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INCENTIVES, ACCOUNTABILITY AND MYOPIC DECISION MAKING: A NEUROSCIENTIFIC INVESTIGATION

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KEY CONCLUSIONS

- Accountability affects cognitive and emotional control, which are both potential moderators of myopia (short-sighted decision making).
- Accountability pressure improves the ability to effectively process information and inhibit responses to conflicting irrelevant and emotionally salient stimuli, but does not have any behavioural effect on the ability to maintain focused attention.
- Managers' task performance is associated with risk and time discounting, which are two direct measures of myopia: more myopic individuals are more stimulated to improve performance by monetary incentive, while for less myopic individuals social pressure is more effective.
- Accountability provokes emotional and cognitive responses in the brain which affect cognitive performance in dependence of the type of task, type of accountability and individual's tendency towards myopic decision-making.
- Accountability enhances the ability to resist emotional distractors and automatic responses, enabling better control of impulsivity and emotional interference, which are important precursors of managerial myopia.

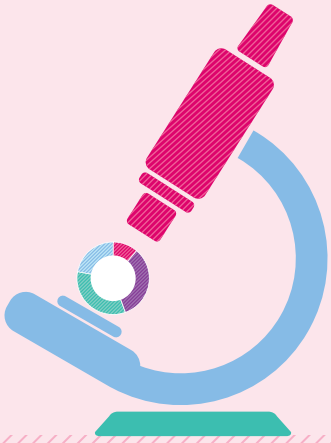
ABSTRACT

One of the challenges of management accounting is to help managers to optimise both the immediate and distant future of their organisations. In particular, management accounting should help individual managers consider both the immediate and delayed outcomes of their decisions.

This is important since in practice, managers often behave myopically when they are overly concerned with short-term results, while neglecting the long-term. Management accounting systems should be designed to curb this inclination but are often unsuccessful, and may even encourage myopic tendencies. For example, while the Balanced Scorecard (BSC) and Value Based Management (VBM) philosophies both aim to prolong managers' time horizon, their heavy reliance on immediate performance measures arguably makes them achieve rather the opposite. Such and other existing cures against managerial myopia fail when they are based on a superficial understanding of the drivers of managerial behaviour and decision making.

In this study we therefore address fundamental drivers of managerial behaviour and decision making. In particular, we investigate how imposing accountability on managers may affect their myopic tendencies. We explore fundamental cognitive drivers of myopic managerial behaviours arguing that myopia stems from a lack of so-called cognitive control. This is the ability to inhibit impulsivity and resist emotional influences. We conducted a functional magnetic resonance imaging (fMRI) study using 30 experienced financial managers. These managers performed a number of cognitive tasks, under two forms of accountability, while their brain activity was monitored. We found effects of accountability on performance across tasks engaging wilful cognitive control. Accountability enhanced the ability to resist emotional distractors and automatic responses, enabling better control of impulsivity and emotional interference, which are important precursors of managerial myopia. Accountability, however, did not affect basic perceptual and attentional abilities. Interestingly, we find that different accountability types trigger different cognitive and emotional mechanisms, suggesting that curing myopia may indeed require a deeper intervention than imposing a set of new measures like has been done in, for example, the BSC and VBM logics.

CONTENTS



INTRODUCTION

Managers continuously make decisions that affect their organisation's future cost, revenues or profits. For example, managers decide on investment projects and estimate how the current investment cash-out flows will be paid back by future cash-in flows.

Managers may also engage in a cost-cutting operation, with the aim to enhance the future margins they earn. Or managers may engage in expensive marketing campaigns, estimating that the return on marketing will eventually be positive and that the overall value of their firm is optimised. The core feature of such decisions concerns the trade-off managers somehow need to make between the investments (cash-out flow) now, and the returns (cash-in flow) in the future. Making such trade-offs is difficult, however, as they essentially come down to comparing immediate, relatively certain decision consequences with future, relatively uncertain decision consequences.

Unfortunately, in practice, managers often fail in this comparison and show behaviour that runs against the goals of the organisation.

Examples of such behaviour are:

- Managers who do not engage in an investment project because future returns are considered too risky.
- Managers may cut quality assurance costs of their operations to increase their margins, but may neglect the future negative consequences on product quality and revenue.
- Managers may avoid expensive marketing campaigns to protect their current profits but thereby losing future revenues due to underexposure of their products.

In all such cases managers could be said to suffer from a managerial illness called 'myopia'.

MANAGERIAL MYOPIA

Myopia is a term stemming from optometry, in which it denotes people's lack of ability to see at a distance. In management accounting, myopia denotes managers' tendency to optimise the present, at a cost to the future. Managerial myopia is considered an important problem, and one that defies many proposed solutions. For example, management accounting theory proposes to use Net Present Value (NPV) analysis to compare and balance the immediate and future cash-flows associated with capital budgeting decisions. This model, however, is not immune against managers' overestimation of immediate cash-out flows, underestimation of future cash-in flows or use of high discount factors biased against the investment.

Moreover, some management accounting tools may even aggravate, rather than alleviate, managers' myopic tendencies. Budgets, and other yearly performance contracts, may force managers to cut costs, for example by delaying marketing efforts, which enables them to meet their present targets but comes at a cost to their future performance. Cures against the overemphasis on current budgets, such as following the Balanced Scorecard (BSC) logic or Value Based Management (VBM), wrongly suggest that myopia is a problem of metric choice. Rather myopia should be considered a behavioural problem, which is deeply rooted in the way people behave in the social and economic contexts of their organisations.

MANAGERS' ENGAGEMENT IN MYOPIC BEHAVIOUR

Understanding when, how and why managers may engage in myopic behaviour is important if our aim is to find a cure against this undesirable type of managerial behaviour. Given the complex nature and various manifestations of myopia such cures are not easily found, as demonstrated by the relatively limited success of tools, such as BSC and VBM, which are currently offered in the management literature. Understanding how myopia can be countered instead requires a better knowledge about how managers can be made accountable for their decision outcomes, such that their decision quality is enhanced.

This focus on accountability in the context of myopia is timely. Both private and public firms and organisations increasingly use formal accountability systems to align the behaviour of individuals with the overall goal of the organisation.

Accountability systems are typically embedded in the hierarchical structures in which subordinates report to superiors about their decisions and decision outcomes. These systems rely heavily on traditional management accounting processes, such as budgeting and performance evaluation.

However, because of an increasing importance to respond to stakeholder pressures in today's firms and organisations, the call for increased accountability is clearly noticeable. Notably, traditional management accounting is often accused of looking backward, rather than forward, so alternative and extended ways of accountability need to be explored. The relative lack of success of the BSC and VBM approaches should make us wonder, however, about the fundamental effects of any accountability structure on human behaviour and decision making.

WHY DOES ACCOUNTABILITY WORK? WHEN AND HOW?

A scan of the literature suggests that accountability systems are based on rather simplistic assumptions of human nature. Slogans like 'What is measured gets done' and 'What you pay is what you get' seem to reflect the basic drivers of much of the innovation in practice. Instead, however, we believe that a careful scrutiny of such fundamental drivers brings us closer to answering when accountability will work or why in practice accountability systems often fail.

Our study explores these fundamental drivers of human behaviour, such as the inclination of humans to act impulsively (emphasising the immediate, neglecting the ultimate), the role of emotional attitudes towards decision outcomes and riskiness (emphasising what appears right, neglecting what may be right after scrutiny), and the existence of cognitive limitations (emphasising information that is easy, neglecting information that is difficult). These basic tendencies all hinder a full and objective evaluation of future outcomes. While in traditional business theory and practice these factors are all seen as examples of 'irrational decision making', they are not uniform and their resolution requires an examination of the 'black box' of human behaviour.

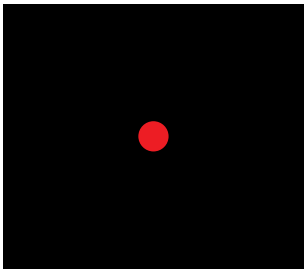
One fundamental way of opening the 'black box of human decision making' is by exploring the neural basis of human myopic inclinations. This requires that we decompose myopic behaviour into more basic components for better understanding. More specifically, we focus on three human characteristics that may explain myopia, which are the ability to exert cognitive control, cognitive effort and emotional stability.

OUR STUDY

We performed an experimental study in which 30 financial managers performed three types of experimental tasks to test their ability to maintain focused attention, effectively process information and inhibit responses to conflicting irrelevant and emotionally salient stimuli. All of these so-called cognitive control abilities play important roles in enabling a manager to resist impulsive, emotionally-motivated or biased responses that can result in irrational, myopic decision making.

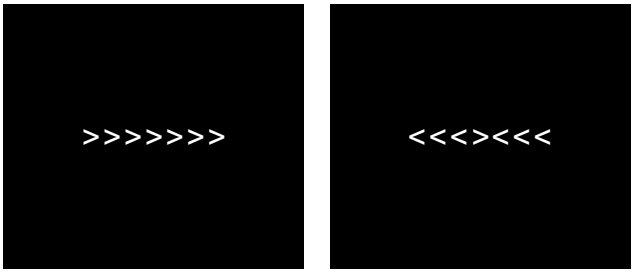
TASK 1: VIGILANCE

Participants were asked to observe a circle on the screen and press the button every time they notice a slight change in its brightness. This enables us to measure individuals' ability to maintain attention over prolonged periods of time and successfully detect faint, infrequent perceptual events. In a managerial context vigilance enables individuals to stay in focus, identify and take into account non-obvious but relevant information.



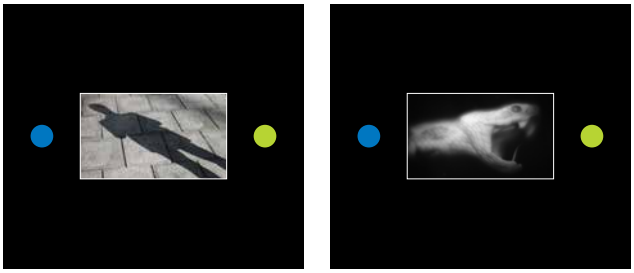
TASK 2: ERIKSEN FLANKER

Participants were asked to provide speeded responses about the direction of the centrally located arrow ('<') flanked by additional arrows pointing either in the same ('>>>>>>>') or opposite ('<<<><<<') direction. The task measures individuals' ability to focus attention, identify possible conflict with contextual information and inhibit automatic irrelevant responses. In a managerial context the listed abilities enable managers to keep their focus on and evaluate the most pertinent information while suppressing impulsive automatic responses to prevailing, however irrelevant and potentially misleading "noise".



TASK 3: EMOTIONAL CAPTURE

Participants were shown two circles – one blue and one green – one on each side of the screen, and asked to provide speeded responses about the location of the blue circle while ignoring distracting neutral images (e.g. a picture of a shadow, chair, etc.) or emotionally salient negative images (e.g. a picture of a snake, tumour, etc.) presented in the centre of the screen. The task allows us to estimate the extent to which individuals can suppress the negative emotional response and keep their performance on task. An ability that allows a manager to efficiently process the relevant information even when faced with salient emotional distractors, such as fear about uncertainties in the future, which may cause myopic inclinations.



TASK PERFORMANCE CONDITIONS

These three tasks were performed under two forms of accountability, social pressure and monetary incentive, which are both valid representations of actual accountability conditions in organisations, but which are likely to have rather different neural effects. Combined with the three tasks, these conditions enable us to estimate to what extent the two accountability pressures modulated both the specific cognitive abilities measured by each of the tasks, as well as the general level of cognitive effort devoted to task performance.

Under social pressure, participants were told that their results would be compared to others. Specifically, participants were told that the results and their ranking within the participant group will be made publicly available.

In the monetary incentive condition participants were told that the speed and accuracy of their responses would determine the amount of money they earned (which would be donated to a charity organisation). Each time they responded correctly and as fast as (or faster than) the fastest one-third of trials from the baseline condition, they earned €0,50.

In addition, participants answered questionnaires on their time preference for money and their general risk-taking inclination. Time preference for money is closely associated with myopic decision making as it indicates unwillingness to delay outcomes for a higher overall return. It was estimated by asking participants about the discount rate they would apply when equating delayed and immediate return (temporal discounting).

Inclination to risk taking was estimated by asking participants what multiplier they would consider as appropriate when choosing risky vs. certain outcomes (probability discounting). As long-term future outcomes are considered risky, unwillingness to accept risk would accentuate myopia. By collecting individual estimates of time and risk preferences, both closely related to myopic behaviour, we were able to relate personal predisposition towards myopic decision making to the obtained experimental results.

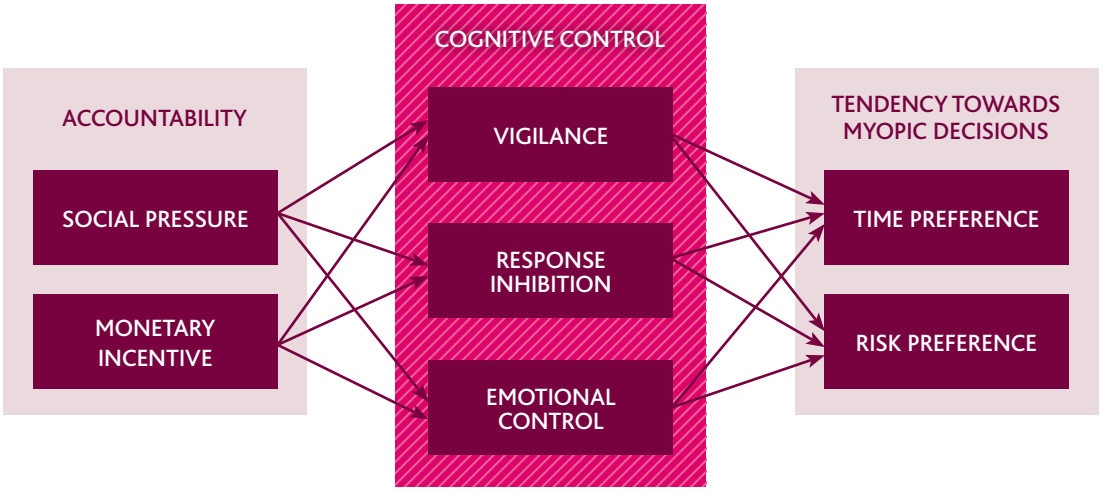
Jointly this study design enabled us to address the following questions:

- To what extent do different forms of accountability modulate cognitive abilities relevant for myopia in decision making?
- What are the mechanisms underlying the effect of accountability?
- To what extent are effects of accountability moderated by myopia related to personality differences?

The relationship between the properties studied are illustrated in Figure 1.

FIGURE 1

Coarse outline of the underlying theoretical model. Different forms of accountability are assumed to modulate the amount of invested cognitive control, which are in turn assumed to modulate cognitive processes underlying myopic decision making, in this case exemplified by increased tendency for immediate vs. delayed outcomes and propensity to avoid risk. Please note that only some of the relationships were studied directly.



A COGNITIVE NEUROSCIENCE APPROACH

When estimating cognitive abilities and the effects of experimental manipulation (in this case accountability) on them, behavioural results provide only coarse information.

While they can inform us of a presence and magnitude of a behavioural effect, the mechanisms that generated the effect are not known, withholding significant information that would allow full understanding and further optimisation of any management accounting or other intervention. This is an important flaw of traditional management accounting views that assume that managers are able to consciously improve their behaviours.

To overcome some of the limits of behavioural testing we recorded and analysed brain activity during task performance using functional magnetic resonance imaging (fMRI). fMRI has become one of the most widely used techniques in cognitive neuroscience research due to its non-invasive nature, availability and high spatial resolution. Making use of the dynamic response in blood flow and resulting level of blood oxygenation to increased or decreased brain activity, fMRI technique allows identification of brain regions involved in cognitive processing and the extent of their activation. With a proper experimental design, fMRI can provide important insights into human cognition and decision making. Importantly, it can not only enable better understanding of the mechanism underlying observed behavioural change, it can also identify situations in which there were significant changes in cognitive processing not obvious in behavioural results, or situations in which different manipulations can lead to same or similar behavioural change through different cognitive mechanisms.

fMRI RESEARCH METHODOLOGY

A total of 30 accounting and finance managers (50% women) in business firms in Slovenia participated in the study. Participants' age ranged from 24 to 52 years (37 years on average), and their work experience ranged from 1 to 26 years (12.8 years on average). Participants had an average of 17 years of education, and most of them held a master's degree in business, economics, accounting or finance. The subjects participated in approximately two-hour-long fMRI recordings at the Centre of Clinical Physiology, Medical Faculty, the University of Ljubljana, Slovenia (Figure 2), in which they completed Vigilance, Eriksen Flanker and Emotional Capture tasks in baseline and two accountability conditions, described previously.

FIGURE 2. fMRI FACILITY

Further study details are provided in Appendix A.

MAIN FINDINGS AND THEIR IMPLICATIONS FOR PRACTICAL APPLICATION

fMRI RESEARCH METHODOLOGY

The aim of behavioural analysis was to ascertain if and how accountability affects managers' performance in the three tasks. Specifically, we were interested in:

- Any change in speed or accuracy of responses
- Whether this change was due to genuinely improved performance or a change in speed-accuracy trade off, and
- Whether there is any correlation between change in task performance and some questionnaire-based measures of myopia.

For the *Vigilance Task* we found no observable effect of accountability pressure on accuracy and only a slight but insignificant trend towards faster responses under the accountability conditions. Change in accuracy and reaction times were not correlated, providing no evidence of speed-accuracy trade off.

Analysis of the *Eriksen Flanker Task* revealed a significant effect of accountability pressure on the speed of responses without decreasing accuracy. By correlating performance in the Flanker task to time and probability discounting we found that monetary incentives were most effective for those participants that are more myopic in terms of time preference. They improved their reaction times under monetary incentive to a significantly larger extent than less myopic participants. Social pressure, on the other hand, was more effective for those who are less risk inclined. The less myopic individuals in terms of risk preference increased accuracy of their responses under social pressure significantly more than more myopic individuals.

In the *Emotional Capture Task* accountability pressure resulted in significant reduction of reaction times, but also in small but statistically significant reduction in accuracy. However, the speed-accuracy trade-off did not occur. Investigation of correlations between behavioural performance and time and probability discounting revealed that probability discounting is positively associated with improvement in reaction times: more myopic participants improved their reaction times more than less myopic ones under both accountability pressures. Results suggest that more myopic individuals have weaker emotional control which gets reinforced with the implementation of accountability pressure. Therefore they are able to improve their performance under accountability pressure more than less myopic individuals.

Overall, we find that accountability affects performance. Accountability pressure improved the ability to effectively process information and inhibit responses to conflicting irrelevant and emotionally salient stimuli, but did not have any behavioural effect on the ability to maintain focused attention in the *Vigilance Task*. Even though different types of accountability pressure did not result in different behaviour on the sample as a whole, a more detailed correlation analysis shows that monetary incentive had greater effect on performance of those that are more myopic, while social pressure was more affective for those less myopic. These results suggest that different accountability regimes differently affect individuals' cognitive processing deemed significant in controlling myopia.

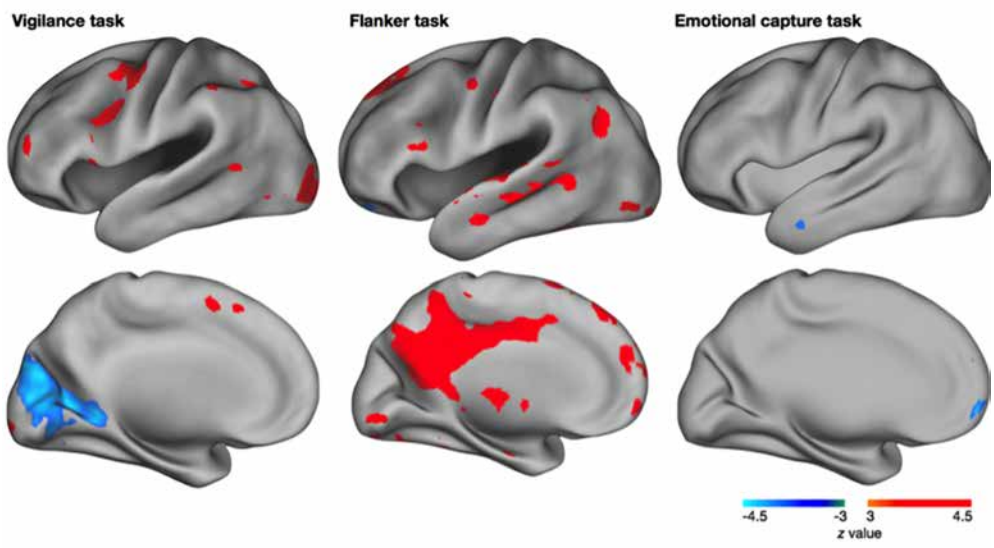
THE EFFECT OF ACCOUNTABILITY ON TASK-RELATED SUSTAINED BRAIN ACTIVITY

Analysis of brain images focused on two aspects of task performance. Analysis of *sustained brain activity* enables revealing changes in brain activity that are maintained throughout task performance, such as elevated attention or suppression of internal thoughts that could disrupt effective processing of task stimuli. Analysis of *transient brain responses* enables identification of differences in the type and intensity of activity devoted to processing a stimulus and generating the appropriate behavioural response.

The analysis of sustained brain activity revealed a significant effect of accountability on brain activity in all tasks (Figure 3). Specifically, in the *Vigilance Task* we observed an increase of activity under accountability pressure in comparison to baseline in brain regions related to attentional maintenance. In the *Eriksen Flanker Task*, an increase in activity under accountability pressure was observed in regions of attentional and cognitive control systems, as well as subcortical structures related to gating of sensory information. Both findings reflect an increase in cognitive engagement during task performance under accountability pressure, most specifically related to attentional processing and cognitive control. No such increases were, however, observed in the *Emotional Capture Task*. In contrast, the results revealed deactivation in brain regions associated with emotional processing. Lack of increased activity in cognitive control and attentional regions might indicate that the task was cognitively highly engaging already in the baseline condition, whereas observed deactivation in regions related to emotional processing could reflect stronger inhibition of potentially distracting processing of the emotional content of the presented stimuli, leading to better behavioural performance.

FIGURE 3. BRAIN ANALYSIS ON THREE TASKS

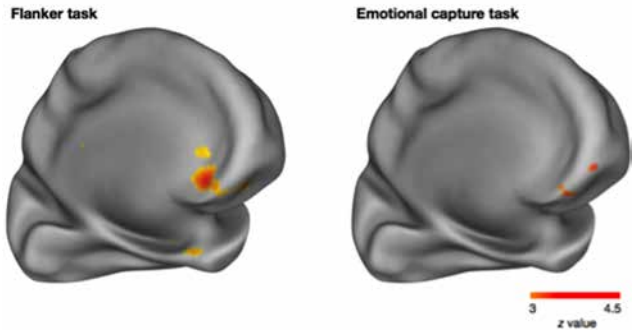
Further comparison of sustained activity during the two types of accountability pressure (monetary incentive versus social pressure) revealed no significant differences.



THE EFFECT OF ACCOUNTABILITY ON STIMULUS PROCESSING

In a further analysis, we focused on the transient brain responses related to processing of stimuli. Specifically, in each task, we tested for the differences in trial related brain responses between monetary incentive and social pressure. These *transient brain activity* analyses revealed significant differences in evoked brain activity in both the *Eriksen Flanker Task* and *Emotional Capture Task*, but not in the *Vigilance Task*. Regions showing differential activation primarily related to emotional processing and decision making (Figure 4). These results suggest that different accountability initiatives engage and activate different cognitive processes. Further in-depth analysis of the presented data as well as future research should provide information on specific differences in cognitive processes elicited under different accountability pressure and relate them to the observed behavioural responses.

FIGURE 4. STIMULUS PROCESSING



CONCLUSIONS

New evidence provided by behavioural, neuroscientific and psychological research shows that our knowledge of human decision making is less analytic and rational than our economic models and theories suggest. Decisions are heavily influenced by biases that are driven by emotions and cognitive flaws rather than reason. This is also true of myopia, which is an important managerial phenomenon and a well-known example of dysfunctional managerial decision making. Complementing behavioural findings with insights enabled by functional neuroimaging can significantly contribute to our understanding of how management accounting systems, and in particular the use of accountability structures, impact myopia.

SPECIFIC FINDINGS AND CONCLUSIONS

Besides confirming that accountability does affect performance, behavioural results revealed that the effectiveness of specific accountability type depends on the pre-exising tendencies of an individual. Practically, the results indicate that the impact of accountability schemes can be maximised when their selection and implementation takes into account their specific effectiveness in individuals most "at risk" of myopia.

Neuroimaging results identified two ways in which accountability affects performance. First, irrespective of accountability type, individuals increased the amount of resources devoted to the task. Second, different types of accountability affected different aspects of information processing. The latter enables better understanding of behavioural results, specifically the difference in impact of accountability dependent on individual predispositions. In our study, monetary incentive improved those processes that were most "problematic" in participants exhibiting myopic tendencies. Further analyses should provide us with more information on specific cognitive processes and brain systems involved.

Behavioural results indicated that performance on some tasks—specifically vigilance—are not improved by accountability. This can inform us in deciding which "battles to fight" using accountability measures and what types of performance we can not expect to improve using accountability. Based on behavioural results alone, it seems that performance dependent on basic vigilance is not affected by either social pressure or monetary incentive. Neuroimaging results, however, further show that absence of performance improvement is not due to lack of trying as participants did increase attentional resources paid to the task. This leads to two conclusions:

- First, some types of cognitive performance can not be further improved by accountability due to inherent limits to cognitive processing. Individuals can be performing at ceiling and no additional amount of effort can improve results. As under accountability individuals still try to do better, this should warn us against employing accountability in such cases, as this can lead to wasted mental resources and build-up of frustration when results do not reflect invested effort.
- Second, behavioural performance estimates do not provide a complete picture of the effect of accountability and the effort involved. Additional care needs to be invested into making sure that the performance assessments faithfully reflect invested effort, both to ensure that we are correctly assessing the effectiveness of accountability measures, and that we are fairly rewarding (or punishing) individuals' performance.

In conclusion, the initial analyses of behavioural and neuroimaging data already provide important information relevant for design and implementation of incentive schemes and accountability systems intended to guide managerial behaviour and will advance the theory of (myopic) decision making. Such studies address a pressing need in management accounting and control practice for well-functioning accountability systems. Our results highlight the need to improve our understanding of the mechanism underlying accountability and the necessity for careful design of such systems so that they can effectively counter specific tendencies in specific situations.

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APPENDIX A

ADDITIONAL METHOD DETAILS

Behavioural results (i.e. participants' performance on the tasks) were analysed by testing statistical differences among the baseline and two accountability conditions. Only correct responses were considered in reaction time analysis. Both response accuracy and reaction times were analysed using repeated measures ANOVA in SPSS.

Neuroimaging data were acquired with Philips Achieva 3.0T TX scanner. The initial functional data pre-processing followed the standard procedures. Specifically, functional images were temporally aligned within each brain volume to compensate for slice-dependent time shifts; odd/even slice intensity differences due to interpolated acquisition were eliminated; images were realigned within and across the runs to compensate for rigid body motion; image intensity was normalised to a whole brain mode; T1 and T2 structural volumes were registered to the atlas representative template in the Talairach coordinate system using a 12-parameter affine transform; functional volumes were co-registered to the structural images and transformed to atlas space using a single affine 12-parameter transform, maintaining a 3-mm cubic representation; finally functional images were spatially smoothed with a Gaussian filter before statistical analysis.

Using FIDL software and voxel-wise GLM approach we estimated beta weights for regressors representing critical events for each of the subjects. To compute group level results the resulting beta weights were entered in a second-level analysis with subjects as random factor. The block related activity (the sustained brain activity related to the baseline, social pressure and monetary incentive block) and target related activity (brain responses to targets in baseline, social pressure and monetary incentive conditions) was compared using whole brain repeated measures ANOVA and appropriate control for multiple comparisons.

APPENDIX B

ADDITIONAL INFORMATION ON BEHAVIOURAL RESULTS

For the *Vigilance Task* we found no observable effect of accountability pressure on accuracy and only a slight but insignificant trend towards faster responses under the accountability conditions. Statistical analysis revealed a significant correlation between time discounting and faster reaction times under the monetary incentive compared to social pressure ($r = -0.38$).

Analysis of the *Eriksen Flanker Task* revealed a significant effect of accountability pressure on the speed of responses without decreasing accuracy. A slight negative and insignificant correlation between change in accuracy and reaction time confirmed that the subjects were able to reduce their reaction times by about 100 ms without sacrificing accuracy of their responses. Comparison of monetary incentive and social pressure revealed no differences between the two accountability conditions. Correlating performance to time and probability discounting revealed that stronger time discounting, which indicates a stronger propensity towards myopia, is associated with participants' reaction times under monetary incentive scheme ($r = 0.46$), but does not affect their accuracy. In contrast, probability discounting was found to be associated with social pressure: those that are less myopic (have a smaller probability discounting) increased their accuracy of responses under social pressure ($r = -0.47$).

In the *Emotional Capture Task* accountability pressure resulted in significant reduction of reaction times, but also in small but statistically significant reduction in accuracy. Investigation of the relation between change in accuracy and speed of processing confirmed that though there was a slight drop in accuracy, it was not a result of a speed-accuracy trade-off. As before, the performance of the participants did not differ between the two accountability conditions. Investigation of correlations between behavioural performance and time and probability discounting revealed that probability discounting is positively associated with improvement in reaction times: more myopic participants improved their reaction times more than less myopic ones.

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