Is Seeking Bad Mood Cognitively Demanding? Contra-Hedonic Orientation and Working-Memory Capacity in Everyday Life

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Abstract

Hedonism, or wanting to feel good, is central to human motivation. At times, however, people also seek to maintain or enhance negative affect or to dampen positive affect, and this can be instrumental for the later attainment of their goals. Here, we investigate the assumption that such contra-hedonic orientation is cognitively more demanding than pro-hedonic orientation, above and beyond the effects of momentary affective experience. We provided 378 participants with mobile phones that they carried with them for three weeks while pursuing their daily routines. The phones prompted participants at least 54 times to report their current affect-regulation orientation and to work on two trials of a cognitively demanding working-memory task. As expected, contra-hedonic orientation was substantially less prevalent than pro-hedonic orientation. It was reported in 15 percent of the measurement occasions. Participants who reported on average more contra-hedonic orientation showed lower average working-memory performance throughout the study interval. Furthermore, controlling for the effects of accompanying affective experiences, momentary occurrences of contra-hedonic orientation were associated with temporary declines in working-memory performance within individuals, and this could neither be explained by lacking task compliance nor by other characteristics of the individual or the situation. Pro-hedonic orientation showed a considerably smaller association with working-memory performance. These findings are consistent with the view that contra-hedonic orientation is accompanied by momentarily more diminished cognitive resources than pro-hedonic orientation is.

Keywords: affect-regulation orientation, contra-hedonic, experience sampling, working memory, positive and negative affect

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Human beings are motivated to seek pleasure and avoid negative experiences. There may, however, be exceptions. Anger, for example, can be helpful when pursuing one's interests in an interpersonal confrontation, and happiness can be inappropriate when delivering bad news. Hence, people may sometimes be motivated to regulate their feelings in a way that runs *counter* to the hedonic principle, at least for the time being. Recent research suggests that such contra-hedonic tendencies can be instrumental for the individual (e.g., Tamir, 2009). Here, we add novel insights suggesting that this comes at a cost. We investigated the interplay of pro- and contra-hedonic orientations as they naturally occurred in daily-life contexts, with between- and within-person fluctuations in working-memory performance. This was possible through the use of a mobile-phone-based assessment technology. Our findings show that contra-hedonic orientation was more strongly related to reductions in working-memory performance than pro-hedonic orientation, even after controlling for the effects of momentary affective experience, and that this could neither be accounted for by lacking task motivation nor by a number of other individual or situational characteristics.

What We Know and What We Do Not Know About Contra-Hedonic Orientation

While it has long been acknowledged that seeking to maintain or enhance one's well-being is an important factor in human motivation, the possibility that there may be moments in which psychologically healthy people seek bad moods has only recently become subject of empirical scrutiny. Contra-hedonic tendencies in mental pathology have received more attention. A pathological desire to maintain or enhance negative feelings, for example, can play a role in the development and maintenance of psychological (e.g., depressive) disorders (e.g., Andrews & Thomson, 2009), and clinical conditions can involve such symptoms as the deliberate inflicting of injury and pain upon oneself, which can serve a variety of functions (e.g., to regulate one's affect, to punish oneself, to influence other people, etc.; Klonsky, 2007). Research on occurrences of contra-hedonic tendencies in non-clinical populations has only evolved relatively recently. An important theme has been the idea that short-term hedonic costs of contra-hedonic tendencies are borne because of their instrumental value. This line of research indicated that, occasionally, seeking negative mood can result from people's being strategic in their attempts to regulate their feelings (e.g., Erber & Wang Erber, 2000; Parrott, 1993; Tamir, 2009). Here, contra-hedonic orientation is seen as a result of seeking affective experiences that correspond to the requirements of the social situation or help to achieve one's goals (e.g., Erber, Wegner, & Therriault, 1996; Tamir & Ford, 2009). For example, Tamir and colleagues showed that undergraduates preferred anger-inducing activities when they were expecting to subsequently engage in a confrontational game in which angrier participants indeed achieved higher game scores (Tamir, Mitchell, & Gross, 2008).

Other research suggests that contra-hedonic orientation may also occur when apparently aversive experiences also entail positive aspects. This may be one reason why some people seek experiences that encompass negative feelings such as fear or pain. Andrade and Cohen (2007), for instance, demonstrated that students who liked to expose themselves to horror movies were more likely to experience both fear and happiness while watching, whereas persons who avoided horror movies typically only experienced fear.

Still another view claims that contra-hedonic orientation may also occur in the interest of self-verification (Nelissen & Zeelenberg, 2009; Wood, Heimpel, Manwell, & Whittington, 2009). Undergraduates low in self-esteem, for example, have been found to be more motivated to dampen positive moods and less motivated to improve sad moods than those high in self-esteem, partly so because they felt less deserving of positive moods and viewed sad moods as more typical of themselves (Heimpel, Wood, Marshall, & Brown, 2002; Wood, et al., 2009; Wood, Heimpel, & Michela, 2003).

Most of these insights were obtained by observing student samples in experimentally controlled (and thereby more or less artificial) settings. Knowledge about contra-hedonic tendencies as they occur in more heterogeneous populations, and in people’s daily lives and natural environments is scarce. Furthermore, despite the fact that there is compelling support for the idea that self-regulatory processes can be resource-demanding (Baumeister & Alquist, 2009), to our knowledge, evidence on the role that contra-hedonic orientation might play in this respect is still lacking. The purpose of our research was to contribute new insights into these fields of study. Below, we delineate the theoretical background underlying our prediction that contra-hedonic orientation is more effortful than pro-hedonic orientation, and introduce our methodological approach to investigating this in the natural context of people’s daily lives.

Is Contra-Hedonic Orientation Effortful?

Contra-hedonic orientation—seeking to maintain or enhance negative affect, or to dampen positive affect—is the exception rather than the rule. It requires overriding the prevailing pro-hedonic orientation of human beings. Research in the context of self-depletion theory has yielded ample empirical evidence that altering pre-potent responses is resource-intensive (for review, see Baumeister & Alquist, 2009). We therefore reasoned that contra-hedonic orientation should necessitate the allocation of capacity. Consequently, the capacity available for the simultaneous processing of another resource-intensive task—for example, storing and manipulating information in working memory—should be reduced. We thus predicted that an individual’s performance in a working-memory task would be lower in situations where he or she reported contra-hedonic orientations of wanting to maintain or enhance negative affect or to dampen positive affect than in situations without such contra-hedonic orientations. We also hypothesized that this would be the case above and beyond the effects that the accompanying affective experiences might have on reduced working-memory capacity (see overview in Derakshan & Eysenck, 2010). As pro-hedonic tendencies of wanting to maintain or enhance positive affect or to dampen negative affect are the predominant orientation in psychologically healthy individuals (Larsen & Prizmic, 2004), we reasoned that it should be accompanied by lower cognitive costs than contra-hedonic motivation. In other words, we assumed that desires to maintain or enhance positive affect represent default tendencies of the motivational system, and as such require less attentional resources than other motivational tendencies.

These predictions are in line with resource-allocation models of cognitive capacity (e.g., Ellis & Ashbrook, 1988; Kahneman, 1973), which propose that all tasks that require effortful processing draw on a limited resource, referred to as capacity, attention, or effort, and that if capacity is allocated to one task, the capacity remaining for the simultaneous processing of other tasks is diminished. They are also consistent with empirical evidence showing (a) that higher cognitive capacity is associated with better self-regulation effectiveness (Kane et al., 2007; Schmeichel, Volokhov, & Demaree, 2008), and (b) that engagement in specific affect-regulatory strategies, such as distracting oneself from emotion-eliciting information or suppressing outward expressions of emotional experiences, are associated with poorer memory, communication, and problem-solving performances (e.g., Baumeister, Bratslavsky, Muraven, & Tice, 1998; Butler et al., 2003; Richards & Gross, 1999, 2000, 2006).

The hypothesis that contra-hedonic orientation is more resource-intensive than pro-hedonic orientation is further consistent with prior evidence that not all regulatory efforts are equally resource demanding. This evidence stems from comparisons of different emotion-regulation strategies aimed at pursuing pro-hedonic orientations. To our knowledge, the respective role of contra-hedonic orientations has not yet been investigated. For example, compared to expressive suppression of negative experiences, reappraisal of an emotional situation in a way that decreases its negative emotional relevance has been found to be less disruptive, or even beneficial, for memory processes (Dillon, Ritchey, Johnson, & LaBar, 2007; Richards, Butler, & Gross, 2003; Richards & Gross, 2000), and less compromising for communication effectiveness (Butler et al., 2003), at least when these strategies are initiated before the emotional response has fully evolved. When emotion regulation is initiated later in the emotion-generative process, reappraisal of a potentially negative situation in a more positive light has been found to be associated with worse subsequent impulse control than distraction, and distraction, with more impaired memory encoding than reappraisal (Sheppes & Meiran, 2008). These studies have led to a refinement of the long prevailing view that all regulatory efforts are equally resource-intensive, irrespective of their specific form. They were, however, restricted to pro-hedonic orientations. Our purpose in this study was to further extend this research on differential costs of various forms of regulatory efforts by demonstrating that the type of hedonic orientation matters as well.

Methodological Approach

In short, we hypothesized that contra-hedonic orientation diminishes the cognitive capacity available for the simultaneous processing of other effortful tasks to a greater extent than pro-hedonic orientation does, above and beyond the effects that the momentary affective experience might have on working-memory capacity. Our investigation of this prediction pursued three methodological purposes. First, in the interest of generalizability, we aimed at recruiting participants who stem from different sites throughout Germany and are heterogeneous with respect to age, education, and gender. Second, to maximize the ecological validity of our assessments, we sought to measure fluctuations in pro- and contra-hedonic orientation and attentional capacity as they naturally occur in people‘s daily lives.

Third, we aimed at investigating the co-variation of affect-regulation orientation and cognition as they occurred between individuals as well as within individuals over time. Prior evidence suggesting that self-regulatory processes may require allocation of cognitive capacity primarily stemmed from between-person comparisons. Yet assuming that associations observed between persons also exist at the within-person level is not necessarily warranted (Lindenberger & von Oertzen, 2006; Molenaar & Campbell, 2009). We used a mobile-phone based assessment technology to realize these aims, which allowed the repeated measuring of participants' affect-regulation orientation, affective experience, and momentary working-memory performance at short intervals as they naturally occurred in participants' daily lives.

Method

Participants

A fieldwork agency recruited 378 participants ranging in age from 14 to 86 years (*M* = 42, *SD* = 19) from three sites in Germany (Berlin, Munich, Düsseldorf; total sample: 50.3% men; 24.1% holders of a college or university degree). Participants' general cognitive capacity as assessed with the Symbol-Digit Test (see below; Lang, Weiss, Stocker, & Rosenbladt, 2007) was comparable to that of their age peers in the representative random sample of the German Socio-Economic Panel Study (SOEP; Wagner, Frick, & Schupp, 2007).[1]

Procedure

The study started with an individual instruction and training session typically conducted in the participants' homes. Participants received mobile phones (Nokia E50) with Java software that controlled the participants' assessment schedule, presented items and tasks, and uploaded responses to a central server. Participants navigated and responded to the instrument using the mobile phone's joystick and keypad. During this first session, participants received extensive instructions and completed a sample trial and ten training trials of the working-memory task described below. They also completed the Symbol-Digit Test (see below, Lang et al., 2007).

Following the instruction session, participants carried the phone with them at all times during three experience-sampling periods of three consecutive days each, which covered a total of six weekdays (Monday through Friday) and three weekend days (Saturday and Sunday) and were separated by intervals of six days. On each experience-sampling day, six assessments were distributed throughout a time window of 12 hours, the beginning of which was chosen by the participants according to their personal waking habits. During each of six 2-hour time periods within the participant's personal time window, one signal was scheduled randomly, with the provision that two adjacent measurement occasions were at least 15 minutes apart. If participants did not respond, they were reminded twice by auditory signals, occurring after five and after ten minutes. If there was still no response, the instrument closed after 15 minutes, thus reducing participants' degree of freedom in determining when to complete the instrument. On average, participants completed at least five of the six daily assessments on 90.7% of their assessment days, $SD = 0.13$. To obtain a sufficient number of assessments, experience-sampling periods were extended for a day if participants completed fewer than five assessments on a given day. Overall, $M = 1.21$, $SD = 1.71$, of these extension days were scheduled per participant. Participants thus completed an average of 54.9 assessments, $SD = 4.1$. They were reimbursed with 100 € (approximately $150). The ethics committee of the Max Planck Institute for Human Development approved the study.

Measures

Perceptual-motor speed. During the instruction session, participants completed the Symbol-Digit Test, which is a modification of the Digit-Symbol Substitution Test (Wechsler, 1981) for computer-assisted assessment that has been validated in the SOEP (Lang et al., 2007). Participants were given mappings of symbols and digits, and their task was to enter the corresponding digit for a presented symbol as fast as possible. The number of correct responses entered within 90 seconds served as an indicator of perceptual-motor speed and was used in this study as a person-level marker of general cognitive capacity (*M* = 30.0, *SD* = 10.7).

Experience-sampling self-report measures. At each measurement occasion, participants first indicated how much they were currently experiencing each of six feelings using a scale ranging from 0 *"not at all"* to 6 *"very much."* Averaging the responses for *joyful*, *content*, and *interested* yielded an indicator of positive affect (average within-person *M* = 3.06, *SD* = .82, within-person Cronbach's alpha: *M* = 0.65, *SD* = 0.19), and averaging responses for *angry*, *anxious*, and *downcast*, an indicator of negative affect (average within-person *M* = 0.73, *SD* = 0.53, within-person Cronbach's alpha: *M* = 0.52, *SD* = 0.28). The items were selected because they represent prototypical positive and negative affect facets that are relevant for, and evince sufficient intra-individual variation in, the daily lives of individuals from different age groups.

Participants also reported their current activity by checking the appropriate response option(s) among (a) *work/school/study* (within-person prevalence: *M* = 22.7%, *SD* = 19.0), (b) *chores/errands* (within-person prevalence: *M* = 18.2%, *SD* = 12.5), (c) *leisure activity* (within-person prevalence: *M* = 19.1%, *SD* = 12.5), (d) *doing nothing/sleeping/watching TV* (within-person prevalence: *M* = 22.5%, *SD* = 13.6), (e) *doctor visit/office run* (within-person prevalence: *M* = 1.4%, *SD* = 2.6), (f) *conversation/visit* (within-person prevalence: *M* = 11.9%, *SD* = 11.0), and (g) *other* (within-person prevalence: *M* = 14.6%, *SD* = 13.5). For our analyses, we combined responses into 4 overarching categories: *occupation* (work/school/study), *errands* (chores/errands and doctor visit/office run), *leisure* (leisure activity, conversation/visit, and doing nothing/sleeping/watching TV), and *unspecified* (other and multiple categories chosen).

Participants further indicated which other persons were present at that time by choosing a response (or several) from (a) *alone* (within-person prevalence: M = 31.4%, SD = 20.0), (b) *partner* (within-person prevalence: M = 26.2%, SD = 25.1), (c) *family* (within-person prevalence: M = 19.6%, SD = 20.9), (d) *friends* (within-person prevalence: M = 12.34%, SD = 11.8), (e) *colleagues/fellow students* (within-person prevalence: M = 14.1%, SD = 14.9), (f) *strangers* (within-person prevalence: M = 8.6%, SD = 9.3), and (g) *other* (within-person prevalence: M = 3.3%, SD = 8.1). Again, we used more encompassing categories in our analyses: *alone*, *private acquaintance(s)* (partner, family, friends), *non-private acquaintance(s)* (colleagues/fellow pupils or students), *stranger(s)*, and *unspecified* (other and multiple categories chosen).

Participants also reported, separately for joy, interest, contentment, anger, anxiousness, and feeling downcast, whether they currently wanted to (a) *dampen*, (b) *maintain*, (c) *enhance*, or (d) *not influence at all* their respective feelings (forced-choice format). A count variable representing the number of responses indicating the wish to maintain or enhance positive affect (i.e., joy, interest, contentment) or to dampen negative affect (i.e., anger, anxiousness, feeling downcast) was used as an indicator of pro-hedonic orientation. Similarly, a count variable of the number of responses indicating the wish to maintain or enhance negative affect or to dampen positive affect served as an indicator of contra-hedonic orientation. Descriptive information on these variables is presented in the Results section.

Working-memory performance in daily life. Following completion of the experience-sampling items, participants used the mobile phone to work on two trials of a numerical memory updating task (MU–task; Salthouse, Babcock, & Shaw, 1991) that has been shown to be a reliable and valid indicator of verbal-numerical working memory (Oberauer, Süß, Schulze, Wilhelm, & Wittmann, 2000; Schmiedek, Hildebrandt, Lövdén, Wilhelm, & Lindenberger, 2009). Figure 1 illustrates how the task was implemented in our study. Participants started a trial via button press. Then, four digits between 0 and 9 were simultaneously presented in a grid of two-by-two cells for 6000 ms. After an inter-stimulus interval (ISI) of 500 ms, five updating operations appeared successively in the cells of the grid (presentation times 3,500 ms; ISI 500 ms). Updating operations were additions and subtractions in the range of -8 to +8, and all intermediate and end results were in the range from 0 to 9. Updating operations were randomly assigned to the four cells with the provision that they appeared in a different location than the one before. After all five updating operations had been shown, the participants' task was to enter the end results for each of the four cells by using the mobile phone's keypad. Corrections of entries were possible if needed. After participants had indicated that they had finished the entry (and possible correction) of their results via button press, they received feedback ("X out of 4 numbers correct"). We determined the proportion of correct responses across both trials as an indicator of the participants' momentary working-memory performance (within-person M = .81, SD = .16).

Statistical analyses. The available data had two characteristics with implications for appropriate data analysis: (a) The data structure was hierarchical with, on average, 54 repeated assessments nested within participants. (b) The time intervals between assessments were not equal (because measurements were distributed throughout three periods of three consecutive days that were interspersed by breaks of six days). To accommodate these characteristics, we used multilevel regression models fitting a time-series-type residual co-variance structure appropriate for unequally spaced repeated measures. Specifically, we used SAS PROC MIXED and restricted maximum likelihood estimation to fit the spatial power residual co-variance structure to the data (Littell, Milliken, Stroup, Wolfinger, & Schabenberger, 2007). The latter corresponds to an autoregressive structure that takes the spacing of measurement occasions into account by using a continuous "time-in-study" variable. We defined the scale of this variable as hours elapsed since the first assessment occasion.

Trend in working-memory performance. Intensive repeated assessments can result in learning- or reactivity-caused shifts in the mean levels of observed variables over time. In order to examine whether such a time-related trend was observable in participants' working-memory performance, the dependent variable in our analyses, we ran a series of multilevel models. In the *no-change* (i.e., intercept-only) model, no predictors were included. In the *linear-change* model, occasion number, counting from zero, was included as a single predictor, and in the *quadratic-change* model*,* occasion number, counting from zero, and squared occasion number were included as predictors (cf. Singer & Willet, 2003). Likelihood ratio tests on the change in deviance indicated that a linear-change model fit the data best, indicating improvement in working performance throughout the three weeks of the study (accounting for 5.8% of the within-person residual variance). To account for this time-related trend, we included occasion number as a covariate in all analyses reported below.

Results

As expected, participants reported considerably more pro-hedonic orientation (i.e., that they wanted to maintain or enhance positive, or to dampen negative affect facets) than contra-hedonic orientation (i.e., that they wanted to maintain or enhance negative, or to dampen positive affect facets). Pro-hedonic orientation was reported, on average, in 92.41% of the measurements, *SD* = 18.22. The number of affect facets that participants wanted to influence in that way varied between zero and six, average within-person *M* = 3.76, *SD* = 1.39. Contra-hedonic orientation was reported, on average, in 14.98% of the measurements, *SD* = 19.31, and the number of affect facets participants wanted to influence in that way varied between zero and five, average within-person *M* = 0.22, *SD* = 0.38. When participants reported contra-hedonic orientation, they typically did so only for a subset of the six affect facets, and with few exceptions also reported pro-hedonic orientations for one or more other affect facets. Reports of currently not wanting to influence any of the six affect facets under investigation were only obtained in, on average, 7.42% of the measurements, *SD* = 18.19. Elsewhere, we provided detailed information on the prevalence and affective contexts of pro- and contra-hedonic orientation in this study (Riediger, Schmiedek, Wagner, & Lindenberger, 2009). In this article, we focus on analyses of the prediction that contra-hedonic orientation is cognitively more demanding than pro-hedonic orientation.

To investigate this, we analyzed the extents to which variations in momentary pro- and contra-hedonic orientations were associated with variations in momentary working-memory performance, above and beyond (i.e., controlling for) the respective roles of the participants' momentary affective experiences. The dependent variable was the participants' momentary working-memory performance. We first tested a model with momentary positive and negative affect (grand-mean centered) and their respective interaction, as well as momentary pro- and contra-hedonic orientations (group-mean centered) and their respective interaction as random predictors on the situation level. We used group-mean centering for pro- and contra-hedonic orientations to investigate how deviations above and below the individual's respective averages were related to within-person fluctuations in working-memory performance. The observation number (grand-mean centered) was included as fixed situation-level covariate to control for learning-related effects (trend). To control for inter-individual differences in the propensity to pro- and contra-hedonic orientation, we further included participants' individual averages of pro- and contra-hedonic orientations (across all measurement occasions, grand-mean centered) as model predictors on the person level. The interaction between momentary positive and negative affect was significantly different from zero (p = .0009) and therefore retained in subsequent models. The interaction between momentary pro- and contra-hedonic orientations, however, was not significant (p = .711) and thus excluded from further analyses. In a next step, we tested for potential quadratic effects of the model predictors. Significant quadratic effects ($p < .05$) were obtained for momentary positive affect, momentary negative affect, and momentary pro-hedonic orientation, and retained in the final model.

Parameter estimates are shown in Table 1. The interpretation of the *fixed effects* is equivalent to those of unstandardized coefficients in ordinary least squares regression. That is, the intercept represents the average working-memory performance when all predictors are zero, and the slopes denote the differential in momentary working-memory performance for a one-unit increase in a given predictor variable when the other predictors are zero (i.e., controlling for the effects of the other predictors).

Parameter estimates for momentary affective experiences indicate that associations of positive and negative affect with working-memory performance were non-linear, and further moderated by the extent of negative and positive affect, respectively. Figure 2 illustrates this interaction. Inspection of the upper part of Figure 2 reveals that at low levels of negative affect, increase in negative affect was associated with slightly better working-memory performance, particularly when positive affect was low. At high levels of negative affect, however, more intense negative affect was associated with slightly worse working-memory performance, and this effect was most pronounced if positive affect was high as well. For associations between positive affect and working-memory performance, the pattern of findings was similar (see lower part of Figure 2): At low levels of positive affect, more positive affect was related to slightly better working-memory performance. At high levels of positive affect, however, more positive affect was associated with slightly worse working-memory performance, particularly when negative affect was high as well.

Our primary focus in this research was on the question how pro- and contra-hedonic orientations were related to working-memory performance over and above the effects of momentary affective experiences just described. In agreement with our hypotheses, momentary occurrences of contra-hedonic orientation predicted momentary decrements in working-memory performance, even after controlling for the effects of momentary affective experiences. This effect is graphically exemplified in Figure 3 for a person with average propensity to report contra-hedonic orientation. Here, the model predicted a decrement in working-memory performance from .83 in situations without, to .64 in situations with maximum contra-hedonic orientation (theoretical range of working-memory performance: 0 to 1). This corresponds to a performance decline by 22.89%. In addition, the higher the participants' average propensity to report contra-hedonic orientation, the lower their average working-memory performance was (across all measurement occasions). With a model-predicted decline in average working-memory performance of -.198 (on a scale with a theoretical range from 0 to 1) for a one-unit increase in average contra-hedonic orientation, the size of this effect is substantial.

In contrast, associations of momentary pro-hedonic orientations and momentary working-memory performance were comparatively less pronounced. There was a small, but significant curvilinear association between momentary pro-hedonic orientation and momentary working-memory performance. When momentary pro-hedonic orientation was low relative to the individual's average, it was associated with a very slight increase in working-memory performance, but the reverse was true when pro-hedonic orientation was high relative to the individual's average. The size of this effect, however, was very small, as exemplified in Figure 3 for a person with average propensity to report pro-hedonic orientation (variation of the regression curve between .80 and .82 on a scale with a theoretical range from 0 to 1). Average pro-hedonic orientation was not significantly associated with working-memory performance.

Parameter estimates of the variance components in Table 1 show that significant interindividual differences remained in the average levels of working-memory performance and in the associations of momentary positive and negative affect and pro- and contra-hedonic orientation with momentary working-memory performance after controlling for all model predictors. Overall, the model accounted for 27.27% of the residual between-person variance, and for 4.93% of the residual within-person variance of working-memory performance.

In a next step of model specification, we tested whether the effects of momentary pro- and contra-hedonic orientation were moderated by the extent of momentary positive or negative affect. This, however, was not the case (i.e., all interactions with $p > .05$).

Following that, we investigated whether the effects of pro- and contra-hedonic orientation on working-memory performance were robust to controlling for other individual and situational characteristics that might influence participants' working-memory capacity. We included participants' age (linear and quadratic effects, grand-mean centered) and their performance in the Symbol-Digit Test (indicative of fluid-cognitive capacity, grand-mean centered) as control variables on the person level, and time of day (hours elapsed since 00:00 am, grand-mean centered), as well as participants' activity and social partner (effect codings with *unspecified* as reference category) as random situation-level control variables. Again, the observation number was included as a fixed situation-level predictor to control for learning-related effects (trend). The quadratic effect of pro-hedonic orientation as well as the effects of average and momentary contra-hedonic orientation predicting lower working-memory performance remained significant after simultaneously controlling for the person-level and situation-level control variables included in this analysis.

We then addressed the question whether the observed declines in working-memory performance accompanying contra-hedonic orientation were due to lacking effort, that is, to participants' being more likely to guess their responses or to work perfunctorily rather than to give their best when they reported contra-hedonic orientations. To this end, we restricted the analyses to occasions of working-memory performances with 75% or more correct responses. Performing at this level requires diligent task compliance, and the likelihood to perform within this range by chance is virtually zero ($p \leq .00003$). On average, participants obtained scores within this range in 77.7%, $SD = 22.2$, of the measurements they provided. Re-estimating the model depicted in Table 1 with this restriction in working-memory performance again yielded negative effects of momentary and average contra-hedonic orientation on working-memory performance that were significantly different from zero (average contra-hedonic orientation: parameter estimate $b = -.12$, $SE = 0.01$, $p < .0001$, momentary contra-hedonic orientation $b = -.02$, $SE = 0.01$, $p = .002$). Hence, the negative effects of the person- and situation-level predictors of contra-hedonic orientations on working-memory performance were not merely based on participants' lacking efforts to conform to the task. The curvilinear association of momentary pro-hedonic orientation with momentary working-memory performance, in contrast, ceased to be significant in this analysis ($p > .05$).

Discussion

People are mostly motivated to feel good. But there may be occasional exceptions. Previous research has demonstrated that contra-hedonic orientation—the wish to maintain or enhance negative affect, or to down-regulate positive affect—occasionally occurs because it is socially appropriate or instrumental (e.g., Tamir & Ford, 2009; Tamir et al., 2008). It may also occur in the interest of positive feelings that can accompany or follow negative experiences (e.g., Andrade & Cohen, 2007). And it may help some individuals to reduce uncertainty by achieving consistency in their affective self-view (e.g., Wood et al., 2009).

While previous research thus demonstrated that contra-hedonic orientation can be instrumental, results of the present study are consistent with the view that this may come at a cost. As expected, contra-hedonic orientations did not occur frequently in the daily lives of most participants. They were reported, on average, in 15 percent of the measurement occasions we obtained, and were thus considerably less prevalent than pro-hedonic orientations, which were reported, on average, in 92 percent of the measurement occasions. When participants reported contra-hedonic orientations, they typically did so only for a subset of the six feelings we investigated here, and mostly reported pro-hedonic orientations for one or more of the remaining ones. Contra-hedonic orientation, thus, was usually part of a complex orientation that involved multiple regulatory directions for different affect facets (for further information on the prevalence and affective contexts of pro- and contra-hedonic orientation in this sample, see Riediger et al., 2009).

In the research reported here, we were interested in the interplay of pro- and contra-hedonic orientations, as they occur naturally in daily-life contexts, with fluctuations in working-memory performance. In our analyses, we controlled for the respective effects of momentary positive and negative affect on working-memory capacity, which were consistent with the proposal that intense affective experiences deplete attentional resources regardless of their valence (Ellis & Ashbrook, 1988): While positive and negative affect of low intensity were associated with slightly better working-memory performances in daily life, positive and negative affect of high intensity were associated with worse working-memory performances, particularly when both positive and negative affect were high. A central idea guiding our study was the assumption that, above and beyond the effects of momentary affective experiences, contra-hedonic orientation should be more effortful than pro-hedonic orientation as it requires overriding of pre-potent regulatory tendencies. Based on resource-allocation models of cognitive capacity (e.g., Ellis & Ashbrook, 1988; Kahneman, 1973) and self-depletion theory (Baumeister, 2002), we therefore hypothesized that contra-hedonic, as compared to pro-hedonic, orientation should be associated with a momentarily more diminished capacity to maintain and manipulate information in working memory, even after controlling for the effects of momentary positive and negative affect.

The results supported this prediction. Pro-hedonic orientation only showed a small relationship to working-memory performance. This relationship was non-linear and independent of momentary affective experiences: When pro-hedonic orientation concerned few affect facets, it was associated with a slight increase in working-memory performance compared to situations where no pro-hedonic orientation was reported. When pro-hedonic orientation concerned multiple affect facets, however, it was related to a slight decrease in working memory performance. The size of these effects, however, was very small.

In contrast, the association of contra-hedonic orientation and working-memory performance was substantially more pronounced: The more contra-hedonic orientation participants reported, the lower their momentary working-memory performance was, and this was independent of the participants' momentary affective experience. With a model-predicted decrement of about 23 percent in working-memory performance from situations without, to situations with maximum contra-hedonic orientation, the effect of contra-hedonic orientation on working-memory performance was about 10 times larger than that of pro-hedonic orientation. These results demonstrated that occurrences of contra-hedonic orientation were associated with within-person fluctuations in momentary working-memory performance. In addition, participants who reported more contra-hedonic orientation on average showed lower average working-memory performance across all measurement occasions, which may partly reflect the aggregated effect of momentary occurrences of contra-hedonic orientation. Average pro-hedonic orientation, in contrast, was not significantly related to between-person differences in average working-memory performance.

These findings were stable after simultaneously controlling for participants' age and perceptual-motor speed, as well as for time of day, momentary activity, presence of social partners, and for trend-related effects, in addition to momentary positive and negative affect. Furthermore, the reductions in working-memory performance accompanying contra-hedonic orientation were not merely due to participants not working adequately on the task. Instead, the negative effects of contra-hedonic orientation (but not the effect of pro-hedonic orientation) on momentary working-memory capacity were also evident when performance was restricted to ranges that required meticulous effort to solve the task. The effects of contra-hedonic orientation on working-memory performance could thus not be attributed to lacking effort alone, or to differences in other individual or situational characteristics. Rather, they are consistent with the idea that contra-hedonic orientation is more strongly associated with momentary decrements in available working-memory capacity than pro-hedonic orientation is.

The present study extends earlier research showing that not all regulatory efforts are equally resource demanding. These prior studies focused exclusively on pro-hedonic orientation (e.g., Butler et al., 2003; Dillon et al., 2007; Richards et al., 2003; Richards & Gross, 2000; Richards & Gross, 2006; Sheppes & Meiran, 2008). Our study contributes new insights into differential costs of various forms of regulatory efforts by demonstrating that the type of hedonic orientation matters as well. It is insofar different from other research on resource demands of emotion regulation, however, in that it focuses on affect-regulation *orientation*, and not on behavioral efforts towards these ends (which can sometimes, but not necessarily always, accompany or follow motivational orientation). It seems plausible to speculate that regulatory behaviors may be more resource-intensive than regulatory orientations alone. Disentangling both is not possible in the present study. This remains an important task for future research that could clarify whether the lower resource demands of pro- versus contra-hedonic orientations shown in this study are also evident in the comparison of pro- versus contra-hedonic regulatory behaviors.

Another important limitation of our research is its correlational nature, which prohibits conclusions about causality and does not make it possible to rule out that the observed association may have resulted from the common influence of unmeasured third variables. Future research will need to employ well-controlled experiments to overcome this limitation. Furthermore, our reliance on self-report limited the present research to the investigation of consciously accessible aspects of pro- and contra-hedonic orientation. An intriguing quest could therefore be the implementation of objective and indirect assessment methods to include aspects that are not consciously accessible. Despite these limitations, the present research contributes substantially to our understanding of the phenomenon of contra-hedonic orientation in everyday life. While contra-hedonic orientation may occur because of the instrumental value that negative emotionality can have in some situations, it is associated with momentarily diminished working-memory capacity.

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Footnotes

[1] To compare performance levels in the Symbol-Digit-Test with those obtained in the SOEP assessment of 2006, we conducted a univariate analysis of variance with age group and sample membership as between-person factors and number of correct responses during 90 seconds in the Symbol-Digit Test as dependent variable. Only participants within the overlapping age range of the two studies (i.e., 16.3–86.5 years) were included in the analyses (present sample: $N = 351$, SOEP sample: $N = 5{,}518$). The ANOVA yielded a significant main effect for age group, $F(6, 5855) = 45.8$, $p = .000$, partial $\eta^2 = .05$; a significant main effect for sample membership, which, however, was of negligible effect size, $F(1, 5855) = 10.9$, $p = .001$, partial eta squared = 0.002; and a non-significant Age Group x Sample Membership interaction, $F(6, 5855) = 44.9$, $p = .77$, partial $\eta^2 = .001$. Follow-up analyses (pair-wise comparisons between the age groups) suggest a slightly positive selection of the adolescent subsample in the present study (< 18 years; present sample: $M = 35.9$, $SD = 8.6$; SOEP sample: $M = 31.20$, $SD = 9.94$; $t[6608] = -2.1$, $p = .04$), but yielded no significant differences between the other age groups in the two samples (all $p > .05$).

Table 1.

Affective Experiences and Pro- and Contra-Hedonic Orientations as Predictors of Momentary Working-Memory Performance: Results from Multilevel Regression

Model parameters	Predicting Working-Memory Performance Estimate	
Fixed effects		
Intercept	.819	**
Affect		
• Momentary negative affect[a]	.005	n.s.
• Squared momentary negative affect[a]	-.003	**
• Momentary positive affect[a]	.003	n.s.
• Squared momentary positive affect[a]	-.003	**
• Momentary negative affect × positive affect[a]	-.008	**
Regulatory orientation		
• Momentary contra-hedonic orientation[b]	-.031	**
• Average contra-hedonic orientation (person average)[a]	-.198	**
• Momentary pro-hedonic orientation[b]	-.001	n.s.
• Squared momentary pro-hedonic orientation[b]	-.002	*
• Average pro-hedonic orientation (person average)[a]	-.009	n.s.
Observation number[a]	.0004	**

(Table continues.)

Table 1 *(continued)*

Model parameters	Predicting Working-Memory Performance Estimate	
Random effects		
Intercept [c]	0.0175	**
Momentary negative affect [d]	0.0002	**
Momentary positive affect [d]	0.0002	**
Momentary pro-hedonic orientation [d]	0.0021	**
Momentary contra-hedonic orientation [d]	0.0003	**
SP(POW) [e]	0.3277	**
Residual [f]	0.03625	**
Modeled variance [g]		
Between persons (Pseudo $R^2_{Intercept}$)	27.26%	
Within persons (Pseudo $R^2_{Residual}$)	4.93%	

Notes. Restricted maximum likelihood parameter estimates in multilevel regression models with spatial power residual co-variance structures (Littell et al., 2007).

[a] Grand-mean centered (deviations from sample mean). [b] Group-mean centered (deviations from individual's mean). [c] Conditional intercept variance (remaining between-person variance in working-memory performance). [d] Conditional variances of the situation-level slopes. [e] Autoregressive parameter (estimated co-variance of two adjacent measurements assuming they were taken one hour apart). [f] Residual (remaining within-person) variance. [g] Proportional reductions in intercept and residual variance components in comparison to models without explanatory variables (Singer & Willet, 2003).

n.s. $p > .05$. * $p < .05$. ** $p < .001$.

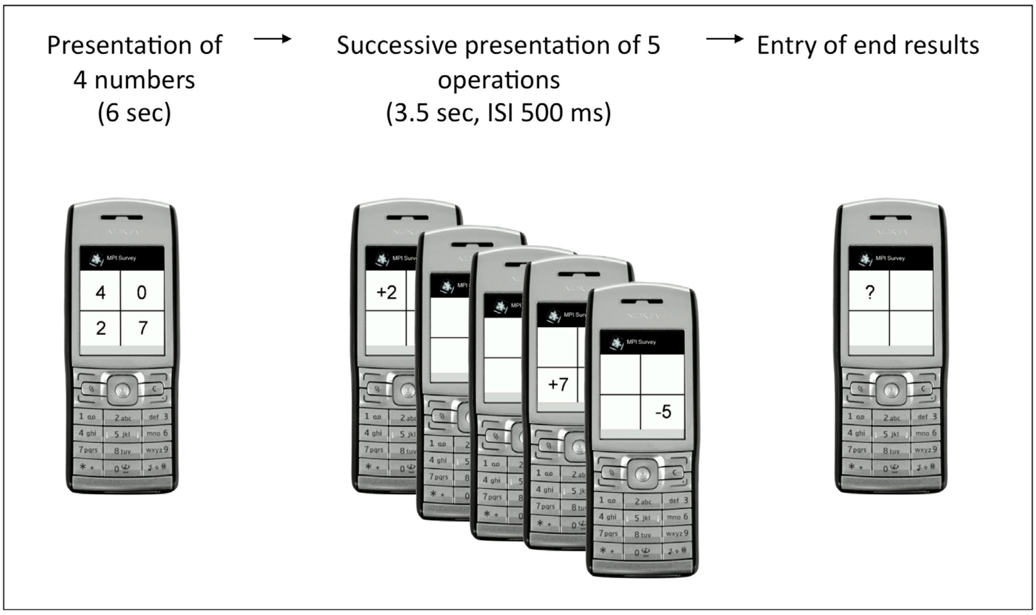

Figure 1. Assessment of working-memory performance in day-to-day life: Numerical memory-updating task. *Note.* ISI = Inter-stimulus interval.

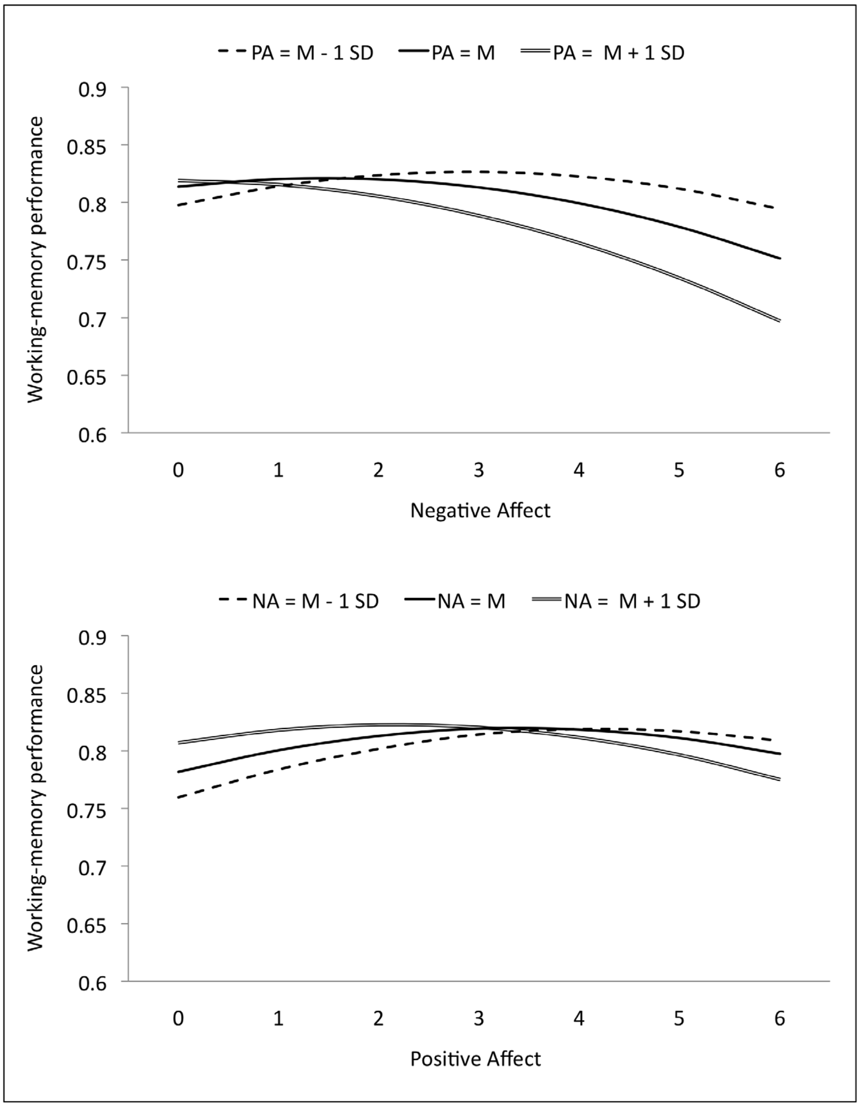

Figure 2. Model-predicted associations between negative affect and working-memory performance for positive affect to be one standard deviation below, at, and one standard deviation above, the sample mean (upper panel); and model-predicted associations between positive affect and working-memory performance at different values of negative affect (lower panel), controlling for pro- and contra-hedonic orientations, session number, and assuming that individual's average pro- and contra-hedonic orientations are at the respective sample means. PA = positive affect, NA = negative affect.

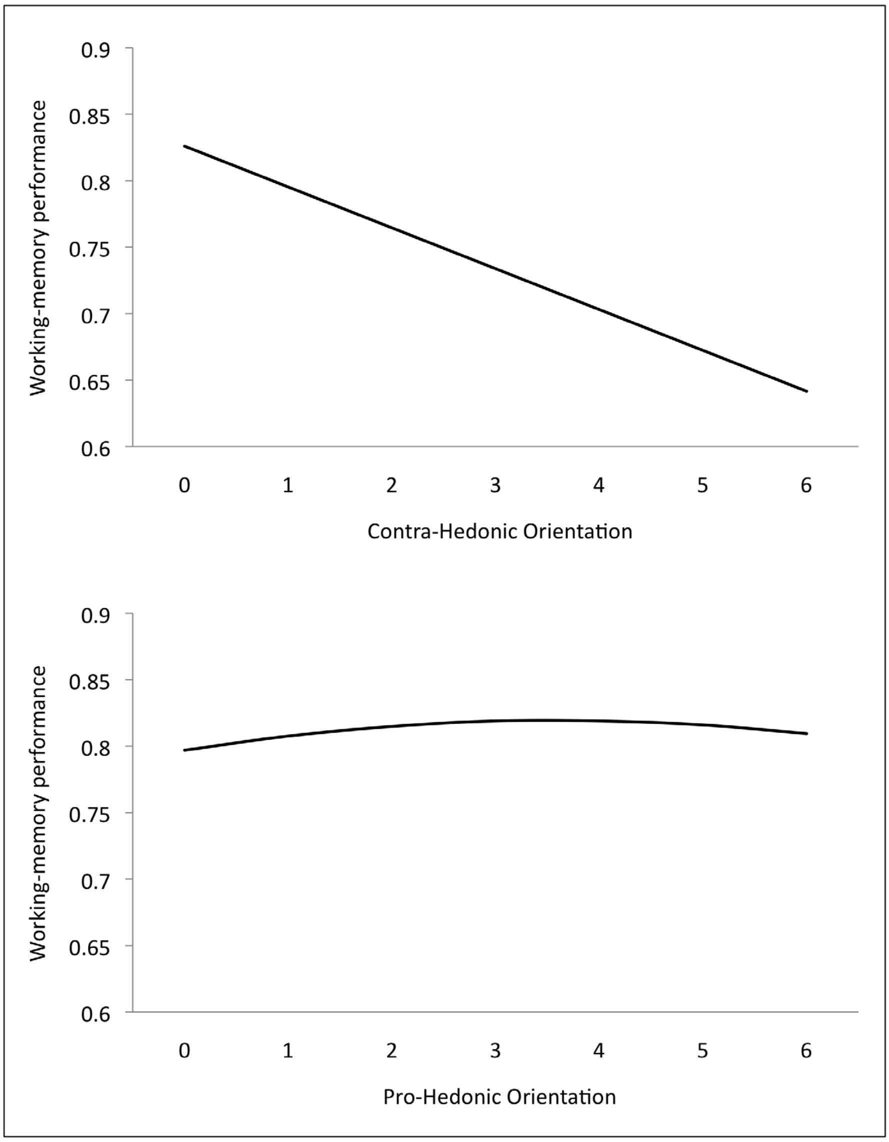

Figure 3. Model-predicted associations of contra-hedonic orientation (upper panel) and pro-hedonic orientation (lower panel) with working-memory performance: Contra-hedonic orientation is a stronger predictor of working-memory performance than pro-hedonic orientation. Model predictions controlling for positive and negative affect, pro- (respectively contra-) hedonic orientation, and session number (see Table 1), assuming that within-person average pro- and contra-hedonic orientations are at the respective sample means.