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Can negative mood improve language understanding? Affective influences on the ability to detect ambiguous communication

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HIGHLIGHTS

- Two experiments found that mild negative mood improved communication and language understanding.
- An analysis of reaction times and recall memory confirmed that negative mood produced more careful and attentive processing.
- A mediational analysis found that it was more attentive processing that mediated mood effects on language understanding.
- The findings confirm that negative affect has adaptive benefits and can improve cognitive and communicative performance.
- The results highlight the important role of moods in fine-tuning communication and social behavior in everyday situations.

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ABSTRACT

Can negative mood improve language understanding? Two experiments explored mood effects on people's ability to correctly identify sentences that lack clear meaning in the absence of further contextual information (ambiguous anaphora). Based on recent affect – cognition theories, we predicted and found that negative affect, induced by film clips, improved people's ability to detect linguistic ambiguity. An analysis of response latencies (Studies 1 & 2) and recall (Study 2) confirmed that negative mood produced longer and more attentive processing, and a mediational analysis suggested that processing latencies mediated mood effects on detecting linguistic ambiguity. These results are consistent with negative affect selectively promoting a more concrete, vigilant and externally focused *accommodative* information processing style, involving more detailed attention to the communicative content of a message. The theoretical relevance of these results for recent affect-cognition theories is considered, and the practical implications of the findings for everyday verbal communication and interpersonal behavior are discussed.

Language is the primary medium of interpersonal behavior, and dealing with ambiguous messages is a common yet challenging cognitive task we face in our everyday life (Fiedler, 2007). Surprisingly, there has been little research on the influence of affective states on language understanding (Forgas, 2013). These experiments investigate the effects of mood states on people's ability to identify and process ambiguous messages.

Detecting linguistic ambiguity

These experiments used anaphoric sentences to examine mood effects on peoples' ability to identify ambiguity in communication. In linguistics, *anaphora* are expressions whose meaning depends upon another expression. When the referential link is unclear, the meaning of an anaphoric sentence becomes ambiguous, as in "The girl yelled at her sister and she cried", where it is unclear who 'she' refers to. Such linguistic ambiguity often occurs when a communicator mistakenly assumes shared contextual knowledge. Ambiguous messages of this kind may often give rise to serious misunderstandings (Wänke, 2007). In this paper we examine the possibility that by recruiting more accommodative, attentive processing style, negative mood may improve people's ability to detect ambiguous messages (Bless & Fiedler, 2006).

Understanding how ambiguous messages are processed is important for a number of reasons. First, the way people deal with anaphora reveals a great deal about how discourse is constructed and maintained. Anaphora challenge pragmatic models of natural language processing, as they violate the conversational maxims of quantity and manner (Grice, 1975). When and how people detect ambiguous anaphora also tells us something about the cognitive mechanisms underlying language comprehension. Based on recent affect–cognition theories (Bless & Fiedler, 2006), these experiments explored the counterintuitive prediction that – contrary to the common belief that negative affect impairs information processing – negative mood may actually *improve* people's ability to correctly identify ambiguous sentences. We may

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define moods as low-intensity, diffuse and relatively enduring valenced affective states without a salient antecedent cause and therefore little conscious cognitive content. In contrast, emotions are more intense, short-lived and have a definite cause and conscious cognitive content (Forgas, 1995, 2002).

Affect and information processing

There is growing evidence that affect plays a critical role in cognition by promoting different information processing strategies (Forgas & Eich, 2013). Bless and Fiedler's (2006) assimilative/accommodative processing model in particular predicts that moods perform an adaptive signaling function. Positive mood signals that the environment is benign, and that reliance on top-down, abstract, knowledge-driven and *assimilative* processing is appropriate. In contrast, negative mood signals that a situation is unfamiliar and problematic, and that more concrete, bottom-up, stimulus-driven and *accommodative* processing is required. Somewhat similar distinctions are suggested by Förster and Dannenberg's (2010) global/local processing model as well as Fredrickson's (2001) broaden-and-build theory.

Several experiments support such a mood-induced processing dichotomy. For example, negative affect was found to increase processing latencies and resulted in improved memory accuracy, greater attention to concrete details, and a reduction in constructive judgmental errors (Forgas & East, 2008; Forgas, Goldenberg, & Unkelbach, 2009; Forgas, Laham, & Vargas, 2005; Schwarz & Skurnik, 2003; Storbeck & Clore, 2005). People in a negative mood also produced more concrete and effective persuasive arguments (Forgas, 2007), adopted less abstract thinking and relied less on abstract scripts and stereotypes (Bless & Fiedler, 2006; Gasper & Clore, 2002; Unkelbach, Forgas, & Denson, 2008). In contrast, positive mood triggering *assimilative* processing may provide an adaptive advantage when a more rapid, abstract and constructive response is required in the top-down processing of messages, scripts and stereotypes (Bless et al., 1996; Forgas, 2013; Koch, Forgas, & Goldenberg, 2013; Paul et al., 2011; Storbeck & Clore, 2005; Unkelbach et al., 2008). Extrapolating from the assimilative-accommodative processing model, these two experiments predicted that message recipients in a negative mood should adopt more attentive processing, pay greater attention to message characteristics, and should be better able to identify linguistic ambiguity.

Experiment 1

The first experiment tested the hypotheses that negative mood should result in more accommodative processing and improve recipients' ability to detect ambiguity in anaphoric messages. Further, better detection should also be associated with longer response latencies, indicative of an accommodative rather than assimilative processing style.

Method

Overview, design and participants

The session was introduced as comprising two unrelated experiments, viewing short films (the mood induction), and a social judgment task, asking participants to evaluate the quality of ambiguous or unambiguous anaphoric sentences summarising common, everyday events. Thus, the experiment employed a two-factor, mixed design with mood as the between-subjects factor (positive, neutral, negative) and sentence type (ambiguous vs. unambiguous) as the within-subjects factor. Participants were 100 students (63 females, 37 males; $M_{age} = 19.39$; $SD_{age} = 4.66$) who received course credit for participating in a lab experiment. Thirteen participants were excluded because they were not fluent in English, misunderstood some instructions, or did not complete the task. Of the remaining 87 subjects, 31 were in the positive mood condition, and 28 were in each of the neutral and negative mood conditions.

Mood induction

Participants first watched either funny, neutral, or negative 8-min film sequences (excerpts from the *Fawlty Towers* comedy series, a documentary about minerals, and *Philadelphia*, respectively), described as part of a separate experiment. This procedure has been shown to reliably induce different mood states (e.g., Koch & Forgas, 2012).

Identifying linguistic ambiguity

The mood induction was followed by what was described as an unrelated message evaluation task. In each of 12 trials, subjects read a short vignette about an everyday event, and then evaluated a single anaphoric sentence on "how precise and clear" it is in summarizing that event. An example was provided as follows: "Consider the event 'Mike dropped the plate and the bowl. This caused the plate to break'. A good description would be 'Mike dropped the plate and the bowl, and the plate broke'. A bad description would be 'Mike dropped the plate and the bowl, and it broke' because it is unclear whether the bowl or the plate broke." Participants rated on a 9-point "communicative quality" scale (bad-good) the precision/clarity of 6 ambiguous and 6 clear anaphoric sentences. Processing latencies were also recorded.

The target sentences were selected in a pilot study. A sample of 38 participants (22 females, 16 males, $M_{age} = 22.57$, $SD_{age} = 4.43$) rated the adequacy of 12 ambiguous and 12 unambiguous anaphoric sentences in describing the key features of a preceding event on a 1–9 (bad-good) scale. The six most ambiguous and six least ambiguous sentences were selected as stimuli to be used in the study.

Mood validation and debriefing

A comprehensive debriefing concluded the experiment, and as part of a post-experimental questionnaire, participants also rated their mood after viewing the films on six-point happy–sad and good–bad scales (the mood validation). Care was taken to remove any residual mood effects as part of the debriefing.

Results

Validation of the mood induction

Self-rated mood on the two mood validation scales was highly correlated and was combined to create a single mood valence measure, $r(61) = .72$, $p < .01$. An ANOVA confirmed that the mood induction was highly effective, $F(2,82) = 41.11$, $p < .001$, $\eta^2 = .51$. Those in the positive condition rated their mood as significantly better than the neutral group ($M_{pos} = 5.18$, $SD_{pos} = 1.02$; $M_{neutral} = 3.94$, $SD_{neutral} = 1.15$, $t(80) = 3.96$, $p < .001$, $d = 1.08$), and those in the negative mood condition felt significantly worse ($M_{neg} = 2.24$, $SD_{neg} = 1.24$, $t(80) = 5.76$, $p < .001$, $d = 1.49$) than the neutral group.

Mood effects on sentence understanding

Ratings of the quality of the sentences summarizing each vignette were averaged for the six ambiguous and six unambiguous sentences. A two-factor, mixed ANOVA confirmed that, as expected, sentence ambiguity had a significant main effect on sentence evaluations, with ambiguous sentences rated as poorer, $M_{amb} = 5.25$, $SD_{amb} = 1.49$, $M_{unamb} = 6.57$, $SD_{unamb} = 1.11$, $F(1,84) = 60.29$, $p < .001$, $\eta^2 = .42$. Mood had no overall main effect on sentence evaluations, $M_{pos} = 5.84$, $SD_{pos} = 1.02$, $M_{neutral} = 6.07$, $SD_{neutral} = 1.14$, $M_{neg} = 5.81$, $SD_{neg} = .94$, $F(2,84) = .53$, NS, $\eta^2 = .01$, suggesting that negative mood did not simply promote a generally more cautious and critical response set, but actually improved participants' ability to discriminate between the ambiguous and unambiguous sentences.

As predicted, there was also a significant interaction between mood and sentence ambiguity, $F(2,84) = 3.35$, $p < .05$, $\eta^2 = .07$, confirming that judges in a negative mood did a significantly better job of

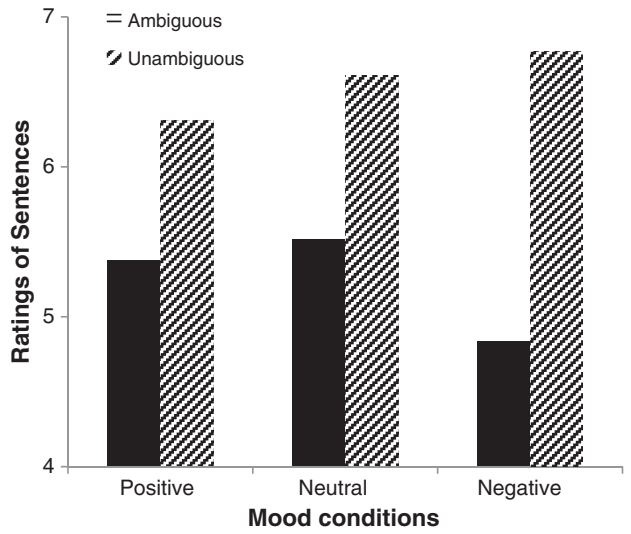

Fig. 1. Mood effects on ability to detect communication ambiguity in anaphora: negative mood promoted the more accurate differentiation between ambiguous (anaphoric) and unambiguous sentences compared to positive and neutral mood.

discriminating between ambiguous and unambiguous anaphoric sentences compared to judges in the neutral and the positive mood conditions (Fig. 1). Follow-up *t*-tests confirmed that negative mood resulted in significantly better ability to differentiate between ambiguous and unambiguous anaphoric sentences ($M_{diff} = 1.93$, $SD_{diff} = 1.75$) than did positive mood, $M_{diff} = .93$, $SD_{diff} = 1.32$, $t(84) = 2.44$, $p < .05$, $d = .64$, and neutral mood $M_{diff} = 1.09$, $SD_{diff} = 1.68$, $t(84) = 2.00$, $p < .05$, $d = .53$, with no difference between the neutral and positive conditions, $t(84) = .39$, NS, $d = .1$ (see Fig. 1).

Mood effects on response latencies

Outlying reaction latencies (>2SD from the mean) were set to 2SD, comprising 3.83 of all responses. We found a significant mood main effect on response latencies, $F(2,84) = 5.69$, $p < .01$, $\eta^2 = .12$, as people in negative mood took significantly longer to evaluate sentence quality ($M_{neg} = 7.09$ s, $SD_{neg} = 1.73$ s) than did happy ($M_{pos} = 5.51$ s, $SD_{pos} = 1.70$s, $t(84) = 3.33$, $p = .001$, $d = .87$) and neutral mood individuals ($M_{neutral} = 6.04$ s, $SD_{neutral} = 2.01$ s, $t(84) = 2.16$, $p < .05$, $d = .58$), with no difference between the positive and neutral conditions, $t(84) = 1.12$, NS, $d = .29$. This pattern is consistent with negative affect producing a slower, more deliberative and accommodative processing style compared to the other groups (Fig. 2). Sentence ambiguity did not influence processing latencies, $M_{amb} = 6.21$ s, $SD_{amb} = 2.10$s, $M_{unamb} = 6.17$ s, $SD_{unamb} = 2.19$ s, $F(1,84) = .02$, NS, $\eta^2 = .00$, and there was no interaction between mood and sentence ambiguity, $F(2,84) = .10$, NS, $\eta^2 = .00$ (Fig. 2). Thus, participants experiencing a negative mood processed *all* sentences more slowly than in the other mood conditions, consistent with a more vigilant and detail oriented accommodative information processing style.

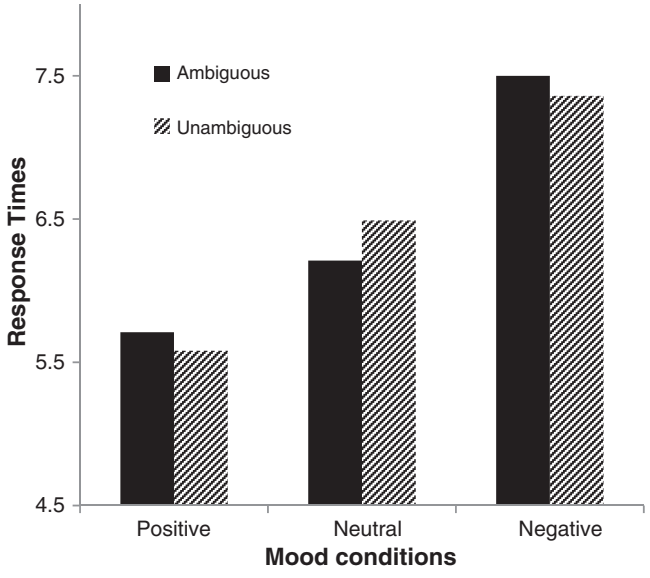

Fig. 2. Mood effects on response times in detecting communication ambiguity in anaphora: negative mood promoted overall longer response latencies than positive and neutral mood, consistent with the predicted more accommodative processing.

Mediational analysis

The role of processing latencies in mediating mood effects on detecting sentence ambiguity was assessed in a mediational analysis using Baron and Kenny's (1986) procedure, comprising three regression equations (Baron & Kenny, 1986). (1) First, the independent variable, mood, was found to be a significant predictor of the mediator, processing latency ($\beta = .34$; $F(1,85) = 11.08$; $p = .001$). (2) Second, the independent variable, mood, was a significant predictor of the dependent variable, sentence evaluation, $\beta = .25$; $F(1,85) = 5.81$; $p < .05$). (3) Third, the independent variable, mood, and the mediator, processing latency, were simultaneously entered into a regression to predict the dependent variable, $\beta_{mood} = .16$, $\beta_{latencies} = .28$; $F(2,84) = 6.49$; $p < .01$. To establish mediation, (1) all three regressions should be significant, and (2) the effects of the independent variable on the dependent variable must be smaller in the third equation (when the mediator is also present) than in the second equation (when the mediator is absent). This was indeed confirmed here by a Sobel procedure indicating mediation, $z = 2.33$, $p < .05$. These results suggest that mood effects on detecting ambiguity were mediated by processing style, with negative mood recruiting more accommodative (and slower) processing strategies (Fiedler & Bless, 2001; Forgas, 2002). This mediational analysis indicates that longer latencies were a *necessary,* but not also a *sufficient* condition for the effect to occur. Some care is needed when interpreting this analysis, as processing latency, although a significant mediator, may be influenced by other variables as well, as is often the case with complex social phenomena (Baron & Kenny, 1986).

Discussion

These results are among the first to show that negative mood promotes more accurate detection of linguistic ambiguity in anaphoric sentences, consistent with a more accommodative and externally oriented processing style. These findings extend prior evidence indicating the benefits of negative mood to the new domain of language comprehension (Forgas, 2013). Our pattern of results is conceptually consistent with other work showing that people in a negative mood are better at detecting deception, are less prone to judgmental mistakes, are less likely to engage in stereotyping and are more attentive to interpersonal norms (Forgas, 2013; Forgas & East, 2008; Koch, Forgas, & Matovic, 2013; Unkelbach et al., 2008). In addition, the mediational analysis is consistent with the prediction that it is processing differences that are responsible for these effects (Bless & Fiedler, 2006).

Experiment 2

Experiment 2 was designed to confirm, clarify and extend the results of Experiment 1. For example, evidence for longer processing latencies in negative mood does not necessarily establish that this involved more effective and more attentive processing, as we do not know what participants did in that extra time. However, as average accuracy ($M_{clear} - M_{amb}$) correlated negatively with average speed, $r(85) = -.33$, $p < .01$, the results do suggest that negative mood produced more attentive

and more accurate language processing. In order to further demonstrate that longer processing was indeed associated with closer attention to sentence quality, Experiment 2 also assessed recall memory for the target sentences as an additional measure of attention to sentence details.

By providing respondents with vignettes of event descriptions in Experiment 1, responses could also be confounded by judges having some prior knowledge of the event. In order to control for this possibility, in Experiment 2 a different experimental task was used, and participants judged linguistic ambiguity without access to background information. Finally, in Experiment 1, the dependent variable was a global measure of the perceived linguistic quality of the sentences. Responses on this generic measure could have been influenced by features other than the grammatical ambiguity of the anaphora. Experiment 2 used a different and more concrete multiple-choice response format to control for this possibility.

In summary, Experiment 2 employed a different experimental task, an improved response format and also assessed recall memory in order to provide more direct evidence for mood effects on linguistic processing. We expected negative mood to improve respondents' ability to recognize linguistic ambiguity, even in the absence of contextual vignettes. Negative mood was also predicted to improve recall performance, consistent with the deeper, more accommodative, detail-oriented and attentive processing of the sentences (Forgas et al., 2009).

Method

Overview and participants

After an audio-visual mood induction, participants completed a language comprehension task, evaluating their understanding of ambiguous sentences. Their memory for the target sentences was subsequently also assessed. Respondents were 73 participants (28 females, 45 males) of Amazon's crowdsourcing service, Mechanical Turk, who were paid 1.20€ to take part in an online experiment. Thirty six subjects were in the positive, and thirty seven subjects were in the negative mood condition.

Evaluating sentence understanding

Participants first watched excerpts from a different set of edited cartoon film clips designed to induce mood (The Jungle Book, The Lion King). Then, in 10 trials of an allegedly unrelated "language understanding task", they were presented with an ambiguous anaphoric sentence and a 3-option multiple choice question assessing their understanding of hat sentence (e.g., "Visiting relatives can be boring"; followed by the question "Who is visiting?" with three concrete response options: "The speaker/writer", "His/her relatives" and "Not clear"). The correct response was always "Not clear", indicating that the sentence cannot be understood without additional referential details. Response latencies were also recorded. The 10 target sentences were selected from a larger sample of 18 in a pilot study ($N = 25$) so as to be moderately difficult for participants to identify as ambiguous.

In order to assess participants' memory of the stimulus sentences, they were asked to 'try to recall and note down each of the 10 single sentence messages that you have encountered before' and type in their responses. Finally, participants rated their mood on two 9-point scales (happy–sad, good–bad) before receiving a debriefing.

Results

Mood validation

Self-ratings on the two mood validation scales were highly correlated, $r(71) = .91$, $p < .001$, and an ANOVA of the combined valence measure confirmed that those in the positive group felt significantly better than those in the negative group, $M_{pos} = 7.65$, $SD_{pos} = 1.34$; $M_{neg} = 2.82$, $SD_{neg} = 1.19$; $F(1,71) = 267.25$, $p < .001$, $\eta^2 = .79$, once again confirming the effectiveness of the mood induction.

Mood effects on sentence understanding

As predicted, ambiguous anaphoric sentences were recognized as 'not clear' more frequently by participants experiencing a negative compared to a positive mood, using an item-level analysis that is more appropriate in an internet-based task $M_{neg} = 36.00\%$, $SD_{neg} = 9.36\%$; $M_{pos} = 26.00\%$, $SD_{pos} = 10.45\%$; $F(1,9) = 25.28$, $p = .001$, $\eta^2 = .74$ (see Fig. 3). Thus, as predicted, even in this more challenging language processing task, the ambiguous anaphoric sentences were processed and recognized with greater accuracy by recipients in negative compared to positive mood.

Processing latencies

Extreme response latencies > 2SD were set to 2SD (3.70% of all trials), as in Experiment 1. As predicted, ambiguous anaphoric sentences were again processed more slowly by participants experiencing a negative versus a positive mood, $M_{neg} = 11.78$ s, $SD_{neg} = 3.29$ s; $M_{pos} = 10.91$ s, $SD_{pos} = 2.59$ s; $F(1,9) = 5.50$, $p < .05$, $\eta^2 = .38$ (see Fig. 3). As also found in Experiment 1, there was a negative correlation between participants accuracy (% of "Not clear" responses) and language processing

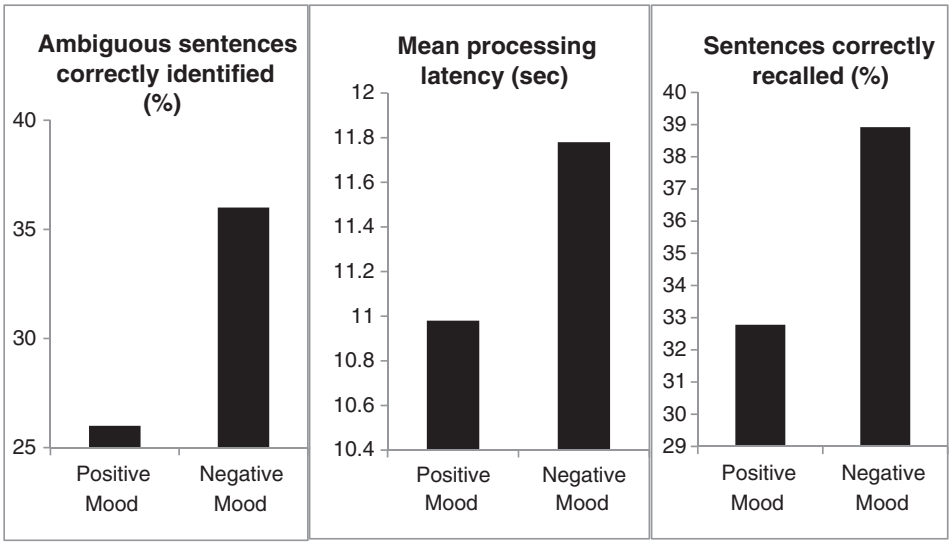

Fig. 3. The effects of positive and negative mood on (a) the ability to correctly identify ambiguous sentences (left panel), (b) the time taken to process the linguistic comprehension task (middle panel), and (c) the ability to remember the target sentences (right panel).

speed, $r(71) = -.22$, $p = .05$, confirming that slower, more attentive and accommodative processing was associated with improved accuracy.

Recall memory

In order to confirm that negative mood resulted not only in longer, but also in deeper and more effective processing, recall memory for the target sentences was also assessed. We found that the target sentences were recalled better by participants in a negative mood ($M_{neg} = 38.92\%$, $SD_{neg} = 10.83\%$) than by those in a positive mood ($M_{pos} = 32.78\%$, $SD_{pos} = 8.86\%$), $F(1,9) = 4.07$, $p = .07$, $\eta^2 = .31$ (Fig. 3), a marginally significant effect that is indicative of more careful and in-depth encoding processes in a negative mood. Consistent with this pattern, recall memory was overall also positively associated with the proportion of correct responses, $r_{overall} = .29$, although this trend did not reach significance because of the low number of observations.

General discussion

Despite growing evidence for the influence of affective states on many social cognitive tasks (Forgas, 1995, 2011a,b,c), insufficient attention has been paid to the role that moods play in language understanding. These two experiments provide convergent evidence for mood effects on people's ability to detect message ambiguity in anaphoric sentences, findings that have a number of interesting theoretical and practical implications.

Theoretical implications

These results are among the first to confirm that mood has a significant influence on language processing and the detection of linguistic ambiguity, consistent with recent affect–cognition theories (Bless & Fiedler, 2006; Forgas, 2002; Förster & Dannenberg, 2010; Fredrickson, 2001). This effect is consistent with negative mood recruiting more accommodative processing and promoting greater attention to message characteristics such as the ambiguity of an anaphoric sentence. The process mediation of this effect was supported by response time data and the mediational analysis in Experiment 1, indicating that negative mood produced longer processing latencies. Experiment 2 also found longer processing latencies in negative mood, and provided additional evidence that negative mood produced deeper and more attentive and accommodative processing resulting in improved recall performance. Cumulatively, these results indicate that as predicted, negative mood resulted in the adoption of a qualitatively different, more accommodative and attentive processing style.

The demonstration of mood effects on language processing extends the recent literature suggesting some cognitive benefits associated with mild negative moods. Several experiments report that negative affect can improve people's ability to detect deception (Forgas & East, 2008), reduce judgmental biases (Forgas, 2011a,b), improve memory (Forgas et al., 2005), reduce reliance on stereotypes (Unkelbach et al., 2008), and improve peoples' ability to evaluate argument quality in persuasive messages (e.g., Bless, Bohner, Schwarz, & Strack, 2001). To this list we may now add another intriguing effect: people in a negative mood may also be better at accurately detecting ambiguous communications.

Could this effect also be due to negative affect simply promoting greater sensitivity to social and communicative norms, rather than producing qualitative differences in processing style? Although there is some evidence that negative affect can also increase sensitivity to external normative expectations (Tan & Forgas, 2010), in the majority of the experiments processing benefits are also observed even in the absence of normative expectations. Thus, the most parsimonious explanation of observed mood effects is consistent with the assimilative–accommodative model (Bless & Fiedler, 2006; for review see also Forgas, 2013; Forgas & Eich, 2013; Forgas & Koch, 2013).

We should also note that not *all* language processing tasks are necessarily improved by negative mood. When the rapid evaluation of messages requiring top-down, heuristic processing is required, positive mood and the assimilative processing style it recruits may provide adaptive benefits. Those in a good mood may be more effective in using abstract, inclusive categories (Koch, Forgas, & Goldenberg, 2013), and perform better when a fast and constructive response is required using top-down, assimilative thinking (Bless et al., 1996; Forgas et al., 2005; Paul et al., 2011; Storbeck & Clore, 2005; Unkelbach et al., 2008).

Practical implications

Effective verbal communication is a critically important skill in everyday life, and is a prerequisite for professional and personal effectiveness (Fiedler, 2007). Many anaphoric sentences in everyday discourse are ambiguous and are not immediately interpretable without further contextual information. Unless recipients can detect the ambiguity of anaphoric statements, erroneous interpretations may follow. Our finding that negative mood improves people's ability to detect anaphoric ambiguity can be important in many applied domains, such as in organizational, educational, and clinical settings, where communicators need to be especially alert to the possibility of miscommunication. Professionals working in these fields may benefit from training designed to increase their awareness of affective influences on their ability to process ambiguous or equivocal messages.

Limitations and future prospects

The mood effects identified here may well be subject to various boundary conditions (Fiedler, 2001; Forgas, 1995, 2002). In particular, mood effects may be diminished in situations that call for more motivated processing due to the increased personal relevance of the task (Fiedler, 2001; Forgas, 2002).Situational and contextual variables, such as the nature of the communication task (Fiedler, 2001; Forgas, 2002) or the relationship between the communicators may also qualify these effects, issues that deserve further attention. However, to the extent that similar results were obtained here across two experiments using different tasks, different dependent measures and different categories of participants suggests that these effects are likely to be robust.

We should also recognize that the communicative consequences of mild, everyday mood states identified here may not readily generalize to more intense and aversive affective states such as depression, anger, disgust or anxiety (Forgas & Eich, 2013). It would also be important to explore corresponding mood effects on communication alertness in more naturalistic situations, for example, by looking at mood effects on the detection of ambiguity in dynamic face-to-face encounters. In conclusion, these experiments extend affect–cognition research to the new domain of language processing. We found that negative mood recruits more attentive processing, and improves language understanding and the detection of ambiguity in anaphoric sentences, effects that have not previously been demonstrated. These results highlight the importance of both positive and negative mood states in managing everyday social communication, an area of research that deserves further serious attention.

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