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The Effect of Mental Progression on Mood

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Abstract

Mood affects the way we think. But can the way we think affect our mood? The present investigation examined this promising link by testing whether mood is influenced by the presence or absence of associative progression. This was tested here by manipulating the scope of participants' information processing and measuring their subsequent mood. In agreement with our hypothesis, processing that involved associative progression was associated with relatively better moods than processing that was restricted to a single topic (Experiment 1). Experiment 2 ruled out the possibility that conceptual plurality alone accounted for these mood differences; results converge with the view that mood is affected by the degree to which thoughts advance conceptually.

There is ample evidence that mood influences what people think, as well as *how* they think. Mood is associated with increases in the amount of information accessible in memory and the diversity of this material (Isen et al., 1985). As moods improve, the lens through which people attend to information broadens in scope, increasing both their sensitivity to relations among remotely associated material in memory (Isen & Daubman, 1984) and the breadth of attention they employ when processing the external world (Clore et al., 1994; see Fredrickson, 1998). Clearly our mood affects the scope of our thinking but is this relationship reciprocal (see Bar, 2009)? The bi-directionality of this link is implied in several psychological literatures, yet few have measured the affective consequences of broad versus narrow information processing. We present evidence that mood is affected by the associative breadth of information processing and the presence or absence of mental progression.

The possibility that processing scope affects mood is consistent with a host of clinical findings. For example, a hallmark feature of depression is a cyclical, ruminative thinking pattern, or an absence of associative breadth (Nolen-Hoeksema, 2000). Importantly, evidence reveals that this thought "recycling" exacerbates negative moods, increasing both the length of depressive episodes (Nolen-Hoeksema et al., 1993) and the severity of depressive symptoms (Nolan et al., 1998; Roberts et al., 1998). Likewise, a telltale sign that someone is experiencing a manic episode is the presence of a "flight of ideas," a continuous

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flow of speech that jumps from topic to topic, usually based on thin but discernable associations (Harvey et al., 1984; Henry et al., 1971; Richards & Kinney, 1990). This work raises the possibility that mood depends not just on the content of thought (Teasdale, 1977), but on the degree to which it covers mental ground.

Substantiating the view that mood is affected by information processing is a wealth of evidence from research on processing fluency. The results of several studies converge on the finding that effortless, speeded processing of information is hedonically pleasurable (Schwarz et al., 1991; Schwarz & Clore, 1996; Winkielman et al., 2003; for review see Clore, 1992). Targets that are preceded by conceptually related information or embedded in congruent contexts elicit more positive affect than targets that are preceded by irrelevant information or embedded in incongruous contexts (Kelley & Jacoby, 1998; Whittlesea, 1993). Although processing ease is a critical determinant of fluency, whether manipulations that increase efficiency (e.g., conceptual singularity) continue to induce pleasure over extended periods of information processing is debatable. For example, in recent work Pronin & Jacobs (2008) demonstrate that invariable processing – reading the same sentence 21 times – diminishes positive affect. This raises the possibility that processing ease is a necessary but not sufficient condition for pleasurable thinking. The effect of processing ease on mood might critically depend on the degree to which one's thinking seems to "go somewhere".

The view that progress affects mood is further bolstered by research on wellbeing. Several scholars argue that perceived progress in the pursuit of a personally meaningful goal is a critical determinant of happiness (Brunstein, 1993; Emmons, 1996). Our argument is that mood is also affected by progress of the mental variety. We propose that progress in this medium can emerge in the absence of a meaningful personal goal. Thinking which advances across concepts in a conceptually coherent way feels progressive, while thinking that is restricted to a single concept feels stagnant. For this reason, the associative breadth of information processing should affect mood.

Whereas previous considerations of the effect of extended information processing on mood have focused on repetition (Pronin & Jacobs, 2008), we measured participants' mood after they processed word lists with narrowly constrained associative relations and after they processed word lists with expansively progressing associative relations (Experiment 1). As predicted, participants' mood was relatively better after periods of broad versus constrained processing. Experiment 2 ruled out the possibility that conceptual plurality alone accounted for these mood differences; results converge with the view that mood is affected by the presence or absence of mental progression.

Experiment 1

We measured participants' mood after they processed information that progressed broadly across concepts and after they processed information that, though associative, remained constrained around a single concept with the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988).

Method

Participants and Experimental Design—Seventy-seven individuals (72% females; mean age = 24.6) from the University community participated for monetary compensation. The study had a 2 (block: progressive, stagnant) × 2 (scale valence: positive, negative) repeated-measures design.

Stimulus Materials—Experimental blocks consisted of lists that were constructed using the University of South Florida Free Association Norm Matrices (Nelson et al., 1998). This database consists of N × N matrices that provide a representation of the associative structure of a given word. For each target word (e.g., dinner), the matrix provides a list of associates and their 'forward-associative strengths' (FSG; the probability that a participant will respond 'supper' when presented the word 'dinner', for example). Two types of lists were constructed: stagnant and progressive.

Twenty-six stagnant lists were constructed by choosing a target word (i.e., the first word in the list; e.g., 'lettuce') and eleven items from the target's matrix with strong FSG (i.e., a high probability of being a response to the target word). A stagnant list therefore consisted of a target word followed by 11 words that are strongly associated with the first item. For example, a stagnant list might consist of the following words: 'lettuce', 'tomato', 'green', 'head', 'vegetable', 'cabbage', 'carrot', 'carrot', 'food', 'leaf', 'salad', 'hamburger'. Lists were constructed in this manner to simulate a state of associative but constrained thought flow.

In contrast to stagnant lists, which were constructed from words within a single matrix, progressive lists were constructed by choosing words across association matrices. This meant that each word in a progressive list was strongly associated with the word that preceded it and the word that directly followed it but not associated with other words in the list. For example, a progressive list might consist of the following 12 words in this order: 'thread', 'needle', 'shot,' 'nurse', 'drugs', 'alcohol', 'wine', 'cheese', 'mouse', 'cat', 'dog', 'bone'. A total of 26 lists were constructed in this manner to stimulate a sense of mental progression.

The probability that the target (first) word was associated with any other item in the list was therefore significantly higher for the stagnant lists (mean FSG = .06) than the progressive lists (FSG mean = .007), $t(51) = 16.56$, $p < .001$. Progressive lists consisted of items that were each strongly associated with neighboring items (mean FSG of neighbors = .08) but not with any other item in the associative list (mean FSG for non-neighbors = 0). Although both manipulations should streamline information processing, our concern is whether mood is differentially affected by fluency induced by conceptual singularity versus conceptual progression.

Pilot testing confirmed that the words used to construct progressive and constrained lists were of equal valence (see SOM).

Procedures—Word lists were presented to participants in two blocks. Each participant was presented a block of 8 progressive lists (96 words) and a block of 8 stagnant lists (96 words). Each of the 96 words appeared on the screen for a duration of 1200 ms. The inter-stimulus interval was 500 ms. Block order was counter-balanced across participants so that half of the participants were administered the stagnant block before the progressive block while the other half were administered the progressive block first.

After each block, participants were prompted to rate the degree to which each of the 20 items of the PANAS scale described their affective state at that precise moment in time. The PANAS consists of two 10-item scales, one measuring positive affect and one measuring negative affect. The order in which the 20 items appeared was randomized.

Each participant was told she or he would see a series of words appear on the screen and that the task was to read each word covertly. It was explained that after each block of words, they would be prompted to indicate, via a key-press, the degree to which a series of 20 adjectives (e.g., ‘happy’’, ‘distressed’), described their mood at that precise moment. Participants were informed that the adjectives would be written in blue font and that they would appear above a scale that ranged from “1 = not at all” to “6 = extremely so”. He or she was told to choose the appropriately labeled key.

After completing a practice block of 5 lists randomly sampled without replacement from the pool of stagnant and progressive lists, participants began the experiment proper (see SOM).

Results

Analyses for all experiments were performed on participants’ mean responses to the positive and negative affect scales (all Cronbach’s alphas exceeded .85).

Results of a repeated-measures ANOVA revealed a significant ‘block’ × ‘scale valence’ interaction, $F(1, 76) = 6.63$, $p = .01$, $\eta_p^2 = .08$. Participants reported feeling significantly greater positive affect following progressive (mean =3.11, s.e. = .13) relative to stagnant blocks (mean = 2.95, s.e. = .13), $t(76) = 2.36$, $p = .02$, d = .27. No such difference in negative affect was detected, $t(76) < 1$, $p = .62$, $d = .05$ (see Figure 1; see SOM).

We then considered how participants’ mood changed over the course of the session (i.e., between the two mood assessments) in relation to the information-processing manipulations (see Table 1). Results revealed a general trend whereby positive affect declined between the first and the second mood sampling but only among participants who performed the stagnant block between these two assessment periods, $t(38) = 3.29$, $p = .003$, $d = .52$. No such decline in positive affect was observed among participants who performed the progressive block between these two periods, $p = .5$, $d = .04$. This analysis also revealed a significant decline in negative affect between the first and second mood samplings, but only among participants who performed the progressive block between these two periods, $t(37)=2.41$, $p = .02$, $d = .48$. No such decline in negative affect was observed among participants who performed the stagnant block between these two assessment periods, $p = .2$, $d = .21$.

In summary, these analyses reveal that participants’ moods were relatively better subsequent to information processing periods that were characterized by mental progression than periods that were characterized by mental constraint. We interpret this as evidence that mood is affected by the presence or absence of mental progression, however it is possible that the effect was driven instead by differences in the variability of the information. To rule out this alternative account, Experiment 2 measured mood subsequent to periods of progressive conceptual processing and mood subsequent periods of processing that was equal in conceptual breadth but lacking in conceptual coherence (i.e., progression).

Experiment 2

Experiment 2 demonstrates that the difference observed in Experiment 1 cannot be explained by conceptual plurality alone. Participants’ moods were relatively better after processing broad, progressive associations than after processing broad, incoherent associations.

Method

Participants and Experimental Design—Seventy-four individuals from the University community (59% female; mean age = 25.5) participated in the experiment for monetary compensation. The study had a 2 (block: progressive, incoherent) × 2 (scale valence: positive, negative) repeated-measures design.

Procedure and Stimulus Materials—Procedures were identical to Experiment 1 with a single exception. Instead of comparing participants' moods subsequent to processing 'progressive' and 'stagnant' lists, we compared participants' moods subsequent to processing 'progressive' and conceptually broad but incoherent lists. In Experiment 2, the same pool of 26 progressive lists was sampled from (without replacement) in both the progressive and the incoherent blocks. For the incoherent blocks only, the order of the words within each list were scrambled before the list was presented to participants. This meant that neighboring items were no longer strongly associated (e.g., 'cow', 'newspaper', 'strawberry', 'tractor', 'watch', 'bell', 'farmer', 'donut', 'church', 'chocolate', 'field', 'boy'; see SOM for additional details).

Results

Results of a repeated-measures ANOVA revealed a significant 'block' × 'scale valence' interaction, $F(1,73) = 5.58$, $p = .02$, $\eta_p^2 = .07$. Positive affect was higher subsequent progressive blocks (mean = 3.11, s.e. = .14) than incoherent blocks (mean = 2.91, s.e. = .15), $t(73) = 3.22$, $p < .01$, $d = .37$. No such differences in negative affect were detected, $t(73) < 1$, $d = .03$; see Figure 2; see SOM.

We also considered how participants' mood changed over the course of the session in relation to the information-processing manipulations (see Table 2). This revealed a decline in positive affect between the first and second mood samplings among participants who performed the incoherent block between the two assessments, $t(34) = 3.24$, $p < .003$, $d = .54$. In contrast, there was a marginal increase in positive affect between the first and second mood samplings among participants who performed the progressive block between the two assessments, $t(37) = 1.36$, $p = .18$, $d = .23$. There were no significant changes in negative affect across the session among any of the participants, all t's < 1; all *d's* < .04.

These findings confirm that associative progression has an effect above and beyond information quantity or variability.

General Discussion

The goal of the present investigation was to test the proposal that people derive greater pleasure from thinking that "goes somewhere" or "flows" (Csikszentmihalyi, 1990) than thinking that is stymied (see Bar, 2009). Whereas previous researchers have tested whether repetitiveness is associated with diminished mood (Pronin & Jacobs, 2008), we considered whether mood depends on the absence or presence of conceptual progress. We tested and confirmed that thinking that covers conceptual ground is associated with better moods than thinking that lacks progression. We then ruled out the possibility that conceptual plurality accounts for this difference by demonstrating that associative progression has an effect above and beyond information variability.

A large body of research points to a relationship between mood and processing scope. People induced to experience positive moods generate more unusual associations on the Remote Association Test (Isen et al., 1985), and are more inclusive of fringe exemplars (e.g., camel) when drawing category boundaries (e.g., vehicle; Isen & Daubman, 1984) than their neutral mood counterparts. The association between negative affect and a narrow scope of attention is also well documented (Fredrickson, 1998; Fredrickson & Losada, 2005; Schwarz et al., 1991). Here we showed that this relation between mood and processing scope is reciprocal; not only does mood affect the scope of attention, but the scope of attention affects mood.

Previous research suggests that contexts appraised as manageable and as offering novelty, change, or a sense of possibility induce interest (Izard, 1977; Silvia, 2008; Tomkins, 1962). Supplementary analyses reveal that the mood differences observed here were not driven by differences in participants' interest levels (see SOM), however it is possible that the progressive structure of information processing affects some dimensions of mood (e.g., excitement, boredom) more than others. By no means is this an exhaustive account of the affective consequences of constrained versus progressive associative processing. This investigation seeks only to establish the bi-directionality of the relationship between associative scope and mood.

The findings presented herein are novel, broadly applicable, and were obtained with an altogether original approach. The work falls short of explicating precisely how scope affects mood, however. Our time series analyses suggest that positive affect decreases when processing remains stagnant (Experiments 1 and 2) and is maintained (Experiment 1) or marginally increased (Experiment 2) when processing progresses. It also suggests that progression diminishes negative affect (Experiment 1). Future work might consider when conceptual progression improves mood, when stymied processing worsens mood and how these mood changes compare to baseline mood measures.

Here we considered how mood changes with associative scope independently of information content. It seems reasonable to expect the two interact in important ways. Our results indicate that, all else equal, conceptual progression was associated with better mood than conceptual constancy. Clearly it is important to consider the conditions under which the reverse is true (e.g., the progression of anxious concerns is not pleasurable).

In conclusion, we have shown that mood is affected by the degree to which thoughts advance conceptually. Fluency as it is currently conceptualized (i.e., more efficient processing) cannot account for these effects; nor can differences in the amount or variability of information processed. Thinking that is broad and that advances in a conceptually coherent manner is likely to be more enjoyable than thinking that is narrowly conceptually restricted. It is theoretically possible that populations that suffer from mood disorders and excessive rumination, such as individuals with major depression, can benefit from a processing experience that is associative, broad, and coherent.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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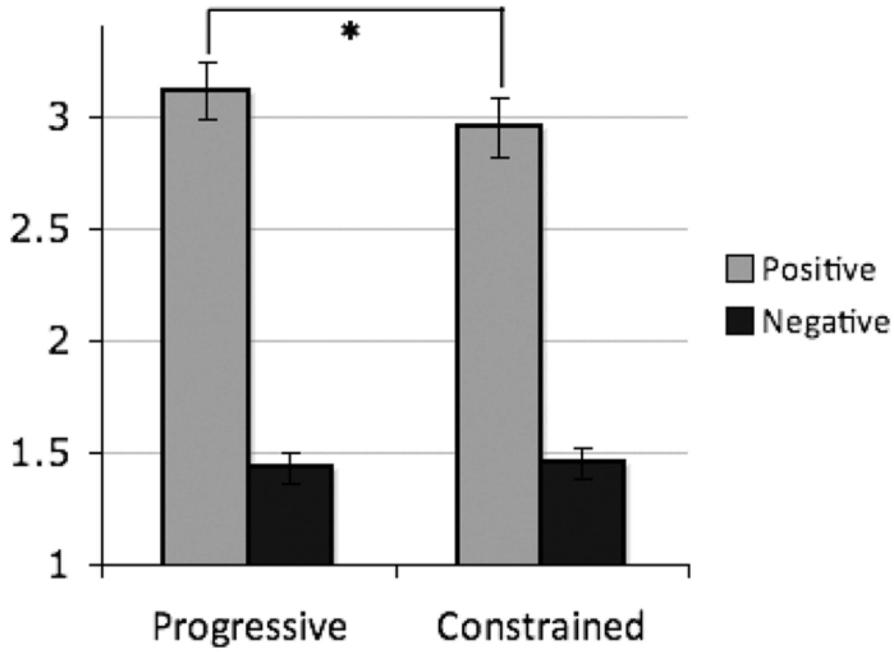

Figure 1.
Mean PANAS ratings by thought pattern and valence (Experiment 1). Results revealed a significant interaction, $p < .01$. Participants reported significantly more positive mood subsequent to progressive versus stagnant blocks, p = .02. (* = p < .05). Error bars depict standard errors of the difference scores.

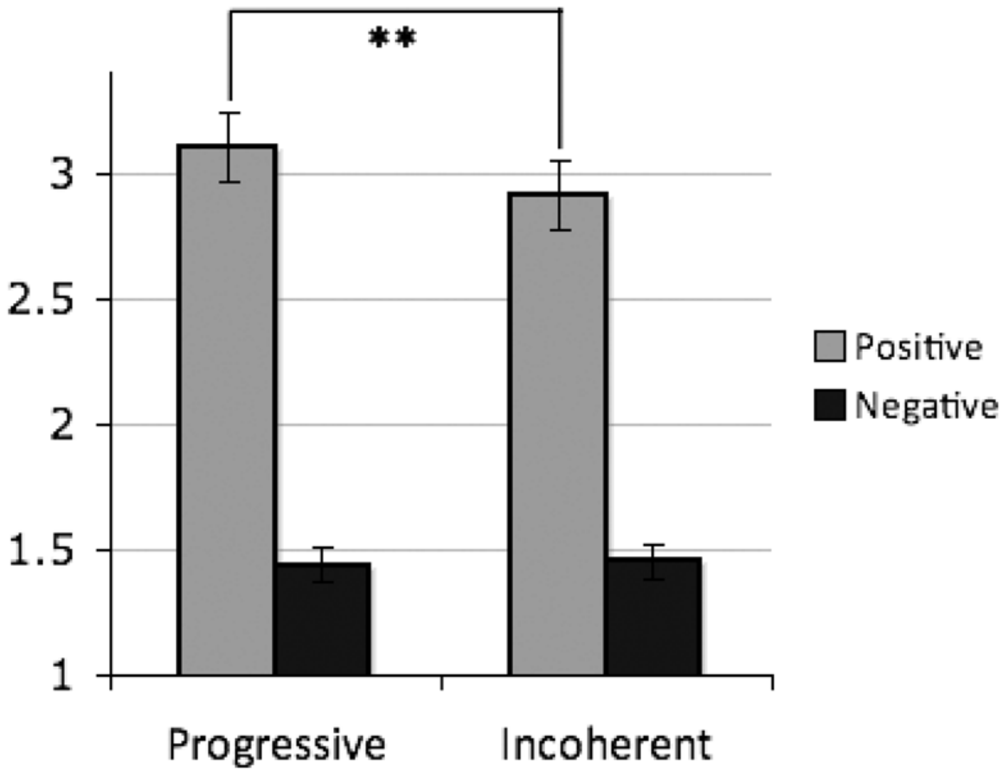

Figure 2.
Mean PANAS ratings by thought pattern and valence (Experiment 2). Results revealed a significant interaction, $p = .02$. Participants reported significantly more positive mood subsequent to progressive versus incoherent blocks, $p < .01$. (** = $p < .01$). Error bars depict standard errors of the difference scores.

Table 1

Positive and negative affect pre- and post-manipulations (Experiment 1).

PANAS Scale	First rating	Intervening Block	Second rating	Change
positive	3.20	stagnant	2.85	−.35***
positive	3.06	progressive	3.01	.05
negative	1.55	stagnant	1.46	.09
negative	1.44	progressive	1.32	−.12*

*** $p < .005$;

* $p < .05$;

Table 2

Positive and negative affect pre- and post-manipulations (Experiment 2).

PANAS Scale	First rating	Intervening Block	Second rating	Change
positive	2.85	incoherent	2.58	−.23***
positive	3.25	progressive	3.37	.12*
negative	1.53	incoherent	1.56	.03
negative	1.38	progressive	1.37	.01

*** $p < .005$;

* $p = .18$;