

The effects of time pressure on managerial decision making

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Experienced managers described a recent time pressured decision and then indicated: how they adapted their decision making strategy to meet the pressure; whether they appraised the situation as a challenge or as a hindrance; and how the pressure changed their emotional state. In addition, all managers completed the Maximizer/Satisficer and Need for Cognition scales. Results showed that managers use six different strategies for adapting to time pressure; that time pressure can induce higher levels of negative and positive affect and can be appraised as either a hindrance that reduces the quality of a decision or a challenge that is beneficial to the decision. There was some evidence that the Maximizer/Satisficer scale was associated with differences in strategy, appraisal and affect. The findings are discussed in the context of Variable State Activation Theory (Maule & Hockey, 1993) and the implications for helping managers to deal effectively with time pressured decision making are discussed.

The effects of time pressure on managerial decision making

Introduction

Research in organizational psychology shows that people often feel there are insufficient hours in the day and that they have to work longer and harder than ever before (Menzies, 2005). This leads to feelings of time pressure which, in work contexts, have led to employee dissatisfaction, alienation, low productivity and absenteeism (Parker & De Cotis, 1983). However, there has been little interest in the effects of time pressure on key managerial activities such as decision making. This is surprising given that laboratory-based research shows that time pressure affects the processes and the outcomes of decision making, often in detrimental ways (Ordonez, Benson & Pittarello, 2015; Svenson & Maule, 1993). The laboratory research is dominated by studies investigating how students make hypothetical choices between apartments and gambles. Surprisingly, there is no research investigating whether the time-pressure effects reported in the laboratory generalise to experienced managers making organisation-based decisions.

The objectives of this study are to investigate whether the strategies used to adapt to time pressure identified in laboratory research are used by experienced managers and, if so, the impact these have on decision outcomes and the emotional state of the decision maker. We also consider the extent to which modes of adapting to time pressure vary with individual differences in processing preferences associated with the Maximizer/Satisficer (MS) and Need for Cognition (NFC) scales.

In the next sections we briefly review laboratory and organizational-based research on time pressure to develop research questions.

Laboratory Studies of Time Pressure

General Effect of Time Pressure

Time pressure impairs performance on many cognitive tasks (Roskes, Elliot, Nijstad & De Dreu, 2013). There are two primary explanations for this: stress and arousal elicited by time pressure distract individuals leaving fewer processing resources to complete the task in hand (Keinan, Friedland, Kahneman, & Roth, 1999); and the need to monitor the passage of time consumes mental resources also reducing those available for the task (Kelly, Jackson, & Hutson-Comeaux, 1997). However, time pressure can be beneficial by energising individuals to initiate important actions they might otherwise neglect (Gardner, 1990) and may even enhance enjoyment of tasks (Zivnuska, Kiewitz, Hochwarter, Perrewew, & Zellars, 2002). These general trends are consistent with the findings from research on time-pressured decision making.

The Effects of Time Pressure on Decision Making

There are two streams of research: one treats time pressure as a contextual factor that influences the overall cognitive strategy underpinning a decision; the other focuses on the affective changes associated with time pressure.

Time pressure as a contextual factor

Time pressure is one among many contextual factors influencing the cognitive strategy underpinning decision making. Other factors include the importance and complexity of the decision and the extent to which decision makers are held accountable for outcomes (Ford, Schmitt, Scheitman, Hults & Doherty, 1989; Payne, Bettman & Johnson, 1993). Changes in strategy are necessary since time pressure restricts the time available to search for and evaluate relevant information (Park, Iyer & Smith, 1989). Maule & Hockey (1993) suggest strategy changes can be described at the macro- and micro-level.

Macro-strategy changes involve a switch in decision rule, usually from a compensatory to a non-compensatory rule (Payne et al 1993; Weenig & Maarleveld, 2002). Compensatory rules involve evaluating all available options thoroughly, then choosing the best amongst these options. The rational model, based on maximising subjective expected utility, is an example of this kind of rule. Non-compensatory rules involve evaluating a subset of the available options in a relatively simple way, choosing the first that is reasonable. 'Take the best' is an example of this kind of rule – it involves choosing the option that is best on the most important attribute (Gigerenzer and Goldstein, 1996). The switch in rules can be adaptive in that non-compensatory rules can lead to better outcomes than compensatory rules under time pressure (Payne et al., 1993). Put simply, when time is used up it is better to have some information about several of the better options rather than a detailed knowledge of just one or two of them.

Micro-strategy changes involve smaller scale changes in cognitive processing. Initial research drew upon Miller's suggestions about how people adapt to information overload (Miller, 1960). Two of these, filtering and acceleration, occur under time pressure. Filtering involves processing high importance information and ignoring low importance information. Wright (1974) showed that time pressure leads people to filter by focusing on negative information and neglecting positive information. Though this effect has been replicated several times (Ben-Zur & Bresnitz, 1981) others have found filtering in favour of positive information (Svenson, Edland & Slovic, 1990). Differences in the relative importance of negative and positive information in these different studies explain the contradictory findings and together they show that people adapt to time pressure by focusing on important information and neglecting unimportant information.

Acceleration involves a general speeding up of cognitive processing allowing more to be achieved in the time available. Several studies have shown that people adapt to time pressure through acceleration (Maule & Mackie, 1990). Maule & Hockey (1993) suggest acceleration is one aspect of a more general mode of adapting associated with working harder. In work settings this might also include working longer than normal and not taking scheduled breaks and rests. However, laboratory studies do not have the potential to investigate these other aspects of acceleration so they remain speculative.

Maule et al (2000) showed a negative correlation between filtering and acceleration and suggested that people tend to adopt one or other mode of adapting. They argued that the mode adopted may either reflect individual differences in cognitive style (Stiensmeier-Pelster & Schurmann, 1993) or differences in how individuals appraise task demands, with each micro-strategy linked to a different

appraisal of demands and the appropriate deployment of resources to meet them (Maule & Hockey, 1993). There has been no research to distinguish between these two explanations.

Laboratory research has identified two further micro-strategy changes. Maule & Mackie (1990) showed that as a deadline becomes more stringent so the incidence of participants failing to respond within the time allowed increases. Interestingly, a sub-group of individuals was responsible for all these cases raising the interesting possibility that ignoring/discounting the deadline may be a third micro-strategy.

Finally, Betsch, Haberstroh, Molter & Glöckner (2004) show that time pressure increases the likelihood that people rely on fast intuitive choice processes based on habit derived from prior learning. This suggests that an intuitive habit-based micro-strategy may be a fourth way in which people adapt to time pressure.

There is no research investigating the relation between macro- and micro-based strategy changes so it is difficult to determine which provides the best way of describing how people adapt to time pressure. However, Bettman, Luce & Payne (1998) argue that the cognitive strategy used by decision makers in non-time pressured situations is better conceptualised as a set of emerging micro-cognitive elements, or what they call elementary information processes, rather than a selection and then full implementation of a specific decision rule. We agree with this view so our study focuses on micro-strategy changes.

Time pressure and affect

Maule & Hockey (1993) argue that time pressure also leads to changes in a decision maker's affective state. Most laboratory studies simply report feelings of time pressure as a manipulation check rather than investigating the nature of affective changes more generally and their impact on decision making.

One exception is a study by Maule et al (2000) investigating how the imposition of a deadline changed the affective states of participants choosing options across a set of hypothetical everyday risk situations. They used self report scales for measuring negative affect (NA) associated with feelings running from tense/anxious to calm and two variants of positive affect. One of these variants, PA, builds on suggestions by Watson and Tellegen (1985) for a dimension associated with feelings from cheerful to miserable. The second variant, PA/En follows suggestions by Thayer (1989) for a dimension associated with feelings from energetic to fatigued (Hockey, Maule, Clough, & Bdzola, 2000). Findings showed that participants in the deadline condition felt more time pressured, more anxious and more energetic. Greater anxiety was attributed to an increased awareness of the extra demands of working to a deadline. Feeling more energetic was attributed to greater task involvement and the need to work harder. Brief periods of increased workload are known to make people feel more energetic (Thayer, 1989). Maule et al (2000) suggest that increased anxiety would normally be expected with the imposition of a deadline since it always increases demands on the decision maker. However, people may not always feel more energetic, particularly if the decision situation stretches over time, since relatively long periods of hard work are known to induce reductions in energy levels i.e. fatigue. These findings suggest that time pressure induces changes in both NA and PA though there is no evidence indicating whether these changes influence the cognitive strategy adopted.

Impact of time pressure on decision effectiveness

Time pressure can have a negative impact on decision making by increasing functional fixedness (German & Barret, 2005), reducing creativity (Elsbach & Hargadon, 2006) and generally decreasing the value of decision outcomes (Payne et al 1993). However, time pressure can also have a positive impact. For example, Svenson & Benson (1993) show a reduction in the framing bias under time pressure i.e. less tendency for trivial changes in the wording of a decision problem to affect choice behaviour. Dhar, Nowlis and Sherman (2000) and Pettibone (2012) show that time pressure reduces context effects such as the compromise effect i.e. too strong a tendency to choose the option that is a compromise between those available. Time pressure can also help decision makers overcome procrastination which can paralyse them from taking action when the choice set is large (Ariely & Zakay, 2001).

These findings suggest time pressure has both positive and negative effects on decision making.

Individual differences

Recently there has been an upsurge of interest in individual differences in human decision making (Phillips, Fletcher, Marks & Hine, 2016). Our research focuses on two measures relevant to time pressured situations.

Maximizer / Satisficer

Schwartz, Ward, Monterosso, Lyubomirsky, White & Lehman, (2002) distinguish between maximizers, who try to evaluate all options then choose the best, and satisficers, who evaluate a more limited range of options choosing the first that is satisfactory. These propensities lead maximizers to process more information, evaluate many rather than a few options and spend more time reviewing options when making a decision as compared with satisficers (Dar-Nimrod, Rawn, Lehman, & Schwartz, 2009; Misuraca & Teuscher, 2013). Despite their best efforts to find the best alternative, maximizers are generally less satisfied with decision outcomes and regret their decisions more than satisficers (Schwartz, 2004) even when they actually experience better outcomes (Polman 2010). In addition, maximizers experience greater time pressure than satisficers when facing the same deadline (Chowdury, Ratneshwar & Mohanty, 2009). These findings suggest maximizers are more challenged by time pressure than satisficers and this may lead them to experience higher levels of negative affect alongside a preference for micro-strategies that sustain relatively high levels of processing e.g. acceleration rather than filtering.

Need for Cognition

The NFC scale captures a person's tendency to engage in and enjoy effortful cognitive activity (Cacioppo and Petty, 1982). Carnevale, Inbar & Lerner (2010) showed a greater propensity for low NFC individuals to fall foul of psychophysical judgment errors such as the framing bias (described earlier). Harman (2011) showed that low NFC participants performed worse on the Iowa Gambling task than high NFC participants because they place more importance on gains rather than losses. Although there are no studies investigating relations between NFC and time pressure, we might expect high NFC decision makers to prefer micro-strategies that maintain cognitive processing at a relatively high level e.g. acceleration rather than filtering.

Time Pressure in the Work Place

Research has shown that sustained periods of time pressure at work have detrimental effects on employee motivation and well-being (Parker & De Cotis, 1983). One pertinent aspect of recent research shows that time pressure is a 'challenge-hindrance' stressor (Widmer et al, 2012). This distinction draws on research by LePine and colleagues (e.g. LePine, Podsakoff, & LePine, 2005) showing that all stressors have hindrance characteristics that cause psychological strain, induce negative emotional states, and constrain and interfere with work performance. However, some stressors also have challenge characteristics that are positively related to work performance. For example, time pressure may be necessary to energise individuals to initiate important actions that might otherwise remain neglected (Gardner, 1990). In addition, people often flourish in the face of challenging job demands and express "enjoyment and even euphoria" (LePine, Podsakoff, & LePine, 2005 pp. 441) when undertaking tasks under challenge stressors such as time pressure. This suggests that time pressure has both detrimental and beneficial effects and may induce both positive and negative emotions (Birdi, Warr, & Oswald, 1995).

This body of research focuses on the longer term effects of time pressure in work environments rather than more immediate effects on managerial activities such as decision making. However the idea that time pressure may have beneficial as well as detrimental effects is consistent with the laboratory research reviewed above. Both bodies of research provide the foundation for the research questions underpinning the work described in this article.

Research Questions

The primary set of research questions (RQs) focuses on the micro-strategies used by managers when making work-based decisions under time pressure. We investigate whether managers use: the micro-strategies filtering and acceleration identified in laboratory research (RQ1.1); a strategy that involves simply ignoring/redefining the deadline, as suggested by Maule & Mackie (1990) (RQ1.2); a strategy involving fast intuitive processes based on habit derived from prior learning as suggested by Betsch et al (2004) (RQ1.3); and whether there are any other strategies that have, as yet, not been discovered by laboratory research (RQ1.4). In addition we investigate the relations between the use of different strategies including an evaluation of laboratory findings showing a negative correlation between filtering and acceleration (RQ1.5).

A second set of research questions focuses on changes in managers' emotional states when making time pressured decisions. Following Maule et al (2000) we investigate whether time pressure leads to a general increase in NA (RQ2.1) and/or an increase in PA (RQ2.2). This expectation is based on research showing that time pressure makes greater demands on decision makers but can also energise them. Finally, we investigate whether there are any systematic relations between micro-strategy use and emotion (RQ2.3).

The third set of research questions focuses on whether time pressure acts as a challenge as well as a hindrance in managerial decision situations (RQ3.1) and the extent to which time pressured decision makers use different micro-strategies in challenge and hindrance situations (RQ3.2). We also

evaluate whether greater hindrance leads to higher levels of NA (RQ3.3) and greater challenge leads to higher levels of PA (RQ3.4).

The fourth set of research questions focuses on individual differences. We investigate whether maximizers tend to use micro-strategies that maintain relatively high levels of information processing, e.g. acceleration, whereas satisficers tend to use micro-strategies that reduce levels of information processing, e.g. filtering and intuitive habit-based strategies (RQ4.1). In addition, we evaluate whether maximizers feel more pressured than satisficers (higher levels of NA), given their desire to process information prior to choice is more challenged by time pressure (RQ4.2); and investigate the extent to which maximizers experience more post-decisional regret as predicted by Schwartz et al (2004) (RQ4.3). We also investigate whether individuals high in NFC use micro-strategies that maintain relatively high levels of information processing e.g. acceleration, given they enjoy effortful cognitive processing (RQ4. 4) whereas those low in NFC tend to use micro-strategies that reduce the levels of information processing e.g. filtering and intuitive habit-based (RQ4.5). In addition we evaluate whether those high in NFC show higher levels of NA than those low in NFC given their desire to process more information is challenged in time-pressured situations (RQ4.6).

Method

Participants

220 participants completed the study (51 women). The sample was recruited from a research organisation's panel of experienced professionals. They were compensated for taking part by the organisation. The mean age of participants was 47.2 years (sd = 10.2 years). When describing their role in their organisation 51% included the word 'manager' in their response, 20% included the word 'director', 5% included the word 'owner' and 3% the word 'consultant'. The responses from the remaining respondents included words covering a wide variety of different professional backgrounds (e.g. training, finance, health and safety, administrative support). The age and role profiles of the sample indicate we have been successful in recruiting experienced managers.

The questionnaire

A questionnaire was designed to evaluate the research questions. Following a statement about the ethics underpinning the research, participants provided information about their gender, age and role in their organisation, and were then asked to type in a brief description of a time pressured decision they had taken recently. This was followed by a question asking participants to consider the extent to which they used each of 37 different ways of adapting to time pressure. These ways of adapting, presented in Table 1, were drawn from the literature review on time pressure and our informal discussions with managers attending MBA classes. Participants used a five-point scale with labels 'not used at all', 'used a little', 'used somewhat', 'used quite a bit', 'used a great deal'.

The next section of the questionnaire was designed to assess hindrance and challenge. Participants indicated whether the time available to make the decision was 'a little less than needed', 'quite a lot less than needed' or 'very much less than needed'. Next they compared their decision with similar decisions taken in the past but without time pressure indicating whether the decision was: underpinned by a process that was 'much worse than usual', 'a little worse than usual', 'about the

same as usual', 'a little better than usual' or 'much better than usual'; associated with a level of confidence about having made the right decision that was 'much less confident than usual', 'a little less confident than usual', 'about the same level of confidence', 'a little more confident than usual' or 'a lot more confident than usual'; and associated with effort expended while making the decision that was 'much less than usual', 'a little less than usual', 'about the same as usual', 'a little more than usual' or 'much more than usual'. Participants were then asked to indicate whether: having more time to make their decision would have made the quality of the decision 'much worse than it actually was', 'a little worse than it actually was', 'about the same as it actually was', 'a little better than it actually was' or 'much better than it actually was'; and whether the amount of control they had over handling the decision was 'much less control than I usually have', 'a little less control than I usually have', 'about the same control as I usually have', 'a little more control than I usually have' or 'a lot more control than I usually have'. They were also asked about how time pressured they felt by indicating whether they were 'not at all time pressured', 'a little time pressured', 'quite time pressured' or 'extremely time pressured'.

The next section focused on participants' emotional state while making the decision. They used a 9-point scale to indicate whether, in comparison to their typical emotional state, they felt more or less energetic, pressured, depressed, tired, tense, elated, alert, calm and stressed. The end points of the scale were labelled 'far less than usual' and 'far more than usual'. These emotion terms are broadly similar to those used by Maule et al (2000). Finally in this section was a question asking participants to indicate the amount of regret they felt about the outcome of the decision using a five point scale with 'not at all' and 'very much' at its end points.

The final section was devoted to the individual difference scales. We used the 13 item Maximization Scale (Schwartz et al, 2002) that delivers a mean score on a seven-point scale, with higher scores associated with maximization. To distinguish between those high and low in NFC we used the 18 item scale devised by Cacioppo et al. (1984). This delivers an average score across the items based on a five-point scale with higher values associated with greater need for cognition.

The questionnaire was completed on-line using Qualtrics software.

Results

We begin with a review of participants' descriptions of their time pressured decisions and then consider the research questions.

Overview of Decision Descriptions

Participants typed in a description of a recent job-related time pressured decision. Eleven participants responded in ways that meant their responses were unusable i.e. they could not recall making a time pressured decision, they stated that they did not make time pressured decisions or they simply wrote nothing. These participants were excluded from further analysis.

The remaining participants provided descriptions that varied from a short sentence to a full paragraph of six or seven sentences. The actual decisions varied enormously and were drawn from the following domains: personnel e.g. hiring and firing; finance e.g. how much to tender for a job;

operational e.g. prioritizing one job over another; legal e.g. whether to sue for compensation; choosing content for a report e.g. writing a market report; and location e.g. moving offices.

RQ1: Strategies Used Under Time Pressure

The first set of research questions, concerning micro-strategies used under time pressure, was investigated using an exploratory factor analysis of participants' responses to the 37 different ways of adapting to time pressure (see Table 1). Factor retention was decided using parallel analysis (Horn, 1965). This involved comparing the analysis of participants' data with analyses of random data generated by "Monte Carlo PCA for Parallel Analysis" (Watkins, 2000). The software generates random data with the number of cases and variables analysed matched to the dataset of interest, and then factor analyses these to produce eigenvalues (effectively providing an indication of the size of the eigenvalues which might be expected by chance). These randomly based solutions were compared to the statistical output derived from the analysis of our participants' data. Data from 1000 iterations of the program were used in the comparison. Six factors were retained from the factor analysis and these are shown in Table 1. All factors had eigenvalues above the average for that factor from the Monte Carlo simulation, and the first 4 were significantly different from the random average at the 1% level. The 5th and 6th factors were retained because of the exploratory nature of the research and due to them making intuitive sense. Retention of 6 factors was compatible with judgements based on the scree plot, although 11 factors satisfied the Kaiser-Guttman criterion with eigenvalues greater than 1. Scales were produced for each of the retained factors using variables loading at >.4 on each factor, with an average of participants' Likert scale responses generating the score for each factor.

The factor analysis indicates that the two micro-strategy strategies commonly found in laboratory research, Filtering and Acceleration, are used by managers when making time pressured decisions in the workplace (RQ1.1). We labelled Factor 1 Filtering since the items loading strongly on it involve reducing information processing load by ignoring all but the more important information. Interestingly 'focusing on issues that might cause problems later' also loaded on this factor, indicating that importance can involve damage limitation as well as optimizing the outcome. We labelled Factor 6 Acceleration since the items loading strongly on this factor involve processing information at a faster rate.

The findings also provide support for the other two strategies identified by laboratory research. Consistent with the suggestion made by Maule & Mackie (1990), we called Factor 2 Ignoring/Redefining the Deadline since the items loading most strongly on this factor indicate time pressure is overcome by challenging, ignoring or renegotiating the deadline rather than working to it (RQ1.2). This factor was also associated with items that flag up the potential impact of the deadline on decision quality, and making it clear that retaining the deadline might not be a cost-free option.

Following research by Betsch, Haberstroh, Molter & Glöckner (2004) we called Factor 3 Rely on Intuition (RQ1.3). This factor has some similarities to Factor 1 (Filtering) in that it involves processing less information e.g., the item 'took account of less information than usual' loads on Factor 3. However, the item loading most strongly on Factor 3 is 'relied to a greater extent on intuition'. This suggests that, in comparison to Filtering, Rely on Intuition involves an increased reliance on automatic / intuitive processing rather than more deliberately based changes in processing

priorities in favour of important information that occur under Filtering. An important feature of Rely on Intuition is that it is associated with a 'reduction in the quality of the decision outcome' and 'trying to do the best in the time available' suggesting that managers believe that this strategy reduces decision effectiveness.

The factor analysis suggested two further micro-strategies not discussed by laboratory research (RQ1.4). Work Longer (Factor 4) confirms a previously untested suggestion by Maule & Hockey (1993) that in the workplace people may adapt to time pressure by not taking scheduled rests and breaks. Finally, Involving Others (Factor 5) is a mode of adapting that involves getting or delegating others to undertake some of the scheduled activities thereby increasing the amount that can be achieved in the time allowed. These two strategies have not been identified before, due in part to the fact that laboratory research uses experimental tasks that do not provide the opportunities to enact them.

A within-subjects GLM indicates factor usage levels vary ($F(4.147, 1040)=81.719, p<.001$, Greenhouse-Geisser correction applied). The most used micro-strategies are Filtering and Work Longer, and the indicated usage for these two is not significantly different (usage scores 3.071, 3.195 respectively, $p>.1$ on pairwise comparison, $p<.05$ on pairwise comparison with other strategies). Below these in usage level, Rely on Intuition has the next highest usage score (2.958) and is significantly different from all other strategies ($p<.05$ in all cases). Acceleration and Involving Others have the same average usage score (2.702) and are significantly different from all other strategies ($p<.01$ in all cases). The micro-strategy with the lowest usage is Ignoring/Redefining the Deadline, with significantly lower usage than all other factors (usage score 1.808, $p<.001$ on pairwise comparison with other strategies). It is not clear if this is due to the inclination of the participants or to the practicalities of actually implementing this strategy in the decision situations being considered by our participants.

Next we analysed whether there were any trade-offs between strategy use (RQ1.5). This was partly to investigate Maule et al's (2000) findings indicating a negative correlation between Filtering and Acceleration. In our study, Filtering and Acceleration were positively correlated ($r=.381, p<.001$), with each explaining about 15% of the variation in the other. Indeed all inter-strategy correlations had positive coefficients, with all but one significant at the 5% level after Bonferroni adjustment (the remaining correlation was significant at the 10% level). This suggests that strategy use is additive, rather than a greater use of one strategy leading to less use of others.

Our findings not only confirm that the four micro-strategies uncovered by laboratory research are used by managers making decision in the workplace but also show that managers use two other micro-strategies not previously identified by this research – Work Longer and Involving Others. In addition, the findings suggest that managers use a combination of different strategies to cope with time pressure rather than a greater use of one strategy leading to less use of the others as suggested by laboratory research.

RQ2: Emotional States

The second set of research questions concerned how time pressure changes the decision maker's emotional state. Participants used nine affect adjectives to rate how they felt at the time they took the decision in comparison with their typical emotional state. A factor analysis based on a varimax rotation, which accounted for 59% of the variance, revealed two factors, as expected (see Table 2).

Items loading on Factor 1 (loadings $>.4$) are strongly indicative of negative affect (NA). Items loading on Factor 2 are strongly indicative of positive affect (PA). Overall scores for NA and PA were derived by finding the mean score across the items loading strongly on each, weighting each item equally.

To investigate RQ2.1 and RQ2.2 we derived the mean levels of NA and PA. These were 5.20 (sd = 1.49) and 5.35 (sd = 1.31) respectively, both significantly above the mid-point of the scale (mid-point = 4, $t = 11.65$, $df = 208$, $p < .001$ for NA; $t = 14.87$, $df = 208$, $p < .001$ for PA). These findings show that time pressure increased both NA and PA, given the mid-point of the scale indicates the usual levels experienced by our participants. It is worth noting that there was a low but significant negative correlation between NA and PA ($r = -.18$, $p < .01$) suggesting that higher levels of one of these emotional states was associated with lower levels in the other.

Next we investigated relations between strategy and emotion (RQ2.3) by looking at the correlations between NA, PA and micro-strategy use. All micro-strategies other than Acceleration were positively correlated with NA though these were all small effects – Rely on Intuition ($r = .19$, $p < .05$) and Work Longer ($r = .18$, $p < .01$) were statistically significant, while Filtering Ignoring/ Re-defining the Deadline and Involving Others were marginally significant ($p < .1$). For PA there was a significant correlation with Filtering ($r = .14$, $p < .05$) and Involving Others ($r = .14$, $p < .05$), and a marginally significant correlation with Acceleration ($r = .13$, $p = .054$) and Work Longer ($r = .12$, $p = .094$); the other two correlations were non-significant.

Overall, these findings are in line with laboratory research in showing that time pressure increases both NA (RQ2.1) and PA (RQ2.2) as suggested by Maule et al (2000). There is some evidence to suggest that the pattern of affective changes is associated with micro-strategy use (RQ2.3) though at this stage this must be treated with some caution given the effects were small.

RQ3 Challenge / Hindrance

The third set of research questions concerned whether time pressure is a challenge / hindrance stressor (RQ3.1). Participants completed 7 scales designed to assess challenge and hindrance features of their decision situation (see Table 3 for these items). An exploratory factor analysis using a varimax rotation, which accounted for 48% of the variance, revealed the expected two factors; see Table 3. Items loading on the first factor are strongly indicative of Challenge. Participants scoring high on this factor are indicating that time pressure: improved the quality of the process; increased their confidence that they have made the right decision; increased the quality of the decision and increased their control over the decision process. The items loading on the second factor are strongly indicative of Hindrance. Participants scoring high on this factor are indicating that: the time available to make the decision was much less than needed; they felt more pressured; and had to expend more effort.

Our suggestion that these two factors reflect Challenge and Hindrance is further supported by correlations between these two (captured in terms of scales derived from an average of participants' Likert scale responses) and the emotion measures. Factor 1 (Challenge) is negatively correlated with NA ($r = -.39$, $p < .001$) but positively correlated with PA ($r = .37$, $p < .001$) showing that greater challenge is associated with less negative affect and increased positive affect. In contrast to this

Factor 2 (Hindrance) is positively correlated with NA ($r = .23, p < .01$) but uncorrelated with PA ($r = -.05, p > .1$). Increased NA and no change in PA is consistent with this being Hindrance.

There was a small but significant negative correlation between Challenge and Hindrance ($r = -.156, p < .05$). This relatively small correlation suggests that rather than a decision situation being exclusively appraised as either challenge or hindrance it is likely that both appraisals can occur for the same decision situation. Finally, we investigated the Challenge/Hindrance aspects of the six different micro-strategies in terms of the correlations with each (RQ3.2). Only one correlation between Challenge and micro-strategy was significant, a negative correlation with Rely on Intuition ($r = -.18, p < .01$) indicating less use of this strategy in challenge situations. In contrast to this there were four significant correlations between Hindrance and micro-strategy use – positive correlations with Filtering ($r = .16, p < .05$), Work Longer ($r = .28, p < .001$), Involving Others ($r = .15, p < .05$) and Acceleration ($r = .15, p < .05$). These correlations suggest greater use of these four strategies in hindrance situations. However, the correlations are quite low and further research is needed to clarify these effects.

These findings support our initial suggestion that challenge and hindrance both play an important role in determining how managers adapt to time pressure when making workplace decisions.

RQ4: Individual Differences

The fourth set of research questions concerned the extent to which time pressure effects were linked to MS and NFC. Correlations between strategy use and the MS scale (RQ4.1) revealed 5 significant effects albeit relatively small ones. In particular, those revealing stronger maximizing tendencies were more likely to use Ignoring/Redefining the Deadline ($r = .26, p < .001$), Rely on Intuition ($r = .16, p < .05$), Working Longer ($r = .19, p < .01$), Involving Others ($r = .15, p < .05$) and Acceleration ($r = .15, p < .05$). This partly supports our suggestion that maximizers make greater use of micro-strategies that maintain higher processing levels, though the increased use of Rely on Intuition runs counter to this.

We also suggested that maximizers would feel more NA in time pressured situations than Satisficers (RQ4.2). This was supported by a highly significant correlation between the MS scale and NA ($r = .33, p < .001$). There was no relation between the MS scores and PA ($r = .03, p > .05$) and we just failed to support previous laboratory research showing that maximizers experience more post-decisional regret ($r = .13, p = .055$) (RQ4.3).

There was only one significant correlation between NFC and strategy use (RQ4.4); those high in NFC used the Ignoring/ Redefining the Deadline strategy to a lesser extent ($r = -.15, p < .05$), although increased use of Filtration and Working Longer were marginally significant. Our investigations of NFC and emotion (RQ4.5) revealed that the correlations between emotion (NA and PA) and NFC were both non-significant ($r < .12, p > .05$).

Overall, these findings show that the MS scale is more strongly associated with the effects of time pressure on decision making than the NFC scale. Maximizers tend to use most of the six micro-strategies to a greater extent than Satisficers and also experience more negative affect. These effects may reflect Maximizers' wish to process more information before making a decision than Satisficers leading them to use micro-strategies to a greater extent in order to achieve this.

Discussion

Our findings reveal that managers use six different micro-strategies in time pressured decision situations. Four of these, Filtering, Acceleration, Rely on Intuition and Ignoring/Redefining the Deadline have been identified previously in laboratory research. We discovered two further strategies: Working Longer, and Involving Others. These two strategies cannot occur in laboratory studies since experimental designs typically prevent participants working beyond the pre-specified experimental session and from involving others when making a decision.

Our findings also indicate that Filtering and Working Longer are used most often by managers, Ignoring/Redefining the Deadline is used least often, with the other three strategies used an intermediate amount. The positive correlations between use of the strategies contradicts laboratory research showing a negative correlation between Filtering and Acceleration (Maule et al 2000). These positive correlations suggest that managers use a combination of strategies to adapt to time pressure with greater use of one associated with a greater use of others. This finding makes sense given that the use of one strategy does not preclude the use of another, and combinations of different strategies may be an effective way of dealing with tight deadlines in managerial settings which extend over longer time scales than laboratory studies.

A second set of research questions concerned emotion. We showed that, in comparison to their usual emotional state, time pressured managers experience higher levels of both NA and PA. Higher levels of NA are consistent with an increased awareness of the extra demands of having to work to a deadline (Maule et al 2000). Higher levels of PA are consistent with greater task involvement and the need to work harder making managers feel more energetic (Thayer, 1989). These findings support the pattern of affective changes reported in laboratory studies (Maule et al 2000).

There were some small but significant correlations between affect and strategy; a greater use of Relying on Intuition, and Working Longer were associated with increased NA. This finding suggests that these micro-strategies are used to a greater extent as the perceived demands associated with time pressure increase (increases in demand are known to increase NA). Also, the positive correlation between PA and Filtering suggests that this micro-strategy involves a prioritisation of information undertaken under conscious control given that higher PA is indicative of greater task involvement and the perceived need to work harder (Thayer, 1989).

At this stage we cannot be sure of the causal relationships underlying these effects – the strategy used may determine affect, affective state may determine the strategy adopted or both could be dependent on an as yet unspecified third variable. Future research is needed to investigate these different possibilities.

A third set of research questions concerned the possible role of challenge and hindrance in time pressured decision making. Our findings showed both were important. Challenge was associated with a better decision process, greater control over the process and a belief that the decision outcome was better than it would have been without time pressure. Challenge was also associated with increased PA and reduced NA a pattern of affective changes indicative of greater task involvement and higher levels of energy associated with working harder (Thayer, 1989). Hindrance

was associated with much less time available than was needed, feeling more pressured and having to expend more effort. Hindrance was also associated with increased NA - a change that is indicative of difficulties dealing with the demands of time pressure. Interestingly the levels of Challenge and Hindrance were weakly correlated suggesting that decision episodes were not appraised as being one or the other. Instead it seems likely that decision episodes involve both, each occurring independently and to varying degrees. Finally, there was evidence associating Hindrance and Challenge to strategy use. Hindrance was associated with greater use of Filtering, Working Longer, Involving Others and Acceleration. Challenge was associated with less use of Rely on Intuition. It is important to recognise that our analyses are based on correlations so we cannot be sure about directions of causality, so there is need for further investigation. In addition, the correlations were significant but the effects were relatively small.

The final set of research questions focused on individual differences. We showed that Maximizers use five of the six strategies to a greater extent than Satisficers: Challenge the Deadline, Intuition, Work Longer, Involving Others and Acceleration. It is worth noting that the strategy not showing this effect, Filtering, involves focusing only on the more important information. We suggested earlier that Filtering was a deliberately based micro-strategy that reduced the information processed prior to choice. Maximizers have a strong proclivity to process relatively large amounts of information so they may appraise Filtering as being less attractive given it conflicts with this proclivity.

We also supported our prediction that maximizers experience higher levels of NA. Maximizers proclivity to process all decision related information is more disrupted by time pressure than satisficers, who are more inclined to process less information in all situations whether time pressured or not. Our findings just failed to support previous laboratory based findings showing that maximizers experience more post-decisional regret. However, it would be wrong to reject this suggestion given the marginal significance level. Our findings on NFC showed only one small but significant effect suggesting those high in NFC used the Ignoring/Redefining the Deadline strategy less. Overall, NFC does not appear to be as important as MS in determining how managers adapt to time pressure.

General Discussion and Conclusions

Our findings show that managers use a broad range of micro-strategies for adapting to time pressure when taking decisions. We have also supported organisational research showing that time pressure is a hindrance/challenge stressor; to date this has not been shown for specific managerial activities such as decision making. Having established these findings further work is now needed to understand better the factors that determine which micro-strategy is adopted, the extent to which this is linked to hindrance/challenge appraisals, and to develop theory linking these aspects in order to understand better how time pressure affects managerial decision making. Maule & Hockey (1993) discuss these issues in the context of Variable State Activation Theory (VSAT), a general model of stress regulation explaining how people adapt to changes in time pressure and similar environmental demands. Some of our findings resonate with this theory. Central to this model is the suggestion that decision makers have task goals and compare the cognitive and other resources needed and actually available to achieve these goals. When the resources needed are available the activity proceeds as normal. In decision situations normal ways of proceeding may involve adopting a choice strategy based on an effort/accuracy evaluation, with decision makers adopting more

complex effortful strategies when task goals are important and less effortful simpler strategies when these goals are less important (Payne et al, 1993).

Maule & Hockey suggest that stressors such as time pressure can increase the need for extra cognitive resources. If increases in demand are small and within normal operating levels then the extra resources are allocated automatically, outside conscious control. However, a large discrepancy between supply and demand for resources signals the need for a more active higher level control process under conscious control. Within VSAT there are four different modes of high level control for dealing with relatively large discrepancies. The first mode involves increasing the amount of effort expended beyond usual operating levels; two of our strategies, Acceleration and Work Longer are examples of this mode. In each case the 'effort budget' is significantly increased to meet the demands of time pressure, either by working harder or longer. Maule & Hockey (1993) review research showing that this mode of adapting can be costly: it can lead to fatigue and if extended over long periods of time can lead to reductions in well-being. In addition, there are upper limits on the speed of processing and how much longer a manager may work which mean that these micro-strategies may be ineffective under severe time pressure.

A second mode of adapting involves lowering goals thereby justifying the use of a simpler, less time consuming strategy; reduction in accuracy associated with simpler strategies is justified if goals are lowered. This mode of adapting is known to occur in the workplace. For example, Sperandio (1978) showed that air-traffic controllers switched from complex individually-based routing instructions to simple generalised instructions when high traffic load reduced the time available for each contact. Filtering is one example of this mode of adapting; it involves focusing on just the most important information. Rely on Intuition is likely to be another. Betsch et al (2004) suggest that this strategy often involves intuitive choice processes based on habit derived from prior learning. This is consistent with Sperandio's findings showing an increased use of generalised instructions as traffic load increased.

A third mode of adapting within VSAT involves modifying or even eliminating the stressor at source. Ignoring/Redefining the Deadline is an example of this mode of adapting. Maule & Hockey (1993) indicate that although this mode of adapting can be the most effective for managing the negative aspects of time pressure, it is not always feasible given that in some situations the time limit is immutable. They also suggest that this mode of adapting is more feasible in situations where the deadline is self-imposed rather than externally imposed. The fourth mode of adapting is to do nothing. This may occur when the decision maker has insufficient cognitive resources to enact mode one, the task is too important to allow mode two and the time pressure is immutable. This is likely to be associated with states such as helplessness (Seligman, 1975) or panic (Janis & Mann, 1977). We suspect that this situation occurs rarely and there was no evidence for mode four in the responses given by participants in our study.

Our findings identify one further strategy not considered by VSAT though readily incorporated in to the model. Involving Others provides an additional way of meeting demands for extra resources by getting others to undertake some of the work needed to make the decision thereby increasing what can be achieved within the deadline.

A key feature of VSAT is that the comparison between task demands and cognitive resources occurs continuously across the task in hand (see Cox, 1987) with the moment by moment changes in this appraisal signalling the need to change the mode of adapting. Our findings showing a positive

correlation between micro-strategy usage and a weak correlation between Challenge and Hindrance are consistent with this view. We would expect strong negative correlations if participants appraised task demands and resources just once at the beginning of the decision process and used this single appraisal for determining whether the situation is perceived to be challenge or hindrance and which micro-strategy is adopted.

A further important feature of VSAT is the central role played by mechanisms that appraise task demands and the resources available to meet these demands. This suggests that key characteristics of the situation such as the number of choice alternatives, the complexity of the available information and the amount of uncertainty surrounding decision outcomes are likely to affect task demands, making them critical in determining the micro-strategy used for dealing with time pressure. The current state of the individual, for example whether they are feeling active or fatigued, is also likely to influence the strategy adopted. Future research needs to assess how these factors along with challenge/hindrance and individual differences determine micro-strategy use in time pressured decision making.

In conclusion, the findings show how our understanding of the effects of time pressure on managerial decision making can be increased by combining insights from both laboratory and field studies. We have shown that findings concerned with micro-strategies, affective changes and individual difference derived from laboratory studies complement suggestions from organisational studies that time pressure is a challenge / hindrance stressor. Our research also shows that the term time pressure covers a wide range of different states, from mild positive feelings of being challenged by the need to make a decision to more extreme negative feelings associated with insufficient time to make a decision of the quality necessary for the situation in hand. Time pressure can be beneficial in the former situation but likely to be detrimental in the latter situations. We also believe that our findings have important training implications. As our understanding of micro-strategies for dealing with time pressure increases and we gain a better understanding of how and when challenge and hindrance appraisals occur, so we can help managers to understand better the different strategies that are available to them and which is likely to be appropriate in a particular decision context. We may also be able to predict when and how it is appropriate to impose time pressure and gain the benefits of challenge and when the imposition of time pressure is inappropriate due to the negative impact of hindrance.

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Table 1. Rotated Factor Matrix from Exploratory Factor Analysis of Strategy Related Variables

Variables	Filtration	Challenging the Deadline	Rely on Intuition	Work Longer	Involving Others	Acceleration
Focussed only on some parts of the problem, ignoring others	.551					
Just tried to achieve the best possible in the time available	.464		.436			
Focussed on important information only	.744					
Analysed only the important information, neglecting the less important information732					
Ignored all but the most important factors775					
Ignored anything not critical to the decision.....	.579					
Focussed on those aspects of the task that could be completed within the deadline480					
Focussed on those aspects that posed the greatest threat or might cause problems in future	.648					
Made the decision on whatever information I had by the deadline	.401					
Negotiated for more time to make the decision		.618				
Went past the deadline and hoped that I would be able to stall for extra time		.650				
Refused to accept the deadline		.807				
Indicated to others that the quality of the decision was likely to be affected by the time limit		.455	.463			
Refused to make the decision unless greater time was allowed		.817				
Accepted that the quality of the decision would be reduced by the limitations in time681			
Took account of less information than usual			.656			
Relied to a greater extent on intuition694			
Followed my gut feeling.....			.463			

Table 1. (cont.)

Variables	Filtration	Challenging the Deadline	Rely on Intuition	Work Longer	Involving Others	Acceleration
Increased the amount of mental effort devoted to the task				.597		
Didn't take scheduled rests and breaks (e.g. coffee break/lunch)				.751		
Worked past the normal finishing time				.789		
Delegated more of the activity to others					.823	
Got other people to undertake some of the activities					.789	
Asked others for advice about the decision					.557	
Tried to think faster than usual						.834
Generally speeded up my rate of working.....						.761
Reduced the amount of consultation with others...						.411
Made a new plan that allowed me to meet the deadline						
Just did what I usually did and hoped for the best						
Got on with other jobs as a means of forgetting the pressure associated with this decision						
Considered fewer possible alternative choices						
Just accepted things as they were and worked in exactly the same way as usual						
Tried to undertake many activities at the same time						
Relied on simple rules such as 'cheapest is best'						
Did things "by the book" rather than being creative						
Deferred other key aspects of my workload						
Spent proportionately more time on defining the problem before acting						
% variance explained (total=45.2%)	11.5	8.0	7.4	6.5	6.4	5.5

Table 2. Rotated Factor Matrix from Exploratory Factor Analysis of Changes in Affect

Variables	Negative Affect	Positive Affect
Pressured	.608	
Depressed	.694	
Tired	.757	
Tense	.887	
Stressed	.860	
Energetic		.794
Elated		.653
Alert		.847
Calm		.565
% variance explained	34.7	25.9

Table 3. Rotated Factor Matrix for Variables related to Challenge and Hindrance

Variables	Challenge	Hindrance
As compared with similar decisions to this one, but without time pressure, the process you followed was (much worse than usual to much better than usual)	.657	
As compared with decisions similar to this one, but without time pressure, how confident are you about having made the right decision? (much less than usual to a lot more than usual)	.731	
If there had been unlimited time rather than time pressure do you think that the quality of the decision would have been (much worse than it actually was to much better than it actually was)	-.466	
How much control did you feel you had over how you handled the decision? (much less than usual to much more than usual)	.715	
The amount of time available to take this decision was (a little less to very much less than needed)		.809
As compared with similar decisions to this one, but without time pressure, was the effort you put in whilst making the decision (much less than usual to a lot more than usual)		.469
How time pressured were you when taking this decision? (extremely time pressured to not at all time pressured)		-.764
% variance explained	26.7	21.5