Background

A number of prominent psychopathologies are characterized by the dysfunctional perseveration of certain thoughts, behaviours or activities. Examples include pathological worrying, which is the current cardinal diagnostic feature of Generalized Anxiety Disorder (GAD) (DSM, 4th ed.; DSM-IV; American Psychiatric Association, 1994); obsessive compulsive disorder (OCD) in which individuals indulge in perseverative bouts of activities such as checking, washing or compulsive thoughts; and rumination, which has been recognized as an important maintaining factor in depression. In almost all examples of these psychopathologies the perseveration is viewed as excessive, out of proportion to the functional purpose that it serves, and a source of emotional discomfort for the individual concerned.

Cognitive explanations of these perseverative psychopathologies have tended to be focussed within individual disorders rather than addressing the possible common factors that might facilitate perseveration per se. Even though there is some evidence for comorbidity across at least some of these perseverative disorders (e.g. Andrews, Stewart, Morris-Yates, Holt & Henderson, 1990; Schut, Castonguay & Borkovec, 2001), suggesting the possibility of some common mechanisms operating across them, there have been few attempts to identify what these common mechanisms might be. However, there has been one recent attempt to address the processes underlying pathological perseveration, and this model has already been applied to a number of perseverative psychopathologies. This model is known as the mood-as-input hypothesis (Martin & Davies, 1998; Martin, Ward, Achee & Wyer, 1993; Davey, Field & Startup, 2002), and it is centrally concerned with explaining how perseveration at a task is generated by the way in which mood is used as information in determining whether the goals of the task have been achieved, and the task should therefore be terminated.

A way of conceptualising the motivating effects of moods has been proposed by Martin et al. (1993) and extended by Sanna et al. (1996) and Martin and Davis (1998). Rather than being intrinsically linked to certain default processing strategies (such as mood-congruent processing), the mood-as-input hypothesis proposes that it is an individual's interpretation of the mood per se that has particular performance implications.

Mood in this connection assumes more of a secondary role, the function of which is derived from 'top down,' 'configural' interpretations based on the goal at hand (Martin and Davis, 1998). For example, during the course of task performance, people may ask themselves, either explicitly or implicitly, 'Have I reached my goal?' People in positive moods would tend to answer yes, whereas people in negative moods would tend to answer no. That is, people in a positive mood are likely to interpret their positive affect as a sign that they have attained or made progress toward their goal (i.e. Hirt et al. 1996; Martin et al., 1993). In contrast, in a negative mood, individuals may interpret their negative affect as a sign that they have not attained or made progress toward their goal and so continue to persist at the task (Frijda, 1988; Martin et al., 1993; Schwarz & Bless, 1991).

However, if the individual asked the question 'Do I feel like continuing this task?', then mood would provide very different information. People in positive moods would again answer 'yes' and people in negative moods 'no'. However, this different question or 'stop rule' in the context of the same mood informs different goal directed behaviour because in this case an answer suggesting that one is enjoying the task (positive mood) would motivate the individual to continue the task longer. On the other hand, an answer of no (negative mood) provides information consistent with terminating the task sooner.
Many studies have lent support to this configural view of how mood states are processed in the contexts of individual tasks (see Martin & Davies, 1998, for a review), and the following study is described in order to clarify both the methodological framework typically adopted and the pattern of results typically derived from mood-as-input studies.

Martin et al. (1993) induced either positive or negative moods in their participants and asked them to generate a list of birds' names. Half of the participants were told to stop generating the names of birds when they no longer felt like doing it (a 'feel like continuing' stop rule), whereas the other half were asked to stop when they thought they had generated as many as they could (an 'as many as can' stop rule). They found that the effect of mood on the generation task was dependent on the stop rule that the participant was asked to use: for those using the 'feel like continuing' stop rule, participants in the positive mood persisted at the task for significantly longer than those in the negative mood. However, for participants using the 'as many as can' stop rule, participants in a negative mood persisted for significantly longer than those in the positive mood. Martin et al. (1993) interpret these effects in mood-as-input terms. For example, participants in a negative mood interpret their mood in relation to the stop rule: in the 'feel like continuing' condition their negative mood tells them to stop. In the 'as many as can' condition their negative mood tells them they are not satisfied with the number of items they have generated on the task, and so they persist at the task for longer.

One particular combination of mood and stop rule is relevant to perseverative psychopathologies. This is the combination of negative mood and 'as many as can' stop rules. Under this configuration, individuals will persist significantly longer at the task because the 'as many as can' stop rule motivates the individual to ask the question “Have I fully and successfully completed the task?” and the negative mood provides the answer 'No', thus leading to further perseveration. This is particularly relevant to the psychopathologies studied in the current project because (1) both pathological worriers and compulsive checkers report chronic levels of negative mood (e.g. Davey et al., 1998; Meyer et al., 1990; Frost et al., 1986), and (2) there are certain characteristics of worriers and compulsive checkers which suggest that they will use fairly strict ‘as many as can’ criteria for terminating a worrying or checking task. For example, worriers hold dysfunctional beliefs about worrying being a necessary and important activity for preventing catastrophes (Davey et al., 1996; Borkovec & Roemer, 1995) which would be consistent with the use of ‘as many as can’ stop rules. In addition, compulsive checkers are known to possess beliefs related to inflated responsibility (defined as the individual's belief in their power to cause harm – Rheume et al., 1994), and this inflated responsibility is likely to motivate the compulsive checker to use very strict ‘as many as can’ stop rules when indulging in a checking task. The current project was designed to examine some of the predictions from this view that perseveration is determined by the use of, and strictness of, the stop rules implicitly brought to the perseverative task in certain psychopathologies.

Objectives

This project was designed to test a series of predictions from the mood-as-input hypothesis as applied to perseverative psychopathologies. The proposal described nine experiments designed to test mood-as-input predictions in the context of three analogue psychopathologies: pathological worrying, compulsive checking, and depressive rumination. Experiments 1-4 were designed to test the effects of inflated responsibility in modulating the effects of stop rules on catastrophic worrying and compulsive checking tasks. It was predicted that levels of responsibility would interact with concurrent mood to determine perseveration at these tasks in ways predicted by the mood-as-input hypothesis. In particular, it was predicted that inflated responsibility would act like strict ‘as many as can’ stop rules to generate task perseveration in combination with negative mood. Experiments 5 & 6 were designed to assess the types of stop rule naturally deployed by individuals scoring high on measures of either trait worry or compulsive behaviour. Mood-as-input hypothesis predicts that such high scorers will adopt strict ‘as many as can’ stop rules, and this will interact with negative mood to generate perseveration in worrying or checking. Studies 7-9 were designed to investigate whether stop rule and mood interacted in ways predicted by mood-as-input hypothesis to determine perseveration on analogue checking and rumination tasks. If mood-as-input hypothesis predictions
are upheld, then this hypothesis is likely to contribute significantly to our understanding of the various perseverative psychopathologies that include pathological worrying, compulsive checking and depressive rumination.

**Methods**

The studies were conducted on analogue participants using established procedures and open-ended perseverative tasks that provided objectively quantifiable measures of perseveration (e.g. the catastrophising interview procedure, Startup & Davey, 2001, analogue checking tasks, Davey, Startup et al., 2003, MacDonald & Davey, in press). Whenever required we used validated and reliable instruments to differentiate the analogue population of participants on the relevant psychopathological dimensions (e.g. the Penn State Worry Questionnaire (trait worrying), the MOCI (compulsive checking), the Beck Depression Inventory (depression). Standard music-based mood induction procedures of the kind described by Startup & Davey (2001) were used when required.

**Results**

The results from all studies have supported predictions from the mood-as-input hypothesis, suggesting that this explanation of perseverative psychopathologies is valid and applicable to a range of perseverative tasks.

Studies 1-4 have demonstrated that (1) manipulating inflated responsibility affects the strictness with which participants use ‘as many as can’ stop rules during both a catastrophising interview task (worrying) and an analogue checking task (compulsive checking), and (2) that inflated responsibility only exacerbates catastrophic worrying and perseverative checking when it is accompanied by negative mood (published as Startup & Davey, 2002, and MacDonald & Davey, in press). Both findings are consistent with predictions from the mood-as-input hypothesis and suggest that inflated responsibility may not be a simple unidimensional contributor to worrying or compulsive checking as some current theories of perseverative psychopathologies suggest (e.g. Salkovskis et al., 2002; Rachman, 1998). For example figure 1 shows how, when responsibility is experimentally manipulated, perseveration at a worry task is increased only when increased responsibility is paired with a negative mood. Increased responsibility actually results in a decrease in perseveration when paired with a positive mood (from Startup & Davey, 2002). Such results would not have been predicted by current clinical theories of perseverative psychopathology (e.g. Salkovskis et al., 2001; Rachman, 1998), but are predicted by mood-as-input accounts.

Studies 5 & 6 have been successful in identifying the kinds of stop rules naturally deployed by worriers and checkers. As predicted by mood-as-input hypothesis, individuals who scored high on trait measures of worrying and checking automatically deploy strict ‘as many as can’ stop rules which contribute to perseveration through their interaction with negative mood (published as Davey, Startup, MacDonald, Jenkins & Patterson, 2003, and MacDonald & Davey, in preparation). Such findings suggest that therapeutic procedures designed to ameliorate perseverative responding might benefit by addressing such types of stop rules. Table 1 shows how the use of ‘as many as can’ stop rules is significantly correlated with measures of trait worry, while the use of ‘feel like continuing’ stop rules is unrelated to any psychopathology measure (from Davey, Startup, MacDonald, Jenkins & Patterson, 2003).

Studies 6-9 have so far successfully shown that perseveration at checking and depressive rumination tasks does conform with predictions from mood-as-input hypothesis (published as Davey, Startup, Zara, MacDonald & Field, 2003; MacDonald & Davey, in press, and MacDonald & Davey, in preparation). These findings demonstrate that perseveration occurs primarily under conditions where the use of ‘as many as can’ stop rules are configured with a concurrent negative mood – conditions which are characteristicly possessed by pathological worriers, compulsive checkers and depressive ruminators. Figure 2 shows how configurations of stop rule and mood contribute to perseveration on an analogue checking task in ways predicted by mood-as-input hypothesis (from
MacDonald & Davey, in press). This study shows that the predicted mood-as-input effects can be detected using a range of checking measures that are relevant to compulsive checking in the clinical domain (e.g. (i) the total number of checks in the task, (ii) the highest number of rechecks of a single item, (iii) the total number of items checked, and (iv) the total time spent checking).

Finally, while undertaking studies 6-9, we were also able to use the analogue checking task in experimental designs which allowed us to compare the mood-as-input account of perseverative checking with some contemporary accounts derived from clinical practice. For example, some informal accounts of OC checking suggest that compulsive checkers feel driven to perform checking activities until either they are fully confident they have completed the checks properly (e.g. Rasmussen & Eisen, 1992; Coles et al., 2003) or they have significantly reduced their anxiety about the task (e.g. Rachman, 1976; Metzner, 1963; Wolpe, 1958; de Silva, 2003). The present studies cast some light on these accounts by suggesting that (1) confidence at having completed the checks properly is in part dependent on the stop rules used at the outset of checking – confidence is greater in those participants who began using an ‘as-many-as-can’ stop rule (that is, the kind of stop rule that we predict would be deployed by someone with inflated responsibility), and (2) the point at which participants stop checking does not appear to be determined by achieving a particular level of confidence regardless of other factors (as might be predicted by those accounts which suggest that checking will persist until a particular threshold level of confidence is achieved); stopping appears to be determined more directly by the configuration of stop rules and mood at outset rather than confidence.

Activities

Apart from publications in peer-reviewed scientific journals, the findings from this programme of research have been presented at various national and international conferences, including the British Psychological Society Annual Conference, Bournemouth, March 2003, the British Association for Behavioural & Cognitive Psychotherapies Annual Conference, York July 2003, and the European Association for Behavioural & Cognitive Psychotherapies XXXIII Annual Congress, Prague, September 2003.

Outputs

Publications


Conference Presentations


**Impacts**

Once the present findings have been verified in clinical populations, there is a real opportunity for the principles contained in the mood-as-input hypothesis to be applied to the development of treatment regimes for perseverative anxious and depressed psychopathologies.

**Other References**


Frost R.O. et al. (1986) Behaviour Research & Therapy, 24, 133-143.


Mean number of catastrophising steps generated by participants in the high and low manipulation of responsibility conditions, for the three mood groups (positive, negative, neutral) (from Startup & Davey, 2002).
**TABLE 1:** Correlations between ‘many as can’ and feel like stopping’ stop rules measures and measures of trait anxiety, trait worrying, responsibility, shame, guilt and scores on the Consequences of Worrying Scale (COWS). From Davey, Startup, MacDonald et al. (2003, in press)

<table>
<thead>
<tr>
<th>QUESTIONNAIRE</th>
<th>VARIABLE</th>
<th>‘many as can’ stop rule</th>
<th>‘feel like stopping’ stop rule</th>
</tr>
</thead>
<tbody>
<tr>
<td>PENN STATE WORRY QUESTIONNAIRE</td>
<td>TRAIT WORRY</td>
<td>.540***</td>
<td>-.156</td>
</tr>
<tr>
<td>OBQ</td>
<td>RESPONSIBILITY</td>
<td>.094</td>
<td>.097</td>
</tr>
<tr>
<td>PFQ</td>
<td>SHAME</td>
<td>.396***</td>
<td>-.087</td>
</tr>
<tr>
<td>PFQ</td>
<td>GUILT</td>
<td>.275**</td>
<td>.084</td>
</tr>
<tr>
<td>COWS (NEGATIVE CONSEQUENCES)</td>
<td>Worrying disrupts effective performance</td>
<td>.265**</td>
<td>-.098</td>
</tr>
<tr>
<td></td>
<td>Worrying exaggerates the problem</td>
<td>.378***</td>
<td>-.067</td>
</tr>
<tr>
<td></td>
<td>Worrying causes emotional discomfort</td>
<td>.348***</td>
<td>-.135</td>
</tr>
<tr>
<td></td>
<td>TOTAL NEGATIVE CONSEQUENCES</td>
<td>.359***</td>
<td>-.086</td>
</tr>
<tr>
<td>(COWS) POSITIVE CONSEQUENCES</td>
<td>Worry motivates</td>
<td>.450***</td>
<td>-.151</td>
</tr>
<tr>
<td></td>
<td>Worry helps analytical thinking</td>
<td>.460***</td>
<td>.004</td>
</tr>
<tr>
<td></td>
<td>TOTAL POSITIVE CONSEQUENCES</td>
<td>.499***</td>
<td>-.110</td>
</tr>
</tbody>
</table>

** p<.01  ***p<.001
Figure 2: (1) Overall number of checks, (2) highest number of checks of a single line, (3) total number of lines checked, and (4) total time (in minutes) spent checking as a function of mood induction and stop rule (from MacDonald & Davey, 2003, in press).