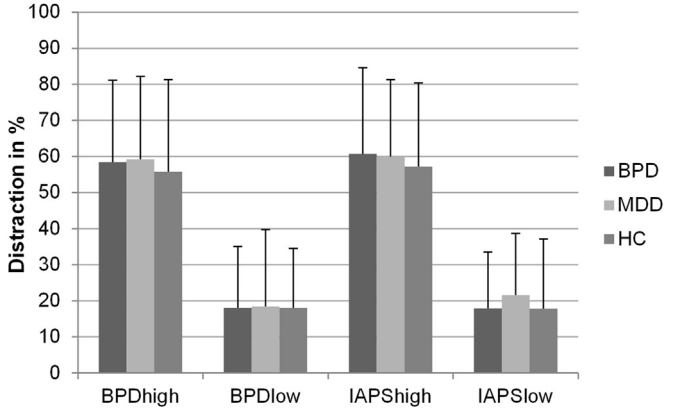

Fig. 1. Results of the Emotion Regulation Choice paradigm.
Note: Fig. 1: Distraction Choice frequencies depicted separately for each group in response to low-intensity (low) and high-intensity (high) borderline-specific pictures (BPD) or IAPS pictures. BPD=patients with Borderline Personality Disorder ($n=24$). MDD=Major Depressive Disorder ($n=19$). HC=Healthy Control ($n=32$).

covariate, which revealed no significant effects of the covariate (IAPS-set: $p=0.399$; BPD-set: $p=0.073$) and did not change the reported results.

2.3.1. Correlation between distraction proportion and symptom severity

In order to assess the correlation between strategy employment and symptom severity, we conducted one regression (forced entry) separately for each group with differential measures of symptom severity as dependent variables (BSL-23 for BPD; BDI-II for MDD and well-being [subscale of the BSL-23] in HC) and distraction proportions of all categories as independent variables. In MDD and HC, no model reached significance. In BPD, we found only one significant model for $distraction_{high\text{-}BPDpics}$ ($\beta=0.55$, $p=0.02$), whereas the overall model with all predictors reached no significance ($R^2=0.34$, $p=0.09$). This result shows that the borderline-specific psychopathology modulates the employment of distraction in high negative self-relevant pictures ($r=0.55$, $p<0.01$).

Note Fig. 2: Analyses of the correlation between borderline symptom severity (BSL-23) and distraction proportion in high negative borderline-specific pictures ($r=0.55$, $p=0.002$). The black line represents the regression line. Each rhombus indicates one patient with borderline personality disorder (BPD), the big rhombus indicates two patients. The dashed lines represent the mean proportion for all groups (distraction 58%, reappraisal 42%). All participants could choose between distraction and reappraisal to regulate their emotions. i.e., a high distraction proportion shows the employment of more distraction than reappraisal, whereas a low distraction proportion shows that patients preferred reappraisal.

2.3.2. Effectiveness ratings

See Table 3 for *M*s, *SD*s and group differences of subjective ER effectiveness. Overall, both patient groups stated that they employed reappraisal and distraction less successfully than HC. In

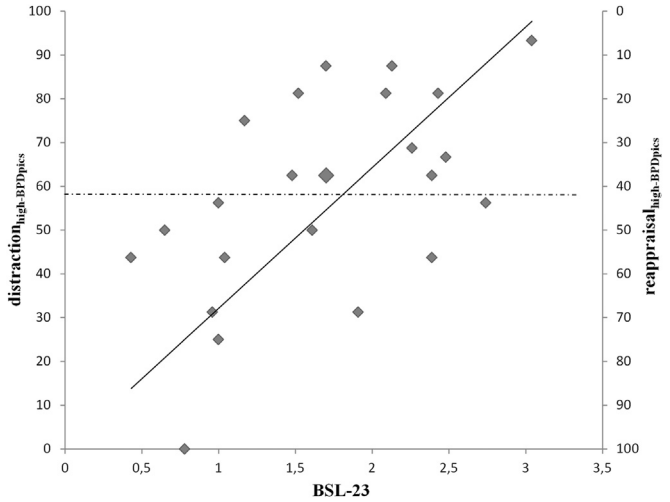

Fig. 2. Scatter plot for the correlation between borderline symptom severity (BSL-23) and distraction in high-negative borderline-specific pictures ($_{high\text{-}BPDpics}$) in patients with borderline personality disorder (n=24).

BPD_{pics}, results of a 2 (intensity: high vs. low) x 3 (group) ANOVA revealed a significant main effect of intensity, $F(1, 72)=133.91$, $p<0.001$, $\eta_p^2=0.65$, a significant main effect of group, $F(2, 72)=10.63$, $p<0.001$, $\eta_p^2=0.23$, and a significant group x intensity interaction, $F(2, 72)=3.61$, $p<0.032$, $\eta_p^2=0.09$. Subsequently conducted one-way ANOVAs showed significant group effects in the high, $F(2, 72)=12.33$, $p<0.001$, and low condition, $F(2, 72)=5.14$, $p<0.01$. Post-hoc tests revealed only significant performance difficulties in patients with BPD compared with HC in high intensive pictures ($p<0.001$), not in low intensive BPD_{pics} ($p=0.051$). There were no differences between BPD and MDD (all $p>0.28$). Patients diagnosed with MDD showed significant effectiveness difficulties compared to HC in high and low stimuli ($ps<0.05$).

In $IAPS_{pics}$, a 2 (intensity) × 3 (group) ANOVA showed a significant main effect of intensity, $F(1, 72)=191.47$, $p<0.001$, $\eta_p^2=0.73$, and a significant main effect of group, $F(2, 72)=8.75$, $p<0.001$, $\eta_p^2=0.20$. The group x intensity interaction was not significant, $F(2, 72)=2.29$, $p=0.109$, $\eta_p^2=0.06$. Subsequently conducted one-way ANOVAs revealed significant group effects in the high $F(2, 72)=8.34$, $p<0.001$, and low condition $F(2, 72)=5.35$, $p<0.01$. Post-hoc tests revealed significant performance difficulties in BPD compared with HC in high intensive pictures ($p<0.001$), but not in low intensive BPD_{pics} ($p=0.121$). There were no differences between BPD and MDD (all $p>0.50$). Patients diagnosed with MDD showed significant effectiveness difficulties compared with HC in high ($p<0.05$) and low stimuli ($p<0.01$).

2.4. Transient HR responses during the ER choice paradigm

In BPD_{pics}, a 2 (intensity) × 3 (group) × 6 (time) ANOVA with repeated measures on time revealed a significant main effect of time, $F(2.33, 160.57)=20.60$, $p<0.001$, $\eta_p^2=0.23$. In all three groups, HR increased from t1 to t3 (emotion induction) and decreased from t3 to t6 in high and low pictures (all $ts>2.56$, $p<0.05$) (regulation phase). The main effects of group and intensity as well as any interaction did not reach significance, $F<1.03$, $p>0.31$, $\eta_p^2<0.02$ (see Supplement B: Figure with transient changes in HR during ER processes).

In $IAPS_{pics}$, the results of the 2 (intensity) × 3 (group) × 6 (time) repeated measures ANOVA showed a significant main effect of time, $F(2.42, 167.07)=16.96$, $p<0.001$, $\eta_p^2=0.20$, and a significant time by intensity effect, $F(2.87, 198.03)=4.33$, $p\leq 0.01$, $\eta_p^2=0.06$, that indicates an increase of HR from t1 to t3 in high and low pictures, but a stronger decrease of HR in the high $IAPS_{pics}$ condition (in all groups: $ts>2.25$, $p<0.05$; one exception in the BPD group: Decrease from t3-t6 in low intensity $t(23)=2.05$, $p=0.052$). Also in this analysis, the main effect of group was not significant, $F(2, 69)=0.27$, $p=0.76$, $\eta_p^2=0.01$ (see Supplement B).

3. Discussion

To the best of our knowledge, this is the first study which comprehensively examined ER choices in patients with BPD. Therefore, we examined ER choices via self-report questionnaires in BPD compared with patients with MDD and HC (subjective level). Moreover, we experimentally investigated the behavioral choice between distraction and reappraisal when facing different emotional intensities (high vs. low negative intensity) and different contents (borderline-relevant vs. unspecific negative pictures). Furthermore, changes in HR were assessed.

As expected and in line with previous studies (Glenn and Klonsky, 2009; Svaldi et al., 2012b), patients with BPD differed from HC in their habitual ER choice behavior across situations in self-report questionnaires. Our findings show that patients choose less distraction and reappraisal strategies, but more rumination, catastrophizing and self-blame in daily life. Despite the diverseness of BPD and depression phenomenologies, we did not find any differences between both patient groups in self-reported *context-unspecific* ER. This result underlines recent research showing that emotion dysregulation is a transdiagnostic risk and maintenance factor for psychopathology in general (Berking and Wupperman, 2012; Werner and Gross, 2010).

Contrary to our hypothesis, we found no differences in ER choices between patients with BPD, MDD and HC at the *behavioral level*. Independently of the stimulus category (BPD-specific vs. unspecific IAPS pictures), in all experimental groups reappraisal was more frequently chosen in low-intensive negative pictures, whereas distraction was preferred in high-intensive negative pictures. This finding is the first evidence that patients with BPD and patients with MDD also show the same choice behavior like HC when regulating negative emotions with varying intensity. Further, our results replicate prior findings in healthy individuals (Sheppes et al., 2011; Sheppes et al., 2014) and is in line with a recent study investigating the ER choice in patients with bipolar disorder (Hay et al., 2014). Like in patients with bipolar disorder, no differences in the choice between BPD, MDD and HC indicate the ability to select appropriate ER strategies under the conditions of the choice paradigm (ER instruction; forced choice paradigm, i.e., the selection of two adaptive ER strategies; and a given choice point for when to regulate). Furthermore, it suggests a *cued ER ability* (Gruber et al., 2014) in patients with BPD and MDD.

In line with our hypothesis, we found a positive within-BPD-group correlation between symptom severity and distraction proportion in high negative BPD pictures. This finding indicates that symptom severity has to be taken into account when investigating ER deficits in BPD. In line with the possibility of a cued ER ability in patients with BPD, we found this effect only in high intensive pictures. This finding supports the possibility that the interaction of content (i.e., self-relevant topics) and intensity (high-intensive situations) increases emotional reactivity and influences ER in patients with BPD. One explanation for this result is that borderline symptom severity is associated with ruminative processes (e.g., Smith et al., 2006; Baer and Sauer, 2011). Thus, in patients with more severe symptomatic ruminative processes might be activated in response to high negative BPD stimuli. In line with the emotion cascade model (Selby and Joiner, 2009), rumination could possibly elicit emotional cascades that would lead to heightened emotional reactivity which, in turn, would increase the preference to choose distraction. However, more research is

needed to clarify the role of ruminative processes in the choice of strategies.

At the physiological level, we did not find heightened transient responses in HR during the choice task in BPD compared with MDD and HC – neither in BPD-relevant nor in unspecific pictures. In all three groups, HR increased during stimuli presentation and decreased during the regulation phase. This result can be seen in terms of a manipulation check, evidencing that the emotion induction and ER instruction worked. Not finding heightened physiological responses in BPD compared to both control groups is in line with several studies finding no physiological hyper-reactivity in BPD in response to IAPS or BPD-relevant pictures (Herpertz et al., 1999; Schmahl et al., 2004; Elices et al., 2012).

Although we did not find differences in the ER choice paradigm, it might be – as our participants were instructed to use reappraisal or distraction (which might have prevented emotion hyper-reactivity) – that in daily life extreme emotional responses are the result of maladaptive ER choices like rumination. This interpretation finds support in the emotional cascade model (Selby and Joiner, 2009), representing the idea that rumination leads to emotional hyper-reactivity and finally to behavioral dysfunctions like non-suicidal self-injury. Thus, our findings underline the importance to increase adaptive ER skills in the therapy of BPD, which is an important treatment target in Dialectic Behavior Therapy (DBT; Linehan, 1993a, 1993b).

In line with this, the results of subjective effectiveness ratings show that patients with BPD rated their implementation efficacy significantly worse than HC in high intensive pictures.[7] As distraction was more frequently used under these conditions, this result indicates more difficulties to apply distraction effectively under highly negative emotional states in BPD. One explanation for this finding are deficits in shifting attention away from negative information (e.g., Domes et al., 2006; von Ceumern-Lindenstjerna et al., 2010) and, therefore, "… it seems reasonable that an inability to distract oneself from negative, emotionally sensitive stimuli might be an important part of the emotion dysregulation found among borderline individuals" (Linehan, 1993a, p. 47). Thus, our results suggest that training of distraction strategies on the behavioral level (e.g., triggering intense bodily sensations, distraction through positive activities) might be more helpful than pure cognitive strategies to reduce heightened negative affect in BPD. These indications are underlined by findings in healthy individuals which show that acute stress significantly impairs the cognitive regulation of emotions (Raio et al., 2013). Further, it is supported by recent results evidencing significantly reduced social problem solving skills after a negative emotion induction (Dixon-Gordon et al., 2011), and no increases of urges to engage in deliberate self-harm and self-punishment after the implementation of expressive suppression compared to acceptance in BPD (Svaldi et al., 2012a). Nevertheless, it is pivotal to train and practice cognitive ER strategies in high-negative situations in BPD to improve attentional processes and to reduce the required cognitive resources of these strategies. This might be especially important for reappraisal, as this strategy enables people to process, evaluate and remember emotional information, which is crucial in the long run (Sheppes, 2014).

Our study has several limitations. First, our sample representativeness is restricted. We tested only women to avoid confounding gender differences in ER (Nolen-Hoeksema, 2012) and because most individuals diagnosed with BPD are women (Skodol and Bender, 2003). Another restriction of our sample representativeness might be that we had only one patient with BPD and comorbid PTSD in our sample.

Further limitations are addressed to the paradigm itself. The IAPS and the BPD picture set were not matched, so the effect of content was not directly measurable. Further, we adapted the original procedure (Sheppes et al., 2011, 2014) and also varied the content of the pictures. Using borderline-specific versus unspecific IAPS pictures was important because of the specific emotional hyper-reactivity in BPD in response to self-relevant themes (Limberg et al., 2011; Sauer et al., 2014) and increased the ecological validity of our design. Nevertheless, it complicates the comparison between the groups, as the normative ratings in valence and arousal differ with regard to some picture categories between BPD and MDD (see Supplement A). Furthermore, we used the picture ratings from a preliminary study (Sauer et al., 2014). Thus, we do not know how the participants in our sample would have rated the BPD-specific pictures. Furthermore, it cannot be ruled out that our training in distraction (in high pictures) and reappraisal (in low pictures) influenced the participants' choices. However, the training phase consisted of only four trials for each condition. This is not much for a habitual trait as complex as ER respectively ER choice. Further, the participants did not explicitly know that they saw high and low pictures, and were instructed to choose the strategy that would be most effective for them to regulate their negative emotions. At the most, it can be assumed that implicit learning took place. And even if that was true, all groups would have the same learning effect, which would also be an important finding, showing that after such a short training patients are able to make adaptive ER choices.

Further, we used a forced choice design, i.e., all participants had to choose between reappraisal and distraction. Thus, it could be that if participants had been allowed to freely choose between different ER strategies, patients with BPD would possibly have deployed more putatively maladaptive strategies like rumination, catastrophizing or self-blame. Additionally, we did not assess the intensity of certain emotions in response to the implementation of reappraisal and distraction, i.e., the emotional consequences of the strategy implementation. Especially with regard to the observed dissociation between self-report ratings and physiological responses in previous studies with patients with BPD (Koenigsberg et al., 2010; Schulze et al., 2011), future studies should integrate those measurements.

Another limitation might be that all participants were told that our study was to examine ER deficits in BPD. This, however, could have primed participants with BPD to think they were not able to engage in effective ER and biased the effectiveness ratings.[8]

Finally, this study was an experimental approach to investigate the ER choice in BPD, MDD and HC with restricted ecological and external validity. Future studies with ecological momentary assessments (Shiffman et al., 2008) are needed to examine the choice behavior in daily life and not only under experimental conditions. Especially, this approach might be fruitful because the effect of different contexts can be further taken into account.

Despite these limitations, our study constitutes an important initial step in the investigation of ER choices in BPD. More work is needed to investigate ER choice profiles in daily life and to study the reasons for maladaptive regulatory choices in psychopathology (e.g., rigidity, lack of ability and access to use adaptive strategies). Future research should elucidate choices between greater repertoires of strategies in patients with emotional disorders. This approach can increase our understanding of ER deficits and help to find ways to modify dysfunctional ER choices in patients with BPD.

[7] It is of note that in the BPD group effectiveness was not generally rated worse than the effectiveness of HC, which might be an indicator that patients with BPD simply perceive themselves as less able to successfully regulate emotions.

[8] We thank the anonymous reviewer for this note.

Conflict of interest

There is no conflict of interest to declare.

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Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.psychres.2016.04.113.

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