The effects of mindfulness and positive fantasizing on rumination and depression: A network perspective

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Table 1
Response Rates by group

Group	N_{Subj}	N_{Resp}	M	SD	$Q_{0.1}$	$Q_{0.9}$
Control	23	3853	0.68	0.18	0.51	0.87
Remitted	16	2242	0.65	0.19	0.42	0.85
Total	39	6095	0.67	0.18	0.48	0.87

Results

This study aimed to determine the relationships between several affective and cognitive symptoms commonly implicated in depression and how these symptoms and their connections change after training in mindfulness and positive fantasizing, respectively.

ESM Data

The data consisted of a total of 39 subjects that submitted a combined total of 6095 responses via the ESM app. As shown in Table 1, the control group responded at a higher rate (0.68) than the remitted MDD group (0.65). This difference is statistically significant, $\chi^2(1, N=39) = 9.20$, $p = .002$. In general, response rates dropped significantly from block 1 (0.72) to block 2 (0.60), $\chi^2(1, N=66) = 153.65$, $p = <.001$, as well as within each block from the baseline assessment (0.71) to the intervention phase (0.63), $\chi^2(1, N=67) = 60.59$, $p = <.001$.

Unless they dropped out prematurely, all subjects underwent both interventions in two blocks separated by a washout period of at least one month. Since network analysis methods, in particular, require much data we decided to increase statistical power by treating a particular subject in block 1 as a distinct entity from that same subject in block 2. For all further analyses we excluded a subject's responses per block if they responded to less than 50% of the prompts in that block. As some subjects responded to less than 50% of the prompts in either block, they were excluded entirely. A total of 33 participants, 21 healthy controls and 12 individuals in remission, remained.

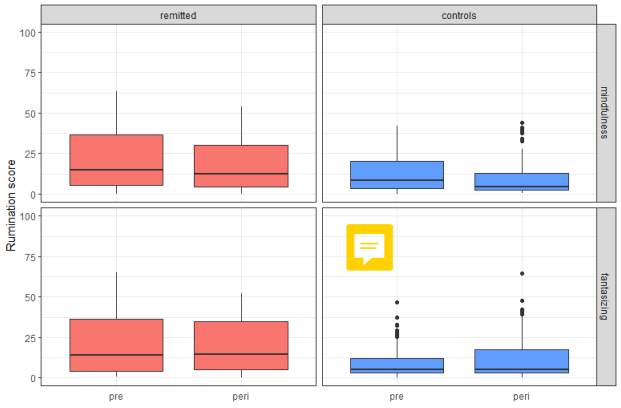

Figure 1
~~*Boxplots of subject-level*~~ *daily average rumination scores per group, intervention, and phase.*

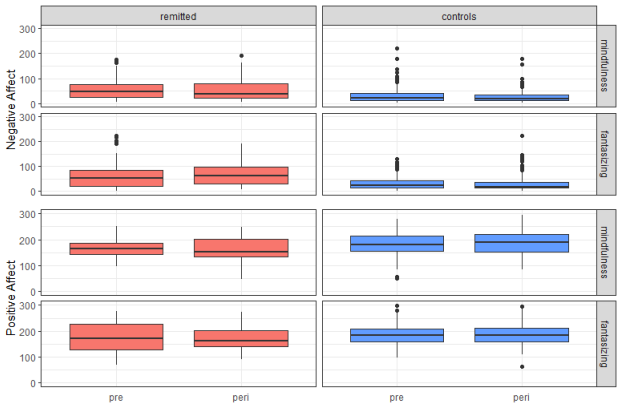

Figure 2
Boxplots of subject-level daily average negative (top) and positive affect (bottom) per group, intervention, and phase.

Figure 1 shows boxplots of subject-level daily average rumination scores per group, intervention, and phase. Comparing the groups (i.e., the columns), we can clearly see that the remitted MDD group, on average, shows higher levels of rumination than the control group. For the remitted MDD group, furthermore, the boxplots hint at a slight lowering ef-

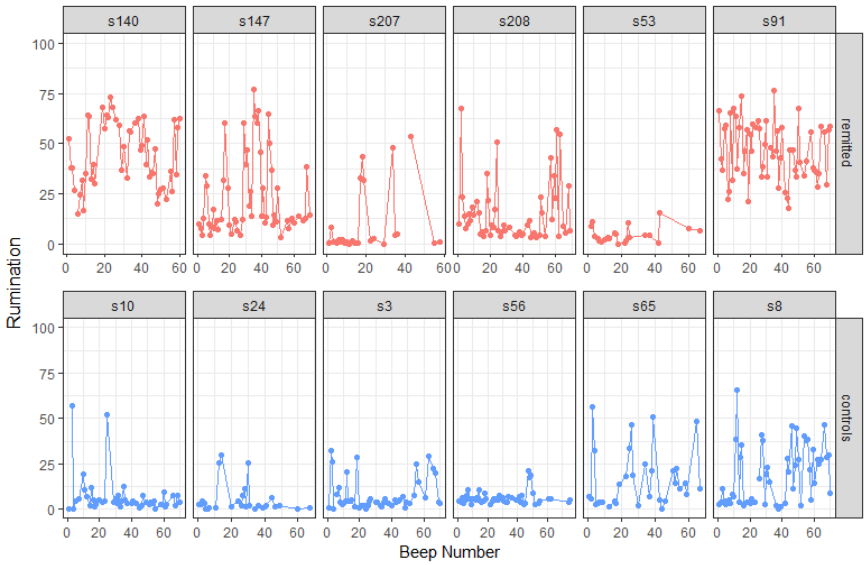

Figure 3

Rumination over the course of the baseline assessment period (block 1 only) for 6 randomly selected individuals for either mental health status group.

fect of both interventions on the average rumination level. In the control group, by comparison, the mindfulness intervention appears to be lowering rumination, whereas the positive fantasizing intervention does not.

Figure 2 depicts the negative and positive affect scores per group, intervention, and phase. Negative affect is the sum of the scores for current sadness, irritation, restlessness, and anxiousness. In contrast, positive affect is the sum of the scores for current satisfaction, wakefulness, and level of energy. Again comparing the groups, we find that negative affect is noticeably higher in the remitted MDD group, whereas there appears to be only a very modest difference in positive affect at best. The boxplots do not reveal a clear difference in the affect measures between the two phases for either intervention. Importantly, however, there are significant differences between participants, both between and within groups,

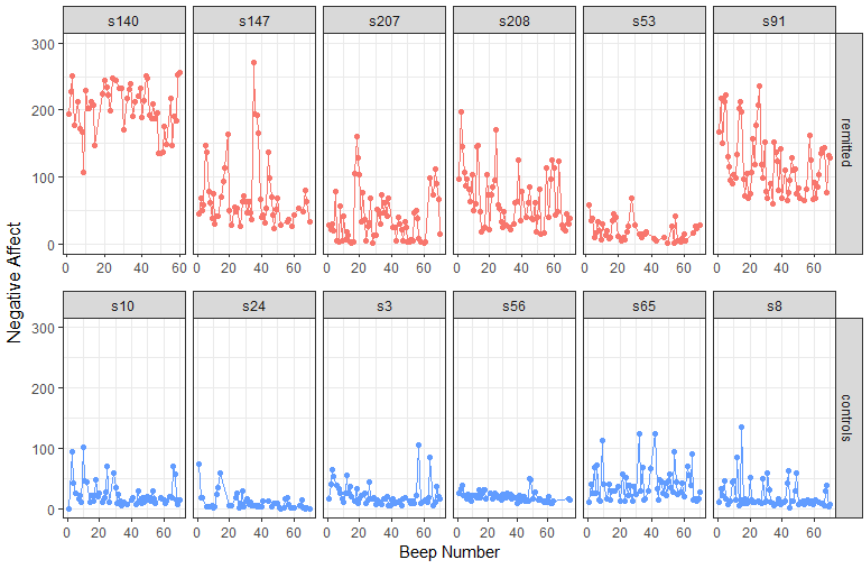

Figure 4

Negative Affect over the course of the baseline assessment period (block 1 only) for 6 randomly selected individuals for either mental health status group.

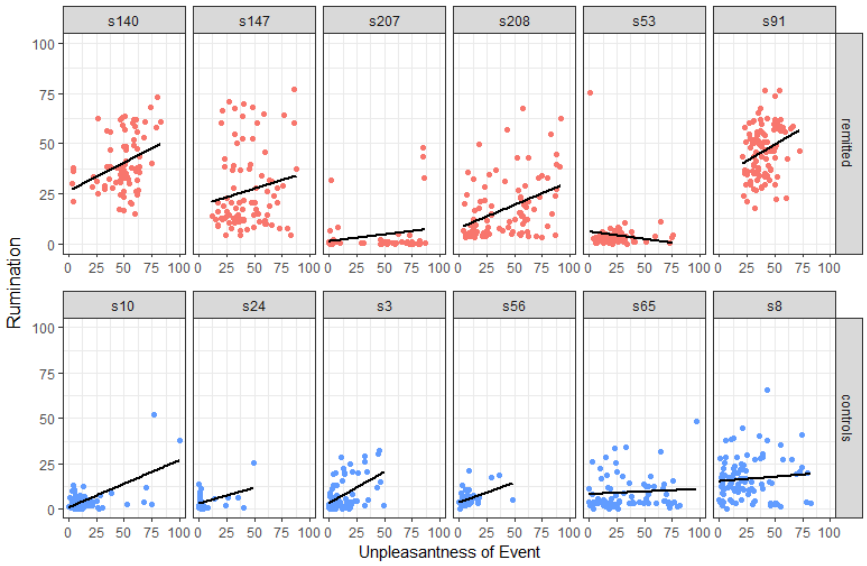

Figure 5

Rumination as a function of the unpleasantness of the most negative event since the previous beep for 6 randomly selected subjects from either mental health status group with per-subject regression lines superimposed.

and within single individuals over time. This is illustrated in Figure 3, which shows the rumination levels over the course of the baseline assessment period for six randomly selected individuals per group. While, on the whole, the individuals in the remitted group indicate higher levels of rumination, s53, for example, has low levels of rumination throughout the baseline assessment period despite being in the remitted MDD group. Furthermore, some remitted subjects (e.g., s140 and s91) constantly display high levels of rumination, whereas others (e.g., s208) show low levels of rumination with occasional spikes. In the control group, most individuals only rarely indicate elevated levels of rumination.

A similar picture is presented in Figure 4. It depicts the negative affect levels during the baseline assessment period for the same six subjects featured in Figure 3. As with rumination, the individuals in remission from depression indicate experiencing much higher levels of negative affect than the healthy controls. Again, however, there striking differences between individuals. s140, for example, shows very high levels of negative affect throughout the baseline assessment period, while s53 indicates hardly experiencing any negative affect. In the control group, all subjects' reported negative affect levels are rather similar to s53. Even so, we see that some healthy subjects report more occasional spikes in negative affect than others. Overall, levels of rumination and negative affect vary vastly between individuals. In addition, for some individuals, we can visually discern phases of, for example, differing levels of rumination, even just within the seven-day assessment period.

Instead of investigating rumination and negative affect over time, we can also look at them as a function of another time-varying variable – for example, the unpleasantness of the most negative event since the last beep. Figure 5 illustrates differences in individuals' reactions to unpleasant events, in terms of levels of rumination and negative affect, respectively. In general, there may be a tendency of the remitted group to report slightly more unpleasant negative events than the control group. In all subjects but s53 (curiously enough found in the remitted MDD group), the relationship indicated by the linear regression line between rumination an the unpleasantness of a recent negative event is positive. However, there are differences in the slope of this regression line, further revealing considerable diversity across participants. Naturally, the exact nature of this relationship is unclear and may be mediated by other variables. While these inter-individual differences are notable in and of themselves, they are, additionally, crucial to consider in our further analysis since they would otherwise distort our results, and therefore, the conclusion we might draw.

Disentangling Within- and between-person variability

As the first step, we examined to what extent the variability in our variables of interest is due to within- and between-person differences. Towards this goal, a simple intercept model with a random intercept was created for rumination, negative affect, and positive affect, respectively. The general structure of these models is given by

$$y_{ij} = \mu + u_i + \epsilon_{ij}, \tag{1}$$

where y_{ij} denotes the observed outcome of the *ith* subject at the *jth* assessment moment. μ is the model intercept (i.e.,

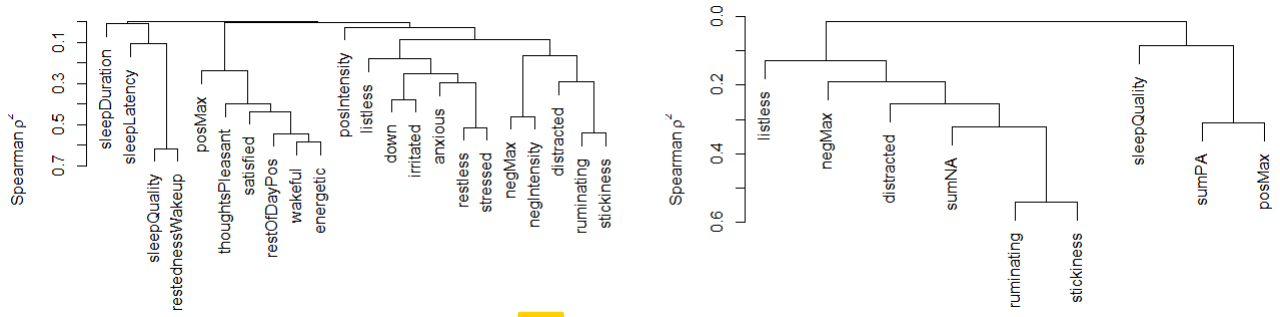

Figure 6

Hierarchical clusters for all available numerical predictors (left) and for the reduced set of predictors (right).

the average outcome), u_i is the random intercept (the average adjustment of the model intercept per participant) and ϵ_{ij} is the error term. For each of these models, only the baseline assessment phases are considered. The intraclass correlation coefficient (ICC) gives us the proportion of the variance explained by between-person effects. For the variable rumination, the ICC is 0.54, meaning that slightly more than half of the variability in the data is attributable to between-person effects. Naturally, the remaining half is explained by within-person effects. The ICCs for negative and positive affect are similar, standing at 0.59 and 0.50, respectively. This is another clear indication that random effects need to be considered in the analysis of our data.

Next, we were interested in determining the extend to which certain predictors could account for between- and within-person variabilities. To do so, we created more complex linear mixed-effects models with a subject-level predictor, namely, the mental health status group to examine which participants tend to report lower versus higher levels of rumination, negative affect, and positive affect. We find significant effects of group for rumination and negative affect, but not for positive affect. Participants in the remitted MDD group report, on average, a 10.85 points higher level of rumination compared to those from the control group, t(3073) = 2.28, p = 0.023. The difference is even more pronounced for negative affect, for which remitted MDD subjects indicate an average of 26.49 points greater levels, t(3073) = 2.11, p = 0.035. By contrast, being part of the remitted MDD group leads to an average reduction of positive affect by 9.84 points. However, this difference is not statistically significant, t(3073) = -0.79, p = 0.426) Comparing the between-subject variability of the intercept models with the extended models', we can determine how much of this variability is accounted for by the newly included group variable. The mental health status explains 13.11% of the between-subject variability in rumination and 9.26% in negative affect. For positive affect, this value is 0, meaning that the mental health status group does not explain any of the between-subject variability for this variable.

As figure 5 demonstrates, there are differences in how individuals react to the unpleasantness of a recent event. Extending the intercept models with a random intercept and slope for the perceived unpleasantness per subject, we investigated what percentage of within-person variability can be explained by how unpleasant a previous negative event was. Regarding rumination, the comparison between the models suggests that 10.06% of the within-subject variability in rumination is accounted for by the level of unpleasantness of the most negative event since the last assessment. For negative and positive affect, the unpleasantness of such an event explains 16.60% and 9.11% of momentary fluctuations, respectively. The same analysis was conducted using the pleasantness of the most positive event since the last beep. The results indicate that event pleasantness accounts for 7.57%, 7.22%, and 24.59% of within-subject variability in rumination, negative affect, and positive affect, respectively. Subsequently, we extended the models by the mental health status group predictor, resulting in models of the structure

$$y_{ij} = (\beta_0 + \beta_1 dep_i + u_{0i}) + (\beta_3 + u_{1i}) unpleas_{ij} + \beta_4 dep_i \times unpleas_{ij} + \epsilon_{ij}, \quad (2)$$

where β_4 adjusts the average slope for those participants in the remitted MDD group compared to the control group. However, comparing models 2 with models **??**, we found that the mental health status, whether an individual is in remission from depression or has never had any mental illnesses, does not explain any of the variability in the strength of association between event unpleasantness and either of the three variables of interest. By comparison, the mental health status may account for 6.52% of the strength of the association between event pleasantness and negative affect. However, it also fails to explain any variability in event pleasantness' association with the remaining two outcome variables.

Nonlinear baseline models

So far, we considered linear effects only since it allows us to approximate the extent to which a given predictor can account for between- and within-person variability. However,

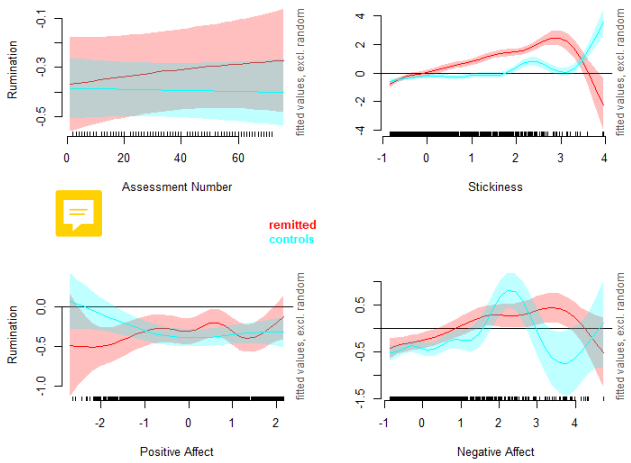

Figure 7

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assuming linearity may be problematic, especially when incorporating time as an additional predictor. Generalized Additive Mixed Models (GAMM) are a statistical method capable of separating inter- from intra-individual effects and handling nonlinearity. We created GAMMs to predict rumination, negative affect, and positive affect.

Rumination

The best-fitting models were selected in three steps: First, we checked for the most suitable random-effects structure. We built the most complex models admissible by the study design both in regards to random- and fixed-effects structure. Such models, however, turned out to be much too complex given the number of data points available. This persisted even after scaling all variables. In terms of random effects, consequently, we had to limit ourselves to a random factor smooth for assessment number per subject. Regarding the fixed effects, we discarded any categorical predictors other than *group* because their inclusion proved most detrimental to model convergence. Due to too many predictors and multicollinearity, model convergence remained problematic even after excluding categorical predictors.We conducted hierarchical analyses to detect highly correlated predictors to deal with this issues. Figure 6 shows the resulting clusters for the set of all variables (left; condition number 32.5) and after reducing that set (right; condition number: 17.2). The results of the first hierarchical clusters in combination with theoretical considerations led us to combine the different positive affect measures (energetic, satisfied, and wakefulness) into an aggregate positive affect variable (*sumPA*). Likewise, the negative affect measures (down, irritated, restless, and anxious) were placed into an aggregate negative affect variable (*sumNA*; note: for the linear models we also used these aggregate affect variables). All measures related to sleep were reduced to just one: sleep quality. The pleasantness of current thoughts (*thoughtsPleasant*) and the positivity of the outlook for the remaining day (*restOfDayPos*) were removed as they correlated very highly with positive affect. The variable *stressed* was removed because it correlated strongly with negative affect. Moreover, the perceived intensity of the most negative (*negIntensity*) and the most positive (*posIntensity*) event since the last assessment were cut in favor of those events' unpleasantness (*negMax*) and pleasantness (*posMax*), respectively. Combining the remaining predictors, we arrived at the most complex models admissible by our study design that would still converge. As a consequence, the model included the main effect for *group*, smooths per group for *assessment number*, pleasantness of the current company (*companyPleasant*; note: because of many missing values, this predictor was not included in the hierarchical clustering analysis), event pleasantness, event unpleasantness, sleep quality, as well as the current levels of distraction, listlessness, and stickiness of thought. In addition, out of the three variables rumination, negative affect, and positive affect, smooths per group were included for the two variables that were not the model's response variable. The random-effects structure consisted only of a random factor smooth for *assessment number* per subject. All three model summaries indicated this smooth term to be significant. Hence, the random-effects structure did not have to be simplified further.

Second, the fixed-effects structure was determined using a backward-fitting model comparison procedure. The final rumination model's fixed effects included the main effect for group, smooths for assessment number per group, negative affect per group, positive affect per group, and stickiness per group. In addition, smooths for listlessness, sleep quality, and company pleasantness were included. Finally, we checked for auto-correlation in the model's residuals. However, no significant auto-correlation was found.

The resulting model parametric coefficient (disregarding the intercept), the main effect for group. Compared to the remitted MDD group, the healthy controls reported an average of 0.28 points (scaled) less rumination. This test result was found to be statistically significant, $t(1197.708)=-7.78$, $p<.001$. The effect size for this analysis ($d = 0.45$) was found to be small according to Cohen's (1988) convention. The remaining results are best conveyed visually (though a model summary can be found in the appendix). In line with expectations, given that we analyzed only the baseline assessment period here, the top left of Figure 7 shows that the assessment number has no significant differential effect on the level of rumination of the two groups. The top right of the same figure, by contrast, indicates that higher levels of stickiness are generally associated with more rumination. This

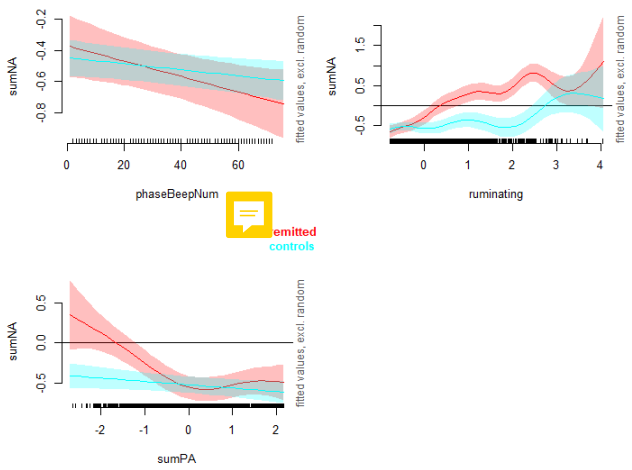

Figure 8

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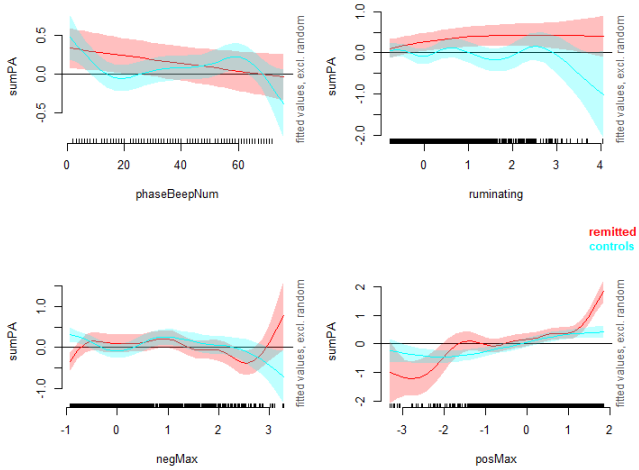

Figure 9

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trend is especially pronounced in the remitted MDD group. The bottom of Figure 7 shows the association of negative affect (left) and positive affect (right) with rumination in the groups. Negative affect, for the most part, does not appear to affect healthy individuals and individuals in remission from depression differently. By contrast, remitted participants tend to indicate higher levels of rumination when positive affect is low compared to the controls. However, this difference fades quickly with rising positive affect.

+++++ should probably describe the effects of the regular smooths (for now see Figure 24 in appendix) ++++++

Negative affect

For negative affect, the final model's fixed effects comprised of the main effect for group, smooths for assessment number per group, ruminating per group, and positive affect per group. Furthermore, it included smooths for the level of stickiness, distraction, listlessness, sleep quality, and company pleasantness. Again, no significant auto-correlation was found. This model suggests that the healthy controls report an average of 0.28 points (scaled) less negative affect than the remitted MDD participants. The test result reached statistical significance, $t(1169.376)=-7.97$, $p<.001$. This effect was found to be small (d = 0.47). Figure 8 depicts the difference in the effects of assessment number (top left), rumination (top right) and positive affect (bottom left) on negative affect by group. While there is no difference between the groups over time (assessment number), rumination and positive affect show significant differences between the groups, in terms of their effect on negative affect. In line with the results from the rumination model, the negative affect model also indicates that higher rumination is associated with more negative affect in the remitted MDD as compared to the control group, though this difference is not significant for the highest levels of rumination. However, this may also be an artifact of the lower number of observations with high levels of rumination. The model, moreover, suggests that low levels of positive affect are associated with higher levels of negative affect in the participants in remission. In the controls, the level of positive affect does not appear to have a strong effect on negative affect.

+++++ should probably describe the effects of the regular smooths (for now see Figure 25 in appendix) ++++++

Positive affect

The model for positive affect contains the main effect for group, a smooth per group for assessment number, rumination, as well as event pleasantness and unpleasantness. Furthermore, it includes smooths for negative affect, stickiness, distraction, listlessness, sleep quality, and company pleasantness. As with the previous models, no significant auto-correlation was detected. Unlike the other models, there is no significant effect of group on the response variable, β=0.002, $t(1147.329)$=0.053, p=0.958. Figure 9 portrays the effects of assessment number (top left), rumination (top right), even unpleasantness (bottom left) and event pleasantness (bottom right) on positive affect by group. For the remitted group, positive affect seems to be following a slight downward trend over time, though the confidence intervals are rather large. The model suggests a slightly positive association between rumination and positive affect, though it is very subtle. Similarly, there is no clear effect of event unpleasantness in either group. Event pleasantness, by contrast, shows a positive association with positive affect in both groups.

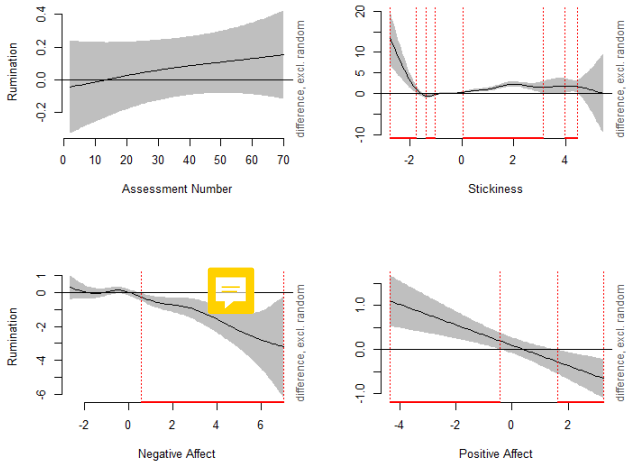

Figure 10
Estimated difference in rumination between the positive fantasizing and mindfulness condition for the remitted MDD group.

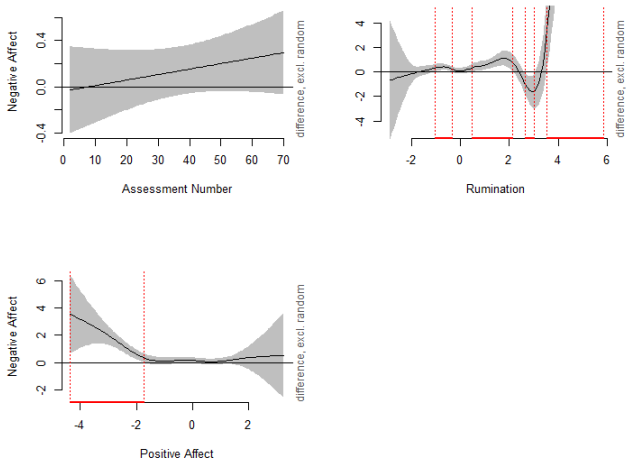

Figure 12
Estimated difference in negative affect between the positive fantasizing and mindfulness condition for the remitted MDD group.

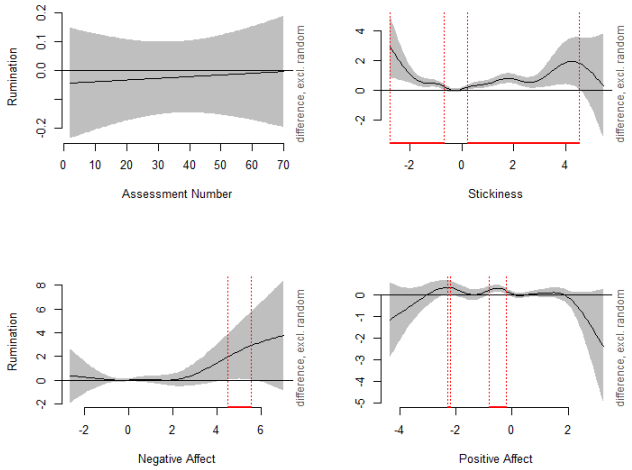

Figure 11
Estimated difference in rumination between the positive fantasizing and mindfulness condition for the control group.

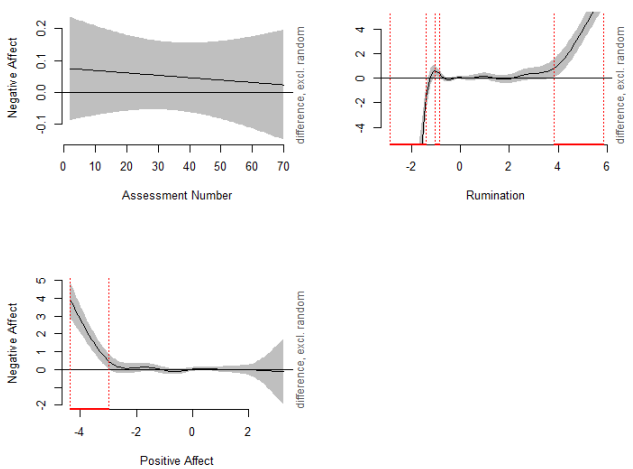

Figure 13
Estimated difference in negative affect between the positive fantasizing and mindfulness condition for the control group.

+++++ should probably describe the effects of the regular smooths (for now see Figure 26 in appendix) ++++++

Nonlinear peri-intervention models

In the next step, the baseline models were applied to the peri-intervention phases. All per-group smooths of a model, however, were extended to the combination of group and intervention. Instead of the normal (scaled) values, furthermore, we used (scaled) change scores. That is, we calculated the mean scores per subject for the baseline period and subtracted it from that subject's peri-intervention scores.

Rumination

The rumination model for the peri-intervention period has three parametric coefficients – the main effects for group, intervention, and their interaction. The main effect for group (β=-0.03905, t(1048.06)=-0.669, p=.503) and the interaction term (β=0.11990, t(1048.06)=1.557, p=.120) did not reach statistical significance. By contrast, the main effect for intervention was statistically significant, albeit small,

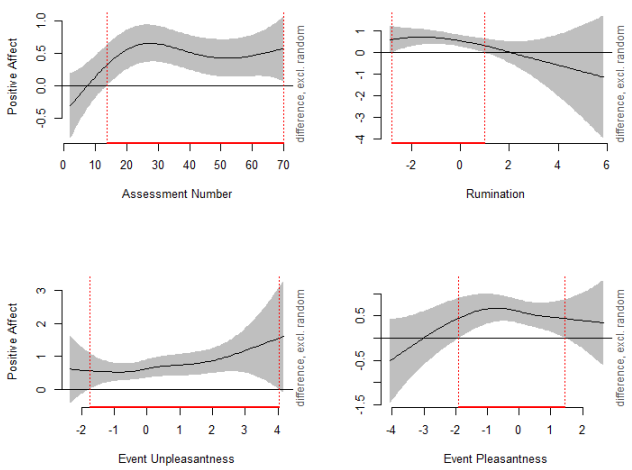

Figure 14

Estimated difference in positive affect between the positive fantasizing and mindfulness condition for the remitted MDD group.

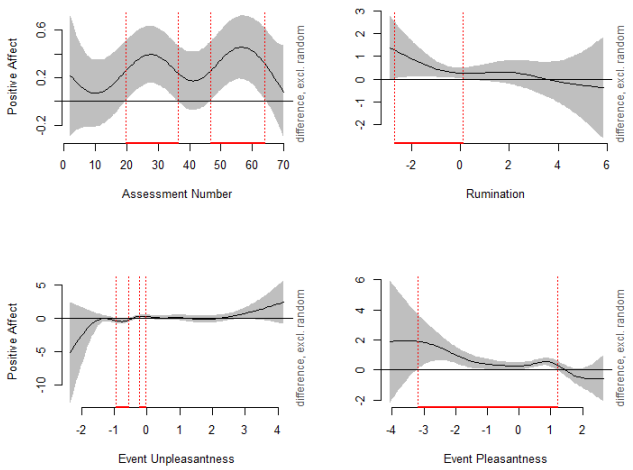

Figure 15

Estimated difference in positive affect between the positive fantasizing and mindfulness condition for the control group.

48.06)=4.024, p<.001; d=0.25. On average, participants receiving the fantasizing intervention reported 0.24 (scaled) points more rumination. Figure 10 shows the estimated differences between the fantasizing and the mindfulness intervention for the remitted MDD group over time (top left), stickiness (top right), negative (bottom left), and positive affect (bottom right). The red dotted lines indicate intervals of significant difference between the intervention types. Even though there appears to be a trend toward lower rumination in the mindfulness compared to the fantasizing condition, the difference never reaches significance. For most levels of stickiness, there appears to be a greater association with rumination in the fantasizing compared to the mindfulness intervention. Mid to high levels of negative affect, by comparison, are associated with higher levels of rumination in the mindfulness group. Similarly, at high levels of positive affect participants receiving mindfulness intervention tend to report more rumination. However, at low to mid levels of positive affect, this tendency is reversed. The same plots as in Figure 10 are depicted in Figure 11 but for the healthy controls. [For time reasons I skip this part for now]

Negative Affect

The negative affect model has the same three parametric coefficients as the rumination model. Unlike with the latter, however, all of them reached statistical significance in this model. All three effects are small according to Cohen's (1988) convention. Compared to the remitted MDD participants, the model, surprisingly, suggests that subjects in the control group report an average of 0.20 (scaled) points more rumination, t(1018.039)=3.432, p<.001, d=0.22. Subjects in the positive fantasizing condition, likewise, report more rumination, β=0.50, t(1018.039)=6.655, p<.001, d=0.42. Interestingly, the interaction between control group and positive fantasizing reverses the main effects. On average, and compared to remitted MDD participants receiving the mindfulness intervention, these participants report 1.14 (scaled) points lower levels of rumination, t(1018.039)=-7.890, p<.001, d=0.49. Figure 12 displays the difference in negative affect between the fantasizing and the mindfulness condition for the remitted MDD group. Similar to rumination, there is a trend toward less rumination in the mindfulness condition as compared to the fantasizing condition over time. This trend too, however, did not reach statistical significance. Rumination, for the largest part, is associated with more rumination in the fantasizing than the mindfulness condition for the remitted MDD participants. Low levels of positive affect are also associated with more negative affect in the fantasizing than the mindfulness condition according to our model. [Difference in control group skipped for now.]

Positive Affect

The three parametric coefficients are significant in the positive affect model. Controls report an average of 0.34 (scaled) points higher positive affect than remitted individuals, t(1063.529)=5.061, p<.001, d=0.31. Similarly, participants in the fantasizing condition indicate 0.41 (scaled) points higher positive affect levels, t(1063.529)=5.415, p<.001, d=0.33. The interaction term, again, cancels some of the main effects. The interaction between control group and fantasizing intervention leads to an average of 0.32 (scaled)

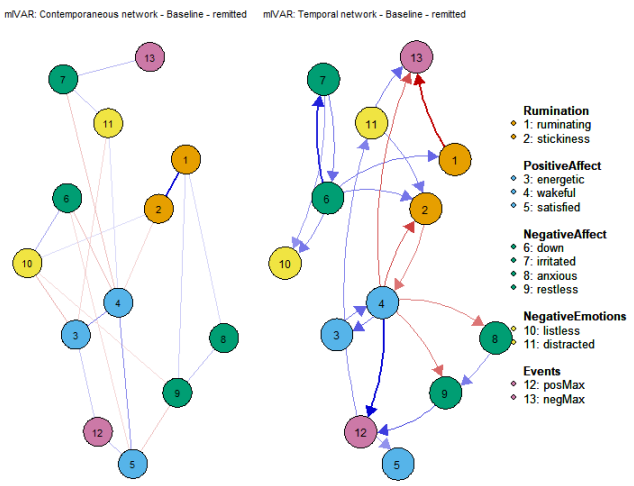

Figure 16
Control group networks at baseline. Left: contemporaneous; right: temporal.

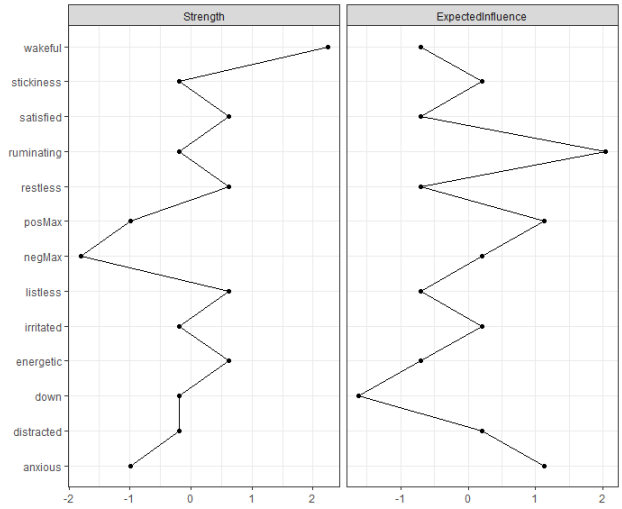

Figure 17
Node strength and expectedInfluence in contemporaneous baseline network of remitted MDD group.

points lower levels of positive affect compared to remitted individuals receiving mindfulness training, $t(1063.529)=-3.345$, $p<.001$, $d=0.21$. Figure 14 portrays the estimated differences in positive affect between the two intervention conditions for the participants in remission from depression. This time, we actually find a significant difference between the conditions over time. After approximately 14 assessments, which is a little less than 1.5 days, positive affect is significantly higher in the fantasizing condition than the mindfulness condition for this group. At low levels of rumination, positive fantasizing is also estimated to lead to more positive affect than mindfulness. Similar results are found for even pleasantness and unpleasantness. For almost all levels of event unpleasantness, positive affect is higher in the fantasizing condition than in the mindfulness condition. A similar result is found for event pleasantness, though it is not significant for the lowest and highest levels of event pleasantness. [Again skipped controls]

Network Analysis

To explore the relationships between the symptoms more holistically, we decided to conduct network analysis. Multilevel vector autoregressive modeling (mlVAR) was used to estimate both temporal and contemporaneous networks. We started by estimating the networks of either mental health status group during the baseline assessment period.

Group comparison

++++++++++++++++ I have networks per group, intervention and phase as well but haven't had the time to describe the results yet ++++++++++++++++++++++++++++++

Figure 16 shows the contemporaneous (left) and the temporal network (right) for the remitted MDD group. Figures 17 and 18 provide us with the node centrality measures *strength* (Note: sum of absolute edge weights between a node and all nodes it is connected to) and *expectedInfluence* (Note: sum of edge weights –> accounts for negative edge weights) for each node of the contemporaneous and the temporal network, respectively. In the contemporaneous network, the nodes with the highest *strength* is *wakeful* with 2.24 (z-score). *Satsified*, *restless*, *listless*, and *energetic* all have a strength value of 0.62. In terms of expectedInfluence, interestingly, it is not wakefulness but *rumination* that has the highest score (2.04). Event pleasantness (1.13) and anxiety (1.13) also have high strength. The centrality measures for the temporal network are shown in Figure 18. Event unpleasantness possesses the highest strength, in terms of incoming edges (2.15). However, the network shows that it is strongly negatively influenced by rumination and wakefulness but very positively so by listlessness. As a result, it InExpectedInfluence is the lowest of all nodes (-2.10). Event pleasantness, by contrast, exhibits both high InStrength (1.21) and InExpectedInfluence (1.93). Both restlessness and wakefulness positively influence it. Wakefulness and feeling down have the highest OutStrengths (2.74 and 1.30). Whereas wakefulness has very little OutExpectedInfluence (-1.38), however, feeling down is also the most central node according to this metric (2.24).

Figure 19 depicts the contemporaneous (left) and the temporal network (right) for the control group. Figures 20 and 21 visualize the accompanying node centrality mea-

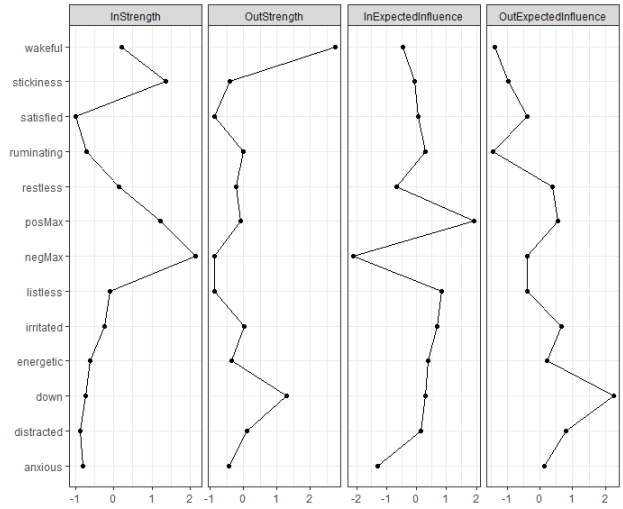

Figure 18

Node InStrength, OutStrength, InExpectedInfluence, and OutExpectedInfluence in temporal baseline network of remitted MDD group.

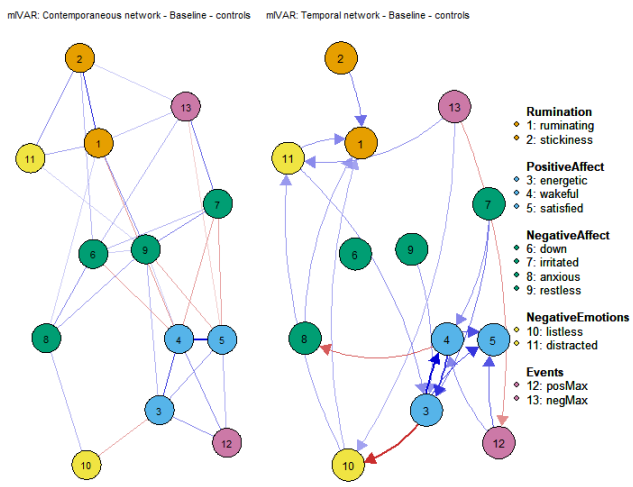

Figure 19

Control group networks at baseline. Left: contemporaneous; right: temporal.

sures. Within the contemporaneous network, restlessness has the highest strength (1.80) followed by wakefulness (1.22). While wakefulness shows very little expectedInflunce (-0.99), similar to the remitted MDD network, restlessness is also most central according to this measure (1.81). Wakefulness, however, is highly central to the temporal network of the control group. It is among the three most central nodes according to all four measures considered. Another positive affect variable scores even higher on all measures: the energy level (*energetic*). Feeling down, which features fairly centrally in the remitted MDD temporal network, is no factor in the control group's network according to these results.

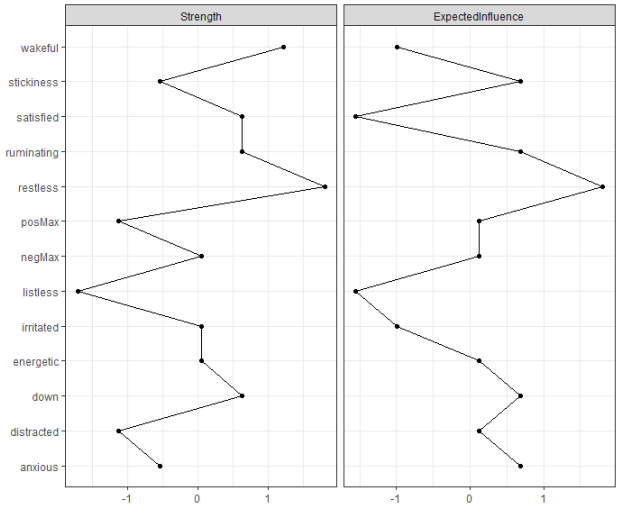

Figure 20

Node strength and expectedInfluence in contemporaneous baseline network of controls.

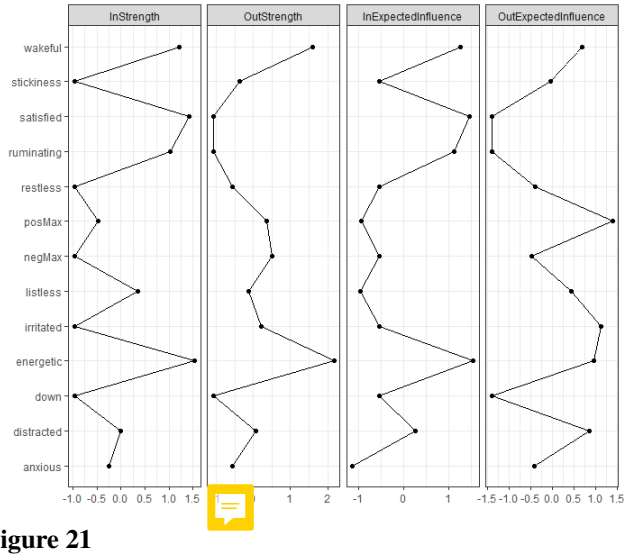

Figure 21

Node InStrength, OutStrength, InExpectedInfluence, and OutExpectedInfluence in temporal baseline network of controls.

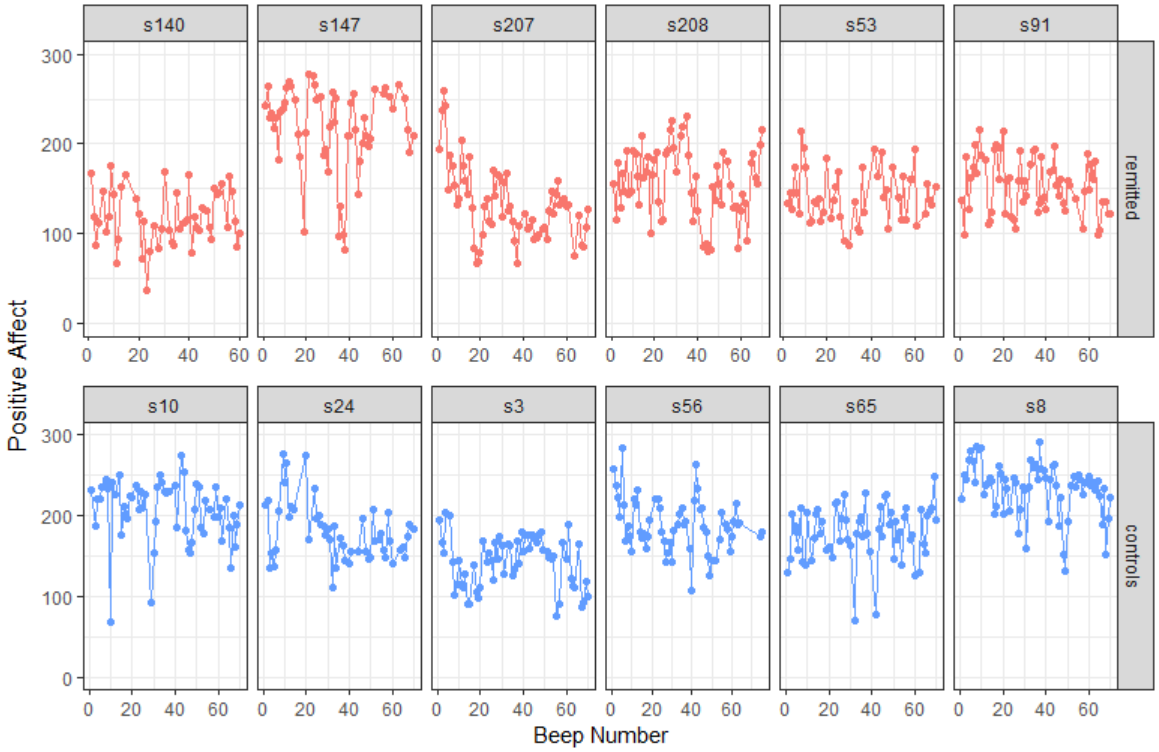

Figure 22

Positive Affect over the course of the baseline assessment period (block 1 only) for 6 randomly selected individuals per group.

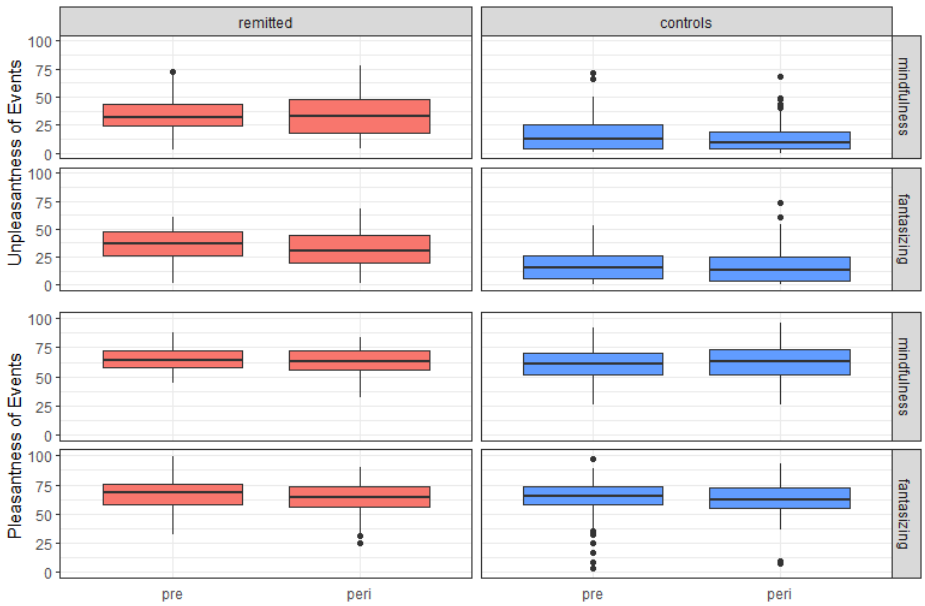

Figure 23

Boxplots of subject-level daily average unpleasantness of most negative event (top) and pleasantness of the most positive event (bottom) since the previous beep per group, intervention, and phase.

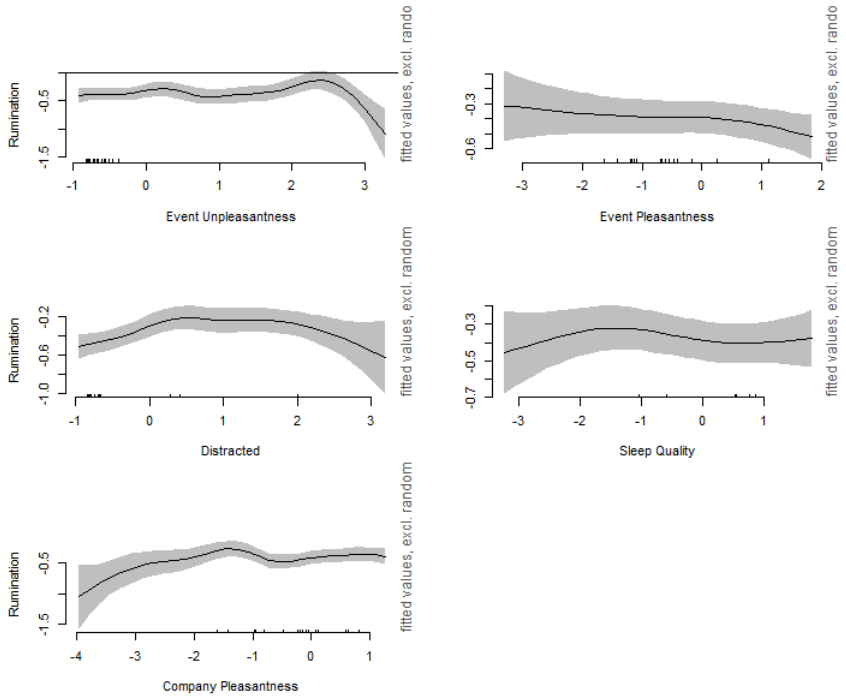

Figure 24
Baseline rumination model smooths.

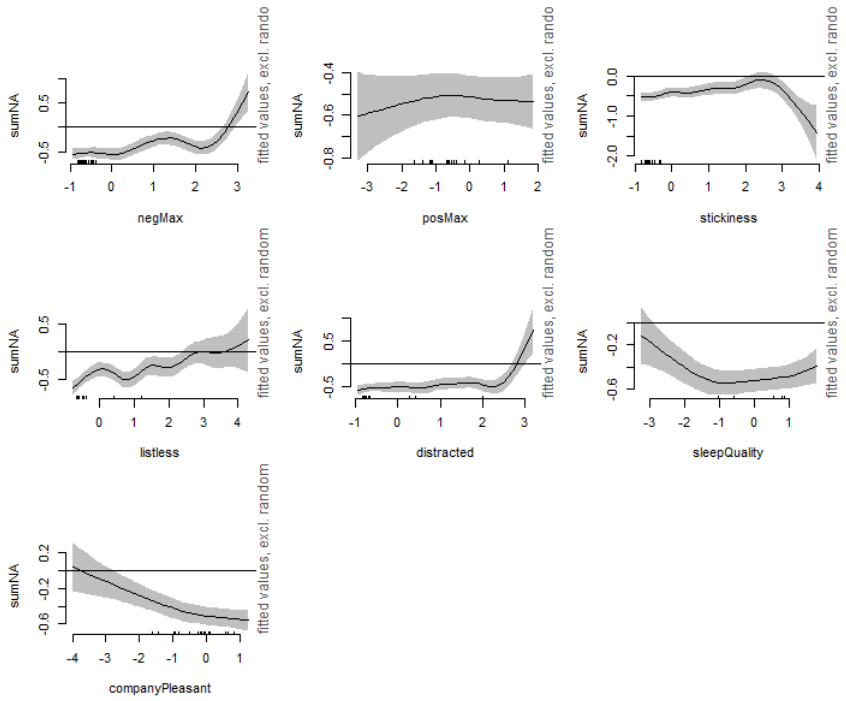

Figure 25
Baseline negative affect model smooths.

Rumination by thought probes

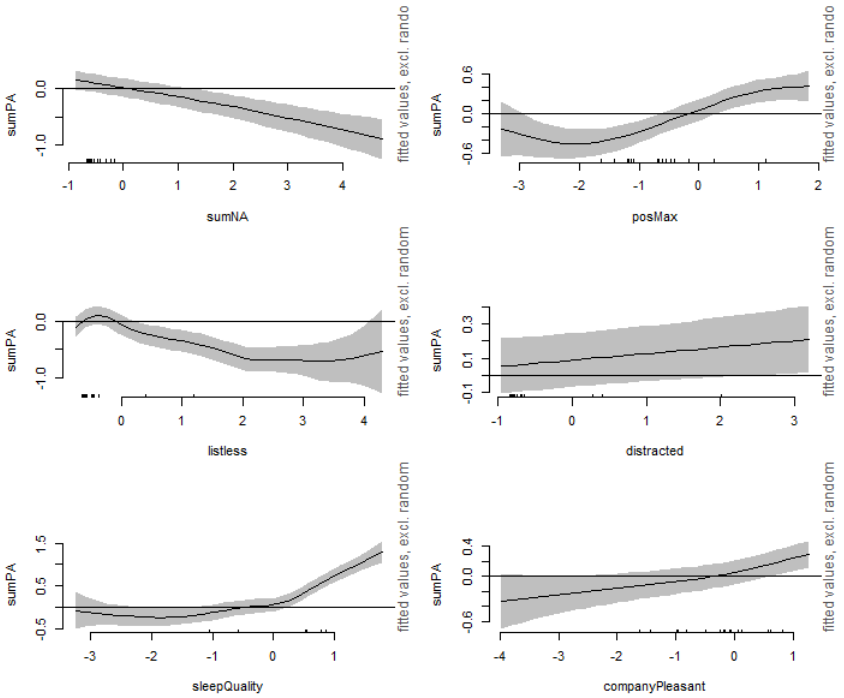

Figure 26
Baseline positive affect model smooths.

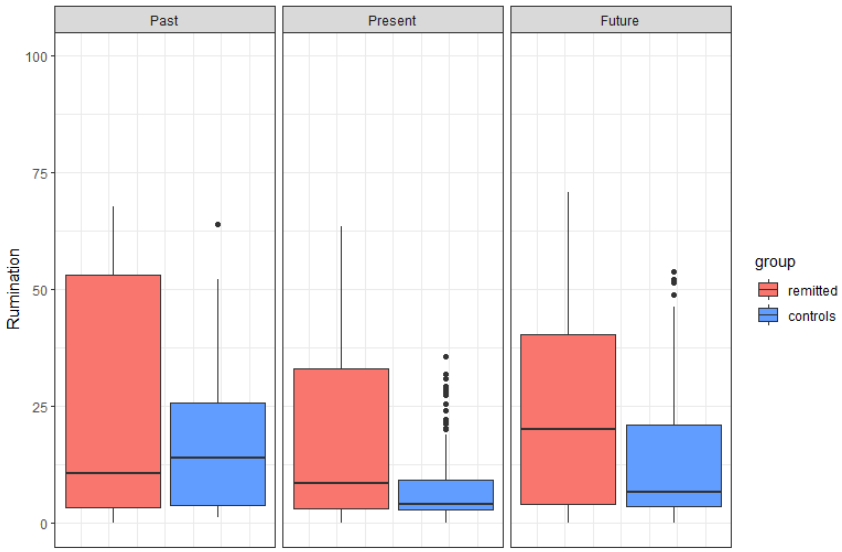

Figure 27
Boxplots of subject-level daily average rumination by time-orientation of current thoughts per group during the baseline assessment period.

Negative Affect by thought probes

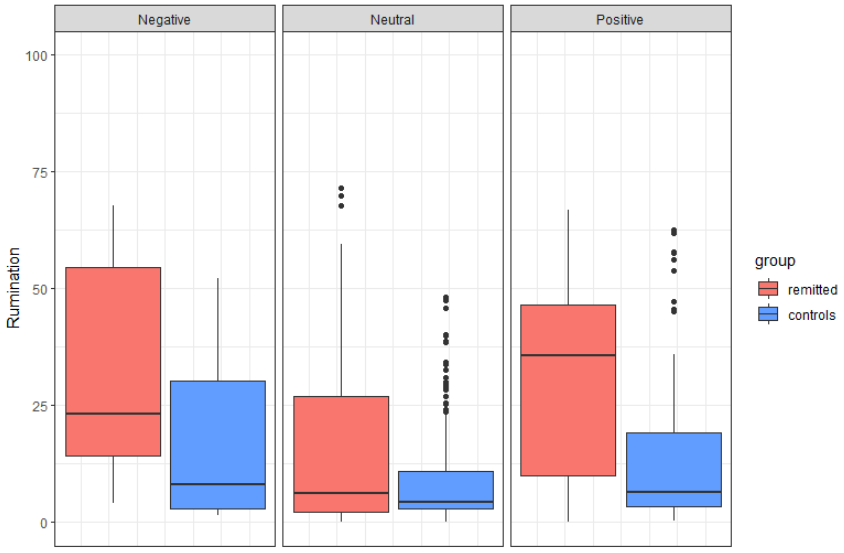

Figure 28

Boxplots of subject-level daily average rumination by valence of current thoughts per group during the baseline assessment period.

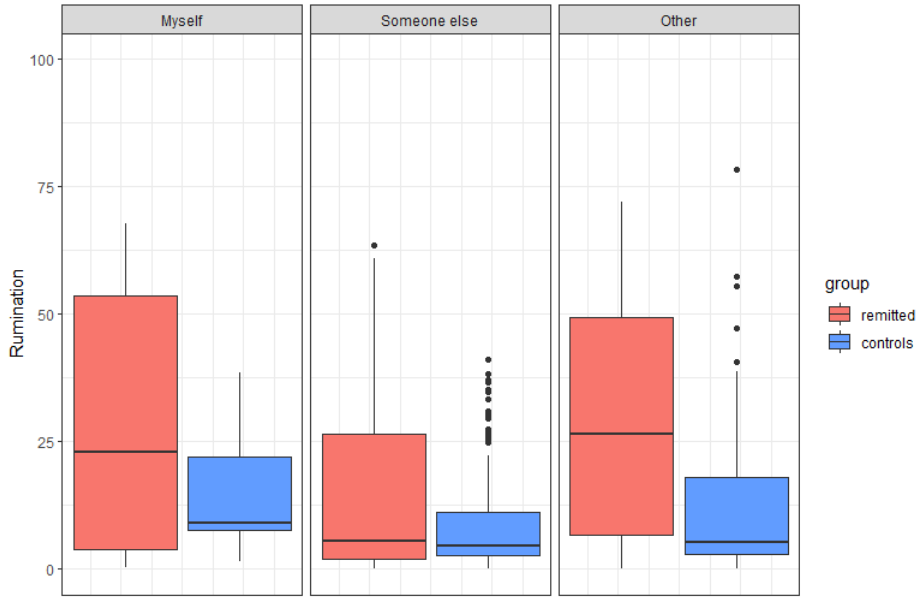

Figure 29

Boxplots of subject-level daily average rumination by object of current thoughts per group during the baseline assessment period.

Effects of mindfulness

Effects of positive fantasizing

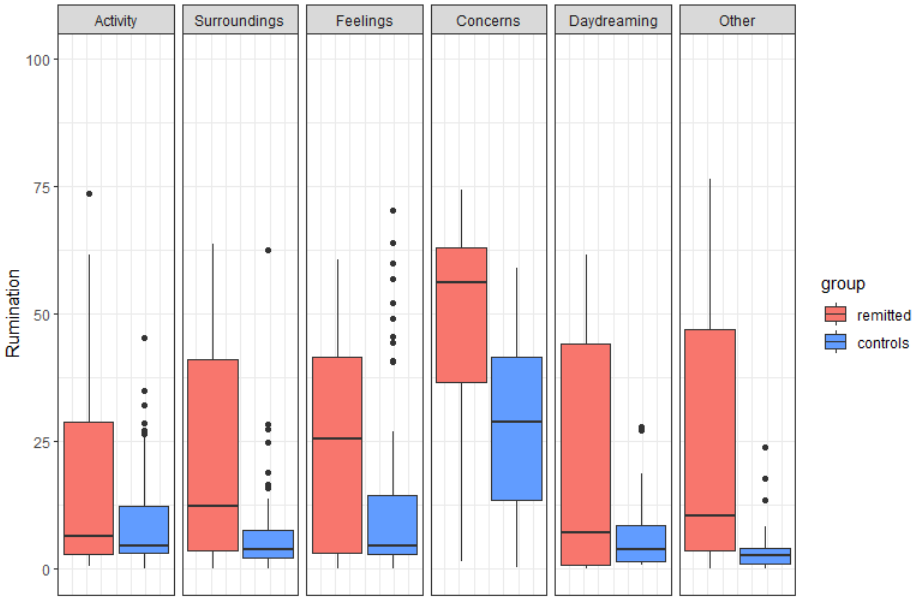

Figure 30

Boxplots of subject-level daily average rumination by object of current thoughts per group during the baseline assessment period.

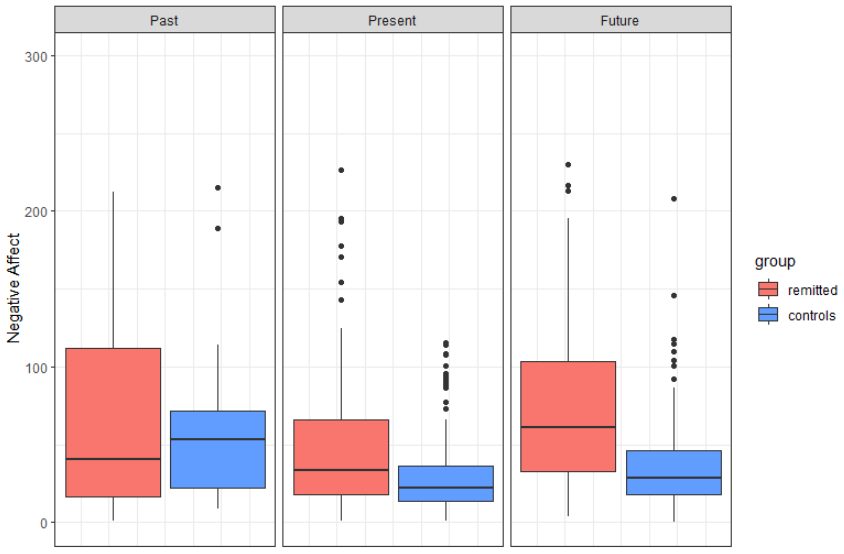

Figure 31

Boxplots of subject-level daily average negative affect by time-orientation of current thoughts per group during the baseline assessment period.

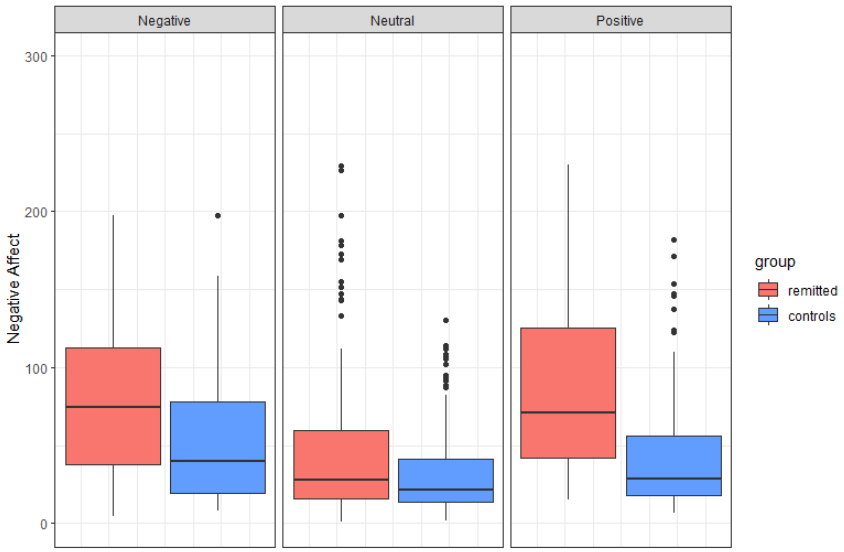

Figure 32

Boxplots of subject-level daily average negative affect by valence of current thoughts per group during the baseline assessment period.

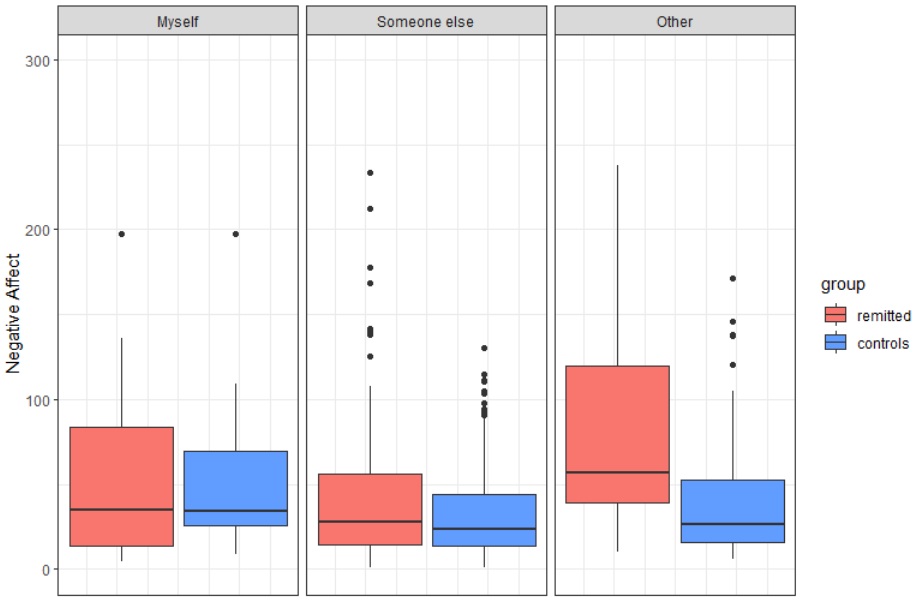

Figure 33

Boxplots of subject-level daily average negative affect by object of current thoughts per group during the baseline assessment period.

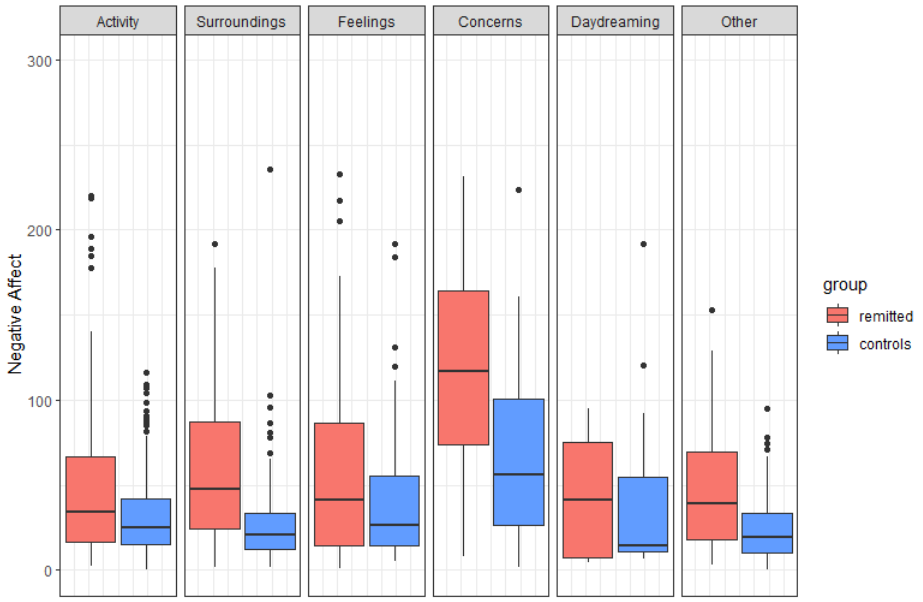

Figure 34

Boxplots of subject-level daily average negative affect by object of current thoughts per group during the baseline assessment period.

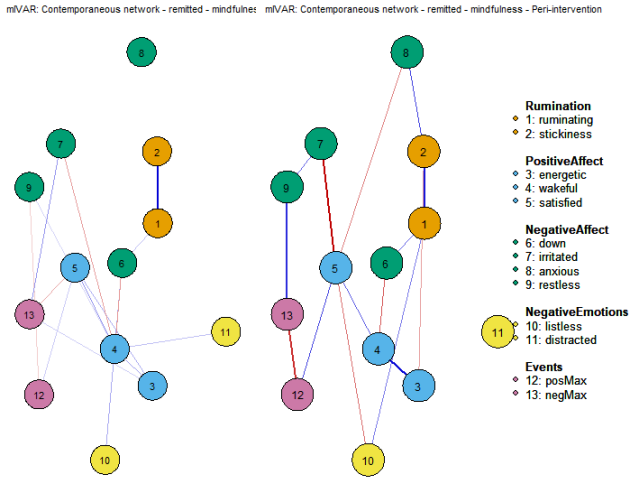

Figure 35

Remitted MDD group (mindfulness condition) contemporaneous networks at baseline (left) and during mindfulness intervention (right).

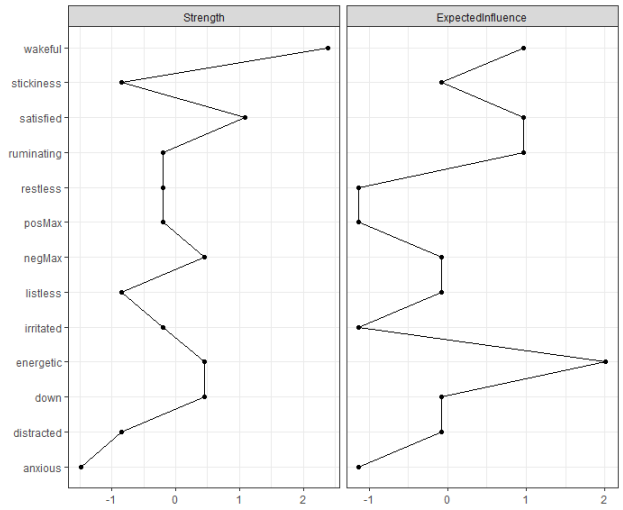

Figure 36
Node strength and expectedInfluence in contemporaneous baseline network of remitted MDD group (mindfulness condition).

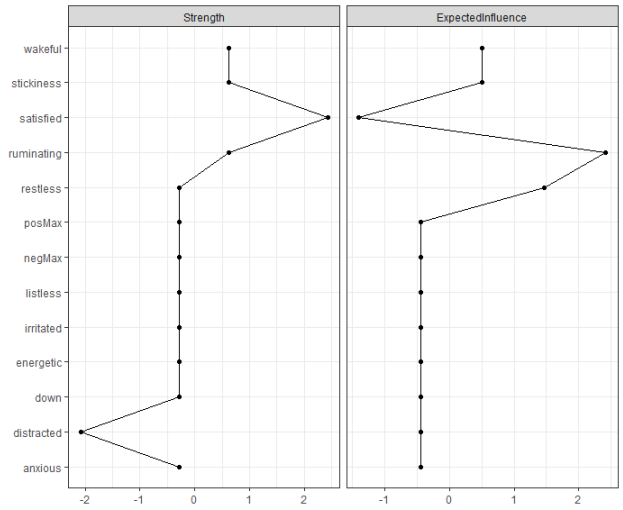

Figure 37
Node strength and expectedInfluence in contemporaneous peri-intervention network of remitted MDD group (mindfulness condition).

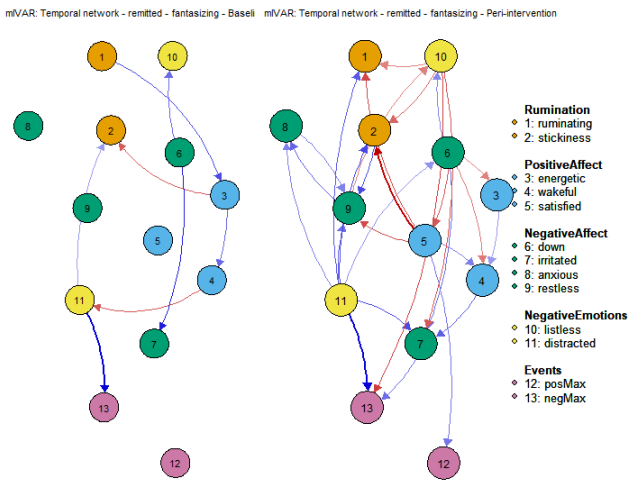

Figure 38

Remitted MDD group (fantasizing condition) temporal networks at baseline (left) and during mindfulness intervention (right).

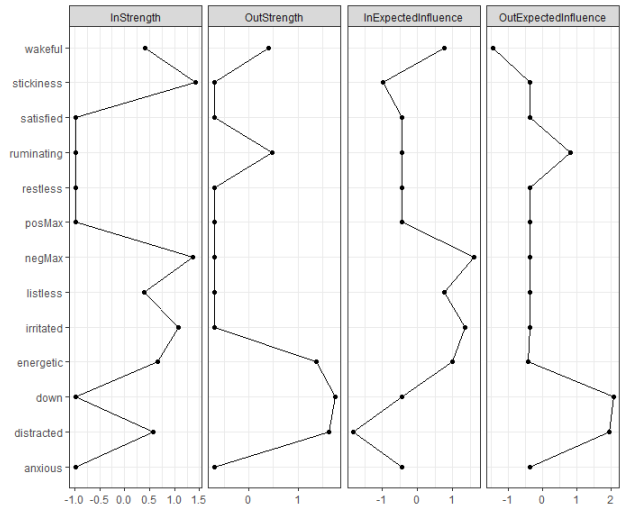

Figure 39

Node InStrength, OutStrength, InExpectedInfluence, and OutExpectedInfluence in contemporaneous baseline network of remitted MDD group (mindfulness condition).

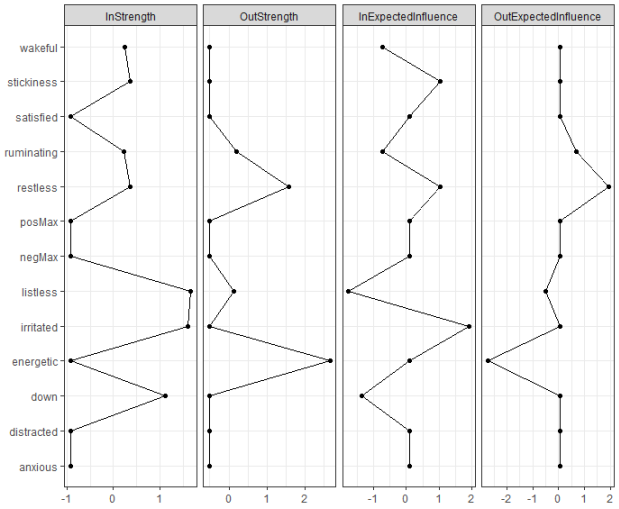

Figure 40

Node InStrength, OutStrength, InExpectedInfluence, and OutExpectedInfluence in temporal peri-intervention network of remitted MDD group (mindfulness condition).