PHILIP ESKENAZI

The Accountable Animal

Naturalising the Management Control Problem

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Het verantwoordelijke dier:
Een naturalistisch perspectief op het probleem van management control

Thesis

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Nunca perseguí la gloria
ni dejar en la memoria
de los hombres mi canción

—Antonio Machado,
Campos de Castilla (1912)

Foreword

1

Where to begin?

2

I could start with a little personal reflection, a slice of autobiography. This dissertation is after all an account of four years of life.

Then again, there is nothing personal about it. How could there be? It was inevitable. It belongs to the great causal order, it was written in the comedy of the stars from the beginning, by Him who is called big bang, *not* by me.

3

This, incidentally, is the shift of perspective we try to make in this dissertation.

4

Where to start, then? Well, what would John do?

En archē ēn o logos kai o logos ēn pros ton theon kai theos ēn o logos—in the beginning was the account, and the account was with God, and God was the account.

5

The oldest known use of *logos*, this central meeting point of the Greco-Judaeo-Christian tradition, is ‘account’. Accounting is as old as writing.

The oldest known inventor of writing, the Egyptian god Thoth, is the moon. He is also the inventor of medicine, magic, numbers, and the calendar, and on behalf of Osiris he records the weight of the soul on its passage to the underworld. He is the Accountant of Death.

6

Let me begin, then, by acknowledging my indebtedness to Thoth. Without him, this work would have been impossible.

It would also have been unthinkable without Plato etc. To summarise, let the record show my indebtedness to the entire Aegypto-Greco-Judaeo-Christian tradition. From this tradition was born the *zōon logon echon*, the animal having *logos*.

The accountable animal.

And here I am, giving an account. And so I return to autobiography.

I wish to express my gratitude to all involved in the chain of events that led to this dissertation. In the first place I am supremely grateful to my promoter, Prof.dr. Frank Hartmann. In many different ways Frank has been a necessary condition in the process. In addition to his extensive direct involvement in the research projects, our encounters have exercised so much influence on my own thinking that my gratitude must extend not only to this dissertation, but also to all conceivable future endeavours. I feel this master-apprentice relation really is the most valuable aspect of the PhD trajectory.

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Many others cannot deny responsibility also. My family, obviously. Gijs, in a way this work is your child more than mine. Steve, to the tune of *cu chiviri* I treasure the memory of our evening couch sessions. My co-author Wim, I thank you for our pleasant collaboration on research, but even more so for our shared appreciation of the German language and other funny things. My office mates Tassos and Marcel, always prepared for discussions on life and football. I thank all others involved along the way, in the department, in the ERIM community, in Rotterdam, Amersfoort, Tilburg, London, and elsewhere.

Then there's Dylan, Cohen, Sabina, and Serrat. Above all soars Lionel Messi, who scored 240 goals since I started working on this dissertation.

Thank you.

Philip Eskenazi

Leusden,
24 February 2015

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Chapter 1
General introduction

He who makes a beast of himself
gets rid of the pain of being a man

—Dr Johnson

1.1 Opening move

Our interest in this dissertation lies with organisational relations of accountability. This includes all social relations that are part of the management control structure as typically studied by organisational scientists. We take the control structure in a very broad sense, partly as formal and partly as informal, and including aspects like reporting practices, incentive schemes, and the types of discourse dominant in the organisation. This is an important theme for management accounting research. A management control structure should help solve the agency problem inherent in organisational activities. We investigate problems in the solutions to this problem. We look at two such solutions in particular: first, we examine the effects of requiring agents to justify their approach to various tasks; and second, we study the role of the controller as safeguard of financial reporting integrity.

We use a range of theoretical and methodological resources to address these issues. This includes traditional approaches based on social-psychological theory and behavioural experiments, but also more novel and naturalistic devices. In the first place we attempt to capitalise on developments in neuroscience. We use electroencephalographic (EEG) recording to examine processes in the brain. EEG is temporally accurate, relatively affordable, and comfortable and safe for participants. It takes advantage of the fact that neurons tend to fire synchronously, leading to large-scale oscillations that can be picked up by electrodes applied to the scalp. EEG allows us to measure magnitude of responses as well as hemispheric differentiation of activity. In addition we use eye-tracking technology to observe oculomotor behaviour. Eye trackers use infra-red cameras to determine the position and size of the pupils in relation to a stimulus, allowing the researcher to infer the point in space at which the gaze is directed. Both of these measurement methods enable us to move closer to studying man as a natural phenomenon.

A major issue in applying these new approaches to problems in management accounting is to bridge naturalistic observations to our theoretical constructs of interest.

What could be the relation between neuronal firing frequency oscillations and professional behaviour? Or between eyes moving to a certain position and the mental processing of a word? How does one theorise on causal relations between these levels? This is a great challenge, but at the same time it brings an opportunity. New methodologies like neuroscience and eye-tracking allow us not just to test the same theories in new ways, but to revise our theoretical constructs.

We will proceed to discuss how this plays out in the three empirical chapters of this dissertation.

1.2 Process accountability

Accountability has been studied extensively by social psychologists. They typically use behavioural experiments to investigate the effect of accountability on the quality of judgements and decisions. An overwhelming proportion of this literature stream indicates a positive effect (De Langhe, Van Osselaer, & Wierenga, 2011; Lerner & Tetlock, 1999). This is often explained by improved reasoning (Tetlock, 1983, 1985). Accountability induces a relatively analytic process of judgement and problem solving (Brtek & Motowidlo, 2002; De Dreu, Beersma, Stroebe, & Euwema, 2006; Simonson & Nye, 1992; Tetlock, 1983). Information is processed more thoroughly, leading to improved judgements and decisions.

In the critical accounting literature accountability is considered from an ethical viewpoint. For example, building on Butler (2005), Messner considers problems arising from the opacity of the self: "Sometimes, the reasons why somebody has taken a particular course of action are not entirely clear to this person herself, such as when a manager makes a decision in a rather intuitive way. In such a case, accountability is limited by the opaque nature of a person's experiences and practical engagements. To which extent is it then ethically justified to compel the manager to provide a full account for what she is not fully conscious of?" (2009, p. 919).

These two streams of literature do not contradict each other. Social psychologists tend to believe accountability is good for performance, as it improves judgements and decisions. Critical accounting scholars point out the ethical problems of accountability, regardless of its effect on personal or firm performance. Contrary to critical theorists, we seek to take an amoral, organisational perspective. However, we can take some leads from critical scholars in order to question the received wisdom that accountability improves performance. Agents are far from fully aware of how they function, and how they come to judgements, decisions, and other behaviour. The need to justify may force agents into more

transparent processes, even if this does not lead to optimal outcomes. We look at two areas in which this is expected to be an acute problem: affective judgement making and insight problem solving.

In Chapter 2 we use recent findings on the role of affect and emotion in judgement making to identify circumstances under which we expect process accountability to lead to impoverished judgement quality. In making judgements and decisions, an important source of information is one's own affective evaluation. This is related to popular notions of sources of decisions like gut feeling, intuition, and premonition. In formal terms, judgements based on affect are manifestations of the affect heuristic (e.g. Slovic, Finucane, Peters, & MacGregor, 2002). Whether the affect heuristic is a suitable way to approach a judgement task depends on many factors. Task characteristics are particularly important in determining the validity of affect as a judgement cue (McMackin & Slovic, 2000). For example, on complex problems with a lot of information, affect-based rather than detail-based information encoding leads to better decisions (Mikels, Maglio, Reed, & Kaplowitz, 2011). Importantly, affect is elusive to consciousness and verbalisation, which implies it would be difficult for accountable agents to explain and justify the use of the affect heuristic in judgements and decisions. Our investigation in Chapter 2 is based on this line of thinking. If judgements under accountability are made with reduced use of the affect heuristic regardless of how appropriate affect is for the task at hand, then for certain tasks accountability will lower judgement quality. We develop a theory to identify the circumstances under which this occurs, and test it through three behavioural experiments. Our results show that when affect is a valid judgement cue, process accountability decreases judgement quality; this effect reverses when affect is not a valid cue.

Chapter 3 builds on the same logic, but in a different domain: we turn from judgement making to problem solving. Our focus is on insight, which is a kind of solution analogous to affective judgement to some degree. Just like the opacity of affect to the subject makes it difficult to account for affective judgements, insight solutions seem to appear in consciousness suddenly and without awareness of the process by which the problem was solved (Bowden, Jung-Beeman, Fleck, & Kounios, 2005). For problems that can be solved either by insight or by analytic strategies, we expect accountable agents to tend to analytic strategies. As in the case of judgement making, the effect on performance then depends on the characteristics of the problem at hand. We test this expectation in three studies again. This time, we complement a traditional behavioural experiment with an EEG study and an eye-tracking study. This allows us to go beyond behavioural effects and get a unique view of the cognitive processing shift associated with accountability. Based on the neuropsychological literature we develop a theory on hemispheric differences in verbal

processing, leading to specific predictions of EEG and oculomotor effects of accountability. Our findings indicate that process accountability indeed lowers solving rates on a set of problems suitable for insight solutions. The EEG and eye-tracking evidence supports our explanation of a processing shift away from insight solving and towards analytic strategies.

1.3 Controller roles

In Chapter 4 we look at controllers as the safeguards of financial reporting integrity[1]. In a setting where a corporation consists of multiple business units (BU) with some degree of independence, BU managers often have an incentive for misreporting (San Miguel & Govindarajan, 1984). For example, the remuneration or chances on promotion of BU managers may be based on reported results. The role of the controller is a solution to this agency problem. BU controllers act on behalf of the corporate board to ensure the soundness of reports from the BU to the board. In addition, controllers often have a role to support BU management in decision making (Hopper, 1980). As the financial experts of the local management team their potential contribution is very relevant. In organisational practice this support role has received increased emphasis, to the point that in many corporations it is considered the main part of the job (Maas & Matějka, 2009).

There is a risk that controllers' involvement with local management influences their role as defenders of reporting integrity (Sathe, 1982, 1983). Existing evidence indicates an increased emphasis on local responsibilities comes with greater organisational slack (Indjejikian & Matějka, 2006; Maas & Matějka, 2009), and pressure from BU managers causes controllers to act against explicit corporate policies (Davis, DeZoort, & Kopp, 2006; Hartmann & Maas, 2010; Lord & DeZoort, 2001). Therefore it is important to know what determines a controller's propensity to compromise on integrity under social pressure from BU management.

We use recent developments in neuroscience to get a view on this. In particular, we apply findings and theory on mirror neurons to the organisational problem of controller roles. Mirror neurons were first found in macaque monkeys (Di Pellegrino, Fadiga, Fogassi, Gallese, & Rizzolatti, 1992): certain cells in the rostral ventral premotor cortex fired both when monkeys made and observed a grasping movement. This provides direct support for the perception-action hypothesis (e.g. Allport, 1987; Prinz, 1987), which posits

[1] This chapter is based on: Eskenazi, P. I., Rietdijk, W. J. R., & Hartmann, F. G. H. Why controllers compromise on their fiduciary duties: EEG evidence on the role of the human mirror neuron system. This paper is under review at *Accounting, Organizations and Society.*

that "perception and action share a common code of representation in the brain" (Preston & De Waal, 2002, p. 9). The discovery of mirror neurons in macaques spurred research into a homologue in the human brain (e.g. Decety et al., 1997; Iacoboni, 1999; Rizzolatti, Fadiga, Gallese, & Fogassi, 1996), yielding promising results. The human mirror neuron system (hMNS) provides a plausible neurological mechanism of imitation (Iacoboni, 2009). Imitation is a pervasive aspect of human social behaviour (see Lieberman, 2007). It is often non-conscious and is important in establishing personal relationships (Chartrand & Bargh, 1999). Central areas of the hMNS (i.e. the IFG and the anterior inferior parietal lobule) have been shown to be active during imitation (Iacoboni, 1999; Koski et al., 2002). The imitation or simulation of facial expressions is similarly facilitated by the hMNS (e.g. Van der Gaag, Minderaa, & Keysers, 2007). In this way the perception of facial expressions activates their motoric representations, and purportedly their experience (Carr, Iacoboni, Dubeau, Mazziotta, & Lenzi, 2003).

Importantly, people differ in their sensitivity to the emotions of others (Davis, 1983), and this manifests in differences in hMNS activity while observing emotional facial expressions (Carr et al., 2003). In Chapter 4 we develop a theory that explains variation in controllers' willingness to compromise on fiduciary duties by variation in hMNS activity. On this picture, the sensitivity of controllers to social pressure from BU managers is a function of their personal neurological make-up. We examine this theory empirically using a survey on professional dilemmas and an EEG recording of professional controllers. We find a moderately strong correlation between these measures. This relation is moderated by the type of dilemma: it is stronger when BU managers are primarily driven by self-interest than when they have non-selfish motives to misreport.

1.4 Concluding remarks

Management accounting is an applied field, affording us the freedom to draw on a mixture of conceptual resources. This has often taken the form of economic and psychological constructs and theories. A traditional economic or folk-psychological conception of agency inherits a view of the human agent as deliberative, intentional, driven by reasons, and transparent to him-/herself. We attempt to move towards studying the human agent as a natural phenomenon. This is made possible by progress in fields like neuroscience and eye-tracking, which by virtue of new measurement methods allow for a more naturalistic perspective on the human agent. While the transition is difficult without doubt, we believe that naturalised accounting research holds a great promise of relevant and powerful new insights for organisations.

Chapter 2
Process accountability disrupts affective judgement

Dass der Mensch in seiner Vorstellung das Ich haben kann,
erhebt ihn unendlich über alle andere auf Erde lebende Wesen.

—Immanuel Kant, *Anthropologie in pragmatischer Hinsicht* (1785)

Abstract

Process accountability (PA) has been shown to improve judgement and decision making on a wide variety of tasks. This improvement results from increased analytic processing and reasoning. However, recent work on the role of affect in judgement making prompts us to consider a negative effect. For certain tasks the increased reliance on analytic processes—and the accompanying inhibition of affective judgement making—induced by PA has a negative impact on the accuracy of judgements. Along these lines we develop a theory on the affect disruption effect of PA. We also include an examination of the role of monetary incentives. These are generally held constant in research on PA, and many studies leave them absent altogether. We discuss grounds to expect an interaction effect between PA and monetary incentives. Our expectations are submitted to experimental testing in three complementary behavioural studies. In Study 1 we establish the dysfunctional effect of PA relative to absence of accountability, and its interaction with monetary incentives to determine judgement accuracy. Study 2 provides a replication of these findings and extends them by including a condition of outcome accountability (OA), which does not cause affect disruption. In Study 3 we adapt our task to show the negative PA effect is reversed when the validity of affect as a judgement cue is removed. Implications for theory and practice are discussed.

2.1 Introduction

An important objective of accounting research is to enable organisations to make high-quality judgements and decisions. This objective can be approached by examining structures of organisational control and their effects on the behaviours and subjective experiences of people. A relevant variable of organisational control structures is accountability. Practical wisdom suggests people will think harder and make better judgements and decisions if they are subsequently expected to justify themselves. Academic research largely corroborates this notion: accountability is often seen as a useful way to externally improve the cognition of judgement and decision makers (Arkes, 1991; Tetlock, 1985; Tetlock & Kim, 1987).

Two main types of accountability are distinguished in the literature: under process accountability (PA) subjects are called upon to explain and justify how they solved a task, while under outcome accountability (OA) subjects are monitored and evaluated on the basis of the consequences of their decisions (Beach & Mitchell, 1978; Siegel-Jacobs & Yates, 1996). Positive effects on judgement and decision making (J&DM) have been found especially for PA (Brtek & Motowidlo, 2002; Doney & Armstrong, 1996; Siegel-Jacobs & Yates, 1996; Simonson & Staw, 1992). This improvement is thought to come from an increase in effortful information processing and a more analytic or systematic processing style (Brtek & Motowidlo, 2002; De Dreu, Beersma, Stroebe, & Euwema, 2006; Simonson & Nye, 1992; Tetlock, 1983). Importantly, the benefits of PA do not apply equally in all task environments (De Langhe, Van Osselaer, & Wierenga, 2011; Lerner & Tetlock, 1999). Given the prevalence of accountability in organisational practice, a better understanding of its impact on judgement accuracy under different conditions is important. Shifts toward analytic processing are associated with improved performance on many J&DM tasks (see Gilovich, Griffin, & Kahneman, 2002), but may also have the opposite effect (e.g. Mikels, Maglio, Reed, & Kaplowitz, 2011). An especially relevant finding is that increased analytic processing may lower judgement accuracy when affect is a valid cue (Halberstadt & Green, 2008; McMackin & Slovic, 2000; Wilson & Schooler, 1991). Since PA imposes a demand for a task approach that can be conceptualized and narrated, we expect accountable subjects to similarly reduce reliance on affect. We refer to this purported effect of PA as ‘affect disruption’ (Halberstadt & Wilson, 2008). It has been shown that PA attenuates the influence of irrelevant affect on judgement (Bodenhausen, Kramer, & Suesser, 1994; Lerner, Goldberg, & Tetlock, 1998); to our knowledge the present report is the first systematic examination of PA effects in task environments where affect is a *relevant* cue.

However, a bias against affective cues is unlikely to cover the full effect of PA. The expectation of the encounter with an audience provides a social incentive that is likely to broadly increase motivation for accurate judgements. This means PA has an effect related to that of monetary incentives (see Bonner & Sprinkle, 2002). Experimental researchers of accountability generally keep monetary incentives constant (for an exception see Vieider, 2011); in fact many studies use a control group without any extrinsic incentive for accurate judgements, which implies motivation is substantially higher for accountable participants. Conversely, in many of the relevant practical organisational settings monetary incentives are present, suggesting a higher base level of motivation than that of experimental control groups. A crucial question is, then, whether in such settings monetary incentives interact with accountability. If so, one should take care in generalizing the findings of accountability experiments which do not provide any incentive to the control condition. We address this issue by including monetary incentives as a factor in our research design.

To get a deeper view of the affect disruption effect of PA, we contrast it both to absence of accountability and to OA (Beach & Mitchell, 1978). OA is generally seen as less beneficial than PA (Brtek & Motowidlo, 2002; Doney & Armstrong, 1996; De Langhe et al., 2011; Siegel-Jacobs & Yates, 1996; Simonson & Staw, 1992). However, in our setting there are grounds to expect a reversal of this pattern. The social encounter with an audience is common to OA and PA, and therefore both should have a similar motivational effect. Conversely, the affect disruption effect should be limited to PA, since under OA there is no need for a justifiable process. As a consequence OA may lead to better J&DM, relative to PA, for certain tasks. To the best of our knowledge no study to date has empirically shown this (cf. De Langhe et al., 2011).

We examine the affect disruption effect of PA in three behavioural experiments. Study 1 shows PA interacts with monetary incentives to decrease (increase) performance on an 'affective' judgement task in the presence (absence) of monetary incentives. Study 2 indicates that this effect is limited to PA and does not hold for OA. Study 3 shows the effect is reversed when affect is not a valid cue, such that PA increases performance both in the presence and absence of monetary incentives. Jointly, these results imply that PA disrupts affect and that this is a potentially dysfunctional effect; holding judgement makers process-accountable may lead to lower judgement accuracy if monetary incentives are present.

This chapter makes two important contributions to the academic literature. First, our research shows that under readily identifiable conditions, PA has a negative effect on judgement accuracy. We should expect PA to diminish performance when affect is a relatively valid cue. To our knowledge this is the first investigation documenting a

negative effect of PA relative to OA. Furthermore, the notion of affect disruption resulting from organisational variables contributes to the growing literature on affect in judgement making (Halberstadt & Wilson, 2008). Second, we explicitly address the role of monetary incentives and their potential for interaction with PA. Our results show that the presence or absence of monetary incentives is crucial in detecting the dysfunctional effect of PA. Much of the published work on PA excludes monetary incentives, which suggests limited generalizability to situations where monetary incentives are present. Our investigation sheds important light on this interaction effect through theory development and subsequent empirical examination.

2.2 Theoretical background

PA disrupts affective judgement

The importance of affect in judgement and decision making has been increasingly recognized over the last decades (e.g. Epstein, 1994; Hsee & Rottenstreich, 2004; Loewenstein, Weber, Hsee, & Welch, 2001; Pham, 1998; Zajonc, 1980). In the context of J&DM affect is seen as a valenced property, assigned to a stimulus or object, which is experienced as a 'feeling state'; the use of this feeling state as a judgement or decision cue is labelled the affect heuristic (Finucane, Alhakami, Slovic, & Johnson, 2000; Slovic, Finucane, Peters, & MacGregor, 2002)[2]. Sometimes the use of affect in J&DM is normatively preferable. For example, Damasio and colleagues (Bechara, Damasio, Tranel, & Damasio, 1997; see also Damasio, 1994) report inferior results on a gambling task in patients with prefrontal brain damage, compared to a healthy control group; this is explained by the patients' impaired ability to learn from previous emotional experiences. In a replication study using a healthy population, greater individual preferences for affective information processing were associated with higher decision quality in the same task (Peters & Slovic, 2000). Furthermore, task complexity moderates the impact of affect on judgement accuracy: for example, affective rather than detail-focused strategies of information encoding have been shown to lead to superior decision quality on complex problems (Mikels et al., 2011).

The interference of reason-based judgement and decision making with affective processes has been dubbed 'affect disruption' (Halberstadt & Hooton, 2008; Halberstadt & Wilson, 2008). This notion originates in the research of Wilson and colleagues (see review

[2] In dual process theories of J&DM (see Evans, 2008) affect plays a central role in the 'System I' account of many (e.g. Epstein, 1994)—although not all (e.g. Sloman, 1996)—models. This suggests affective J&DM has conceptual links with intuitive, holistic, parallel, effortless, rapid J&DM.

by Wilson, Lindsey, & Schooler, 2000), who established that reasoning about attitudes has an impact on those attitudes, sometimes in undesirable ways. For example, experimentally induced analytic reasoning rendered judgements less consistent with stable attitudes (Wilson & Dunn, 1986); reduced post-choice satisfaction (Wilson et al., 1993); and reduced judgement reliability as compared to expert judgement (Wilson & Schooler, 1991). McMackin and Slovic (2000) provide further experimental evidence that an increase in analytic processing can decrease judgement quality. They asked participants to estimate the average rating (on a scale from 'dislike' to 'like') a set of print advertisements had received from a sample of peers, who had been shown the same set earlier. This task is suitable to approach using the affect heuristic: one's own affective evaluation of a print advertisement is a fairly valid cue for their average rating, while an alternative approach based on analysis is unlikely to provide superior cues. Indeed, participants who were instructed to think about specific reasons before making their judgement were outperformed by the control group, in line with the affect disruption hypothesis.

The studies discussed here typically manipulate reasoning directly by asking participants to consider and list reasons for and against their choices prior to reporting their decisions and attitudes. The proposed explanation is based on the availability heuristic (see Tversky & Kahneman, 1973). There is often no accessible and complete set of reasons underlying an attitude (Nisbett & Wilson, 1977). While deliberating, a subset is activated that is easy to access and verbalize (Wilson, Hodges, & LaFleur, 1995). This subset may give rise to a different attitude; any bias present in the subset of reasons will then be reflected in the attitude (see Wilson et al., 2000). Importantly, affective cues are not easily verbalized as reasons (Halberstadt & Hooton, 2008). As a result, reasoned attitudes may be particularly biased against affect (Halberstadt & Wilson, 2008).

We expect PA to have a similar affect-disrupting effect in tasks like the advertisement judgement task. In this task, affect is ostensibly a relatively valid cue to base one's judgement on. For brevity we henceforth refer to such tasks as 'affective tasks'. If the processing shift associated with PA decreases reliance on affective cues, we should expect diminished judgement accuracy on affective tasks. Note that PA differs crucially from the 'reasons analysis' manipulation of Wilson and colleagues, because accountable subjects are not explicitly required to consider reasons for liking or disliking the object. Instead, they are expected to use a process that can be verbalized and narrated. However, the result may be a similar bias against affective cues. We investigate this possibility in the present chapter, but first we turn to a discussion of the moderating role of monetary incentives.

Accountability and monetary incentives

The affect disruption hypothesis entails a bias against affective judgement cues for process-accountable participants. However, the overall effect of PA is more complex. Regardless of the type of task, accountability works through the expectation of a social encounter. It is well-established that this expectation leads to a broad increase in attentiveness to the task (Brtek & Motowidlo, 2002; Kruglanski & Freund, 1983; Mero & Motowidlo, 1995), epistemic motivation (De Dreu et al., 2006; De Dreu, Nijstad, & van Knippenberg, 2008; Scholten, Van Knippenberg, Nijstad, & De Dreu, 2007), and cognitive effort (Lerner et al., 1998; Tetlock, 1983, 1985; Tetlock & Kim, 1987). If we simply compare the presence of PA to a condition characterized by the absence of any incentive, the increase in motivation and cognitive effort is likely to result in improved performance across a wide range of tasks (Bonner & Sprinkle, 2002). For the accuracy of judgements like those made in the advertisements task (McMackin & Slovic, 2000), it might even be the case that the positive motivational effect is stronger and overshadows the negative affect disruption effect.

The question is whether this is an externally valid test. The implicit assumption that non-accountable subjects have no incentive to perform may limit generalizability, because motivation can also be increased by other means than accountability. For example, direct monetary incentives can accomplish that goal (Lee, Locke, & Phan, 1997; Riedel, Nebeker, & Cooper, 1988; Wright, 1989; Wright, 1992). Monetary incentives have been linked to effort and performance in various ways (for a review see Bonner & Sprinkle, 2002): e.g., through expectancy theory (e.g. Vroom, 1964); agency theory (e.g. Eisenhardt, 1989); goal-setting theory (e.g. Locke & Latham, 1990); and social-cognitive theory (e.g. Bandura, 1997). Importantly, in many organisational settings at least some incentives are present regardless of PA. If PA and monetary incentives increased performance additively, this would be of limited relevance for researchers, since holding monetary incentives constant experimentally would not influence the observation of the PA effect. However, we expect the incremental motivational effect of PA to be smaller for subjects with a monetary incentive. As a consequence, we predict an interaction between PA and monetary incentives.

This implies the affect disruption effect of PA is more visible in the presence of monetary incentives than in their absence. Moreover, the same logic applies to other possible dysfunctional consequences of PA. Using a control group without any incentive may therefore overestimate the benefits of PA for practice. In the present study we include monetary incentives as an additional variable in order to address this issue directly. If our expectation is borne out, PA and monetary incentives will interact such that the effect of

PA on judgement accuracy for affective tasks is more negative in the presence than in the absence of monetary incentives.

Hypothesis 1: When affect is a relatively valid judgement cue, in the presence of monetary incentives, PA leads to lower judgement accuracy than non-accountability.

Hypothesis 2: When affect is a relatively valid judgement cue, the negative effect of PA on judgement accuracy is smaller in the absence of monetary incentives than in their presence.

We report a direct experimental test of these predictions in Study 1. In addition, in Study 3 we examine whether this effect is contingent on the validity of the affect cue. If it is true PA disrupts affect, the effect on judgement accuracy should turn positive when affect is not a valid cue. We capture this prediction in an additional hypothesis.

Hypothesis 3: When affect is a relatively invalid cue, PA leads to higher judgement accuracy than non-accountability.

Process versus outcome accountability

In the preceding discussion we refer to the effects of PA relative to non-accountability (NA). However, a number of studies instead contrast PA to OA (e.g. Brtek & Motowidlo, 2002; Doney & Armstrong, 1996; De Langhe et al., 2011; Siegel-Jacobs & Yates, 1996; Simonson & Staw, 1992). While process-accountable subjects are called upon to justify their task approach regardless of its results, this is not the only way organisations can impose accountability. Under OA, subjects are not required to justify their *approach* to a task, but instead are monitored and evaluated on the basis of the *consequences* of their judgements and decisions.

Previous findings suggest that, when compared to OA, PA leads to superior judgements and decisions under a variety of circumstances (Siegel-Jacobs & Yates, 1996). For example, Simonson & Staw (1992) showed that PA attenuates the problem of escalation of commitment, while OA exacerbates it. Doney and Armstrong found that for professional buyers, PA has a positive effect on information analysis, while OA does not affect it (1996). In a study reported by Brtek and Motowidlo (2002), PA improves validity of judgements about interviewees; conversely, OA decreases validity. Finally, De Langhe et al. (2011) showed that PA, relative to OA, boosts cue abstraction processing, but not exemplar-based processing; as a result PA leads to higher accuracy on elemental learning

tasks, while leaving it unaffected for configural learning tasks. This effect is driven by improved performance on elemental tasks for those process-accountable participants low in analytic intelligence (De Langhe et al., 2011, Study 2) and rational thinking style (ibid., Study 3). Proposed explanations for these results are that PA but not OA provides guidance for improvement (see Brtek & Motowidlo, 2002) and that outcomes are often harder to justify than processes, increasing stress to dysfunctional levels (see Siegel-Jacobs & Yates, 1996).

For an affective task the relative effects of PA and OA are somewhat different. The expectation of the subject to have an encounter with an audience and the associated motivational effect is shared by PA and OA. The difference between the two types of accountability lies in the nature of the encounter: only PA requires the subject to use a process that can be verbalized and narrated; these are the properties we expect to lead to an increase in analytic processing. Conversely, the OA encounter may make it more desirable to reach good judgement outcomes, but without providing the decision maker with much guidance on how to achieve that (Brtek & Motowidlo, 2002). Therefore, in our setting we expect both OA and PA to have a motivational effect, but only PA to have an affect disruption effect. Study 2 provides a direct test of these predictions.

Hypothesis 4: When affect is a relatively valid judgement cue, PA leads to lower judgement accuracy than OA, regardless of monetary incentives.

2.3 Study 1

In Study 1 we test two predictions that follow from the theoretical discussion above. The first prediction, based on affect disruption theory (Halberstadt & Wilson, 2008), is that PA has a negative impact on judgement accuracy when affect is a valid cue. The advertisements task used by McMackin & Slovic (2000) allows us to test this. The second prediction is that the relation between PA and judgement accuracy is moderated by monetary incentives. When monetary incentives are present, the motivation level of the control group is relatively high and affect disruption is expected to drive the effect of PA on judgement accuracy. Conversely, in the absence of monetary incentives we expect baseline motivation will drop and the motivational effect of PA will attenuate the affect disruption effect.

2.3.1 Method

We conducted an experiment of 2 x 2 (accountability x monetary incentive) between-subjects design in the behavioural lab of Erasmus University Rotterdam. Participants were undergraduate students recruited from the faculty of Business, who signed up voluntarily in exchange for course credits. A total of 98 people (57 females; M_{age} = 19.7; SD_{age} = 2.1) took part in this study.

Upon arrival in the lab, participants were seated in a waiting room. From there they were escorted by the experimenter to individual, soundproof cubicles, where they completed the computerized experimental procedure. Participants were randomly assigned to one of the four conditions, without the awareness of the experimenter. They were asked to look at twenty print advertisements and estimate the average rating each of these advertisements received from a recently surveyed peer group[3], on a scale of 1 ('Dislike') to 9 ('Like'). They were informed that they would score 5, 3, 1, or 0 points per advertisement, depending on the distance between their estimation and the true average rating. The twenty advertisements were presented in random order. Participants made their choice by first clicking the radio button (on the nine-point scale) corresponding to their estimation and then clicking a button labelled 'Continue'.

All participants were instructed to score as many points as possible. Those in the performance-based monetary incentive condition were informed they would be rewarded with an amount in the range of EUR 2 to EUR 8, depending on their final score. Conversely, participants in the incentive base condition were told they would receive a fixed payment of EUR 5. This allowed us to keep constant across conditions the fact that participants would earn at least some money; and moreover that the expected value of the reward was in the same range across conditions. Furthermore, participants under PA were told their approach to the task would be evaluated afterward. They were informed they would have to justify their decision process in writing after the task, and that there was a chance of one in three they would be randomly selected for a face-to-face interview at the end of the computer session to further justify their decision process. Participants in the non-accountable condition were told their responses would be treated anonymously.

At the end of the computer procedure, participants answered a number of posttest questions. These included a check for the accountability manipulation ("During the tasks, I made sure I would be able to justify my decisions") and a question to check for a potential

[3] A total of 51 people (25 females; M_{age} = 20.4; SD_{age} = 2.1) participated in a pretest to establish the average rating per advertisement. Advertisements were presented in random order. Average ratings for the different advertisements ranged from 3.7 to 7.1.

confounding effect on anonymity of the two manipulations ("I felt that my answers would be treated anonymously"), both on a scale from 1 (= *do not agree at all*) to 5 (= *agree very much*). Participants were then picked up from the cubicles and were paid their reward. If applicable they had a short face-to-face interview about their task approach with the experimenter. Finally, all participants were debriefed and left the lab.

2.3.2 Results and discussion

Conducting a two-way (accountability and monetary incentives) ANOVA on the accountability manipulation check revealed only a main effect of accountability: $F(1, 94) = 4.689$; $p = .033$. No further statistically significant effects were present. We conclude our manipulations were successful.

The dependent variable, judgement accuracy, was computed as the average absolute difference between the participant's estimated popularity of an ad and the actual average rating it received in the pretest. As a result, higher values indicate lower overall judgement accuracy. We conducted an ANOVA on this measure using accountability and monetary incentives as factors. This revealed a significant interaction effect ($F(1, 94) = 5.483$; $p = .021$) and furthermore a significant main effect of incentives ($F(1, 94) = 10.245$; $p = .002$). Specifically, in the monetary incentive condition, participants under PA deviated more from the correct answer ($M = 1.39$; $SD = .26$) than non-accountable participants ($M = 1.20$; $SD = .31$): $F(1, 94) = 4.072$; $p = .046$. This provides support for hypothesis 1. In the absence of a monetary incentive, the task performance of accountable participants ($M = 1.44$; $SD = .26$) did not differ significantly from that of non-accountable participants ($M = 1.57$; $SD = .44$): $F(1, 94) = 1.694$; $p = .196$. The combination of this null-finding and the interaction effect supports hypothesis 2. In sum, both hypotheses under examination in Study 1 are supported by the results.

Furthermore we conducted a mixed between-within subjects ANOVA, treating the advertisement (out of the set of twenty) as a within-subject factor. If the results were driven by specific advertisements rather than the overall task setup, we would expect to find cross-level interactions. The analysis revealed the same between-subject effects as reported above, but no support for cross-level interaction effects[4]. Specifically, the Wilks' Lambda for the interaction between accountability and advertisement was .787 ($F(19, 76) = 1.082$; $p = .386$); for the interaction between monetary incentives and advertisement it

[4] This mixed between-within subjects ANOVA was applied mutatis mutandis to Studies 2 and 3 as well, each time failing to reveal any cross-level effects; therefore, we do not report further on these tests in the Results sections of Studies 2 and 3.

was .753 ($F(19, 76) = 1.311$; $p = .202$); and for the three-way interaction it was .844 ($F(19, 76) = .738$; $p = .768$).

A potential alternative explanation of the observed results is that the manipulations changed participants' beliefs on how peers judge advertisements, rather than the nature of their own judgement process. In order to exclude this alternative explanation we included a question in the posttest survey which asked whether people believed the average ratings to be based more on people's emotions or rational thoughts. A two-way ANOVA using accountability and incentives as factors revealed no significant interaction or main effects, supporting the notion that our manipulation affected processing style.

The results found in Study 1 support our assertion that PA comes with a dysfunctional consequence in the affective task domain. However, this negative effect only manifests itself when judgement makers have a substantial base level of motivation. By manipulating the presence of monetary incentives we were able to vary the base level of motivation. The resulting interaction between PA and monetary incentives suggests that the effectiveness of PA depends on environmental factors, and that implementation of accountability should be considered carefully, as dysfunctional consequences may occur.

2.4 Study 2

In Study 2 we seek to replicate the effects found in Study 1, and moreover to demonstrate that this pattern holds for process accountability, but not outcome accountability. More specifically, we purport PA but not OA induces an analytic processing style and thus affect disruption. Conversely, the motivational effect of accountability, which compensates the affect disruption effect when no sufficiently strong alternative motivator is present, is shared by PA and OA: under both types of accountability the subject expects an encounter with an audience. Therefore, performance is predicted to be higher under OA than under PA, regardless of the monetary incentive condition.

2.4.1 Method

We conducted an experiment of 3 x 2 (accountability x monetary incentive) between-subjects design in the behavioural lab of Erasmus University Rotterdam. Participants were undergraduate students recruited from the faculty of Business, who signed up voluntarily in exchange for a reward of EUR 10. A total of 132 people (75 females; $M_{age} = 21.6$; $SD_{age} = 2.4$) took part in this study.

Again we invited participants to the waiting room of the lab, where they were picked up by the experimenter and brought to an individual cubicle. This time, participants were recruited on the basis of a (fixed) financial reward of EUR 10, and therefore we adapted the monetary incentive manipulation such that participants could earn between EUR 10 and 20 depending on points scored, while those in the control condition received a payment of EUR 15 regardless of performance. Process-accountable participants were told their *approach* to the task would be evaluated in a face-to-face interview afterward; it was made clear the interviewer *would not* have access to their responses or scores; and in addition participants were asked to describe their approach to the task in writing after completing it. Outcome-accountable participants were told their *final score* would be evaluated in a face-to-face interview afterward; in this condition it was made clear the interviewer *would* review responses and scores; furthermore, participants were requested to assess their own performance in writing after completing the task. Finally, non-accountable participants were reassured of their anonymity and informed they would be prompted to describe to what extent they enjoyed the task[5].

Participants then completed the task, which was identical to the one used in Study 1. This experiment was conducted as part of a series; the separate experiments were presented in random order[6]. This time we included a manipulation check for monetary incentives in the posttest survey, designed to measure whether the participant believed a higher score would lead to a higher reward; furthermore, we included a manipulation check to separate PA and OA from the non-accountable condition, as well as a check to separate PA from OA. After completion of the final task, participants were picked up from their cubicle, and if applicable brought to a separate room to complete the brief accountability interview. All participants were then paid their reward and debriefed before leaving the lab.

2.4.2 Results and discussion

A two-way ANOVA on the accountability manipulation check using accountability and incentives as factors revealed only a significant main effect of accountability: $F(2, 126) = 21.560$; $p < .001$. Post-hoc comparisons on the basis of the Tukey HSD test indicated that non-accountable participants ($M = 2.02$; $SD = 1.02$) scored significantly lower than both process-accountable ($M = 3.45$; $SD = 1.37$) and outcome-accountable ($M = 3.55$; $SD =$

[5] This allowed us to keep constant across conditions the fact that participants expected to have to write something after completing the task.
[6] We checked for order effects by incorporating task position as an additional factor and found no evidence of an interaction with either of our independent variables.

1.25) participants, while the latter two groups did not differ significantly. The manipulation check designed to distinguish between PA and OA was analysed in a two-way ANOVA including only the two relevant levels of accountability, as non-accountable participants were not asked to respond to this item. There was a marginally significant difference between the two groups ($F(1, 84) = 2.861$; $p = .094$), such that outcome-accountable participants had a stronger expectation ($M = 3.64$; $SD = 1.18$) than process-accountable participants ($M = 3.18$; $SD = 1.35$) to discuss scores in the post-task interview. The monetary incentive manipulation check was also analysed in a two-way ANOVA, revealing only a significant main effect of incentives: $F(2, 126) = 7.061$; $p = .009$. Participants whose reward in fact depended on performance had a stronger corresponding belief ($M = 4.21$; $SD = 0.98$) than those whose reward was fixed ($M = 3.71$; $SD = 1.15$). We conclude our manipulations were successful.

A two-way ANOVA on judgement accuracy showed a significant main effect of accountability ($F(2, 126) = 5.875$; $p = .004$), a main effect of incentives ($F(2, 126) = 4.841$; $p = .030$), and a marginally significant interaction effect ($F(2, 126) = 2.348$; $p = .100$). Post-hoc analysis using the Tukey HSD test revealed that participants under OA performed significantly better ($M = 1.23$; $SD = 0.33$) than participants under PA ($M = 1.50$; $SD = 0.39$). This supports hypothesis 4.

Furthermore, we looked at the simple effect of accountability at both levels of incentives. When incentives were present, accountability had a significant effect ($F(2, 126) = 3.706$; $p = .027$), such that participants under PA ($M = 1.49$; $SD = 0.37$) performed worse ($p = .015$) than those under OA ($M = 1.20$; $SD = 0.38$), and worse ($p = .027$) than those under NA ($M = 1.23$; $SD = 0.33$). OA and NA did not differ significantly. When incentives were absent, again the effect of accountability was significant ($F(2, 126) = 4.517$; $p = .013$); participants under OA ($M = 1.25$; $SD = 0.28$) performed better ($p = .022$) than process-accountable participants ($M = 1.52$; $SD = 0.41$), and better ($p = .006$) than non-accountable participants ($M = 1.58$; $SD = 0.49$). Here, the conditions of PA and NA did not lead to significantly different judgement accuracy.

In sum, the findings of Study 1 were successfully replicated and extended. The negative effect of accountability on judgement accuracy in affective tasks was found to be limited to PA and did not occur for OA. This is in line with our predictions and supports the notion that affect disruption is responsible for the diminished accuracy of subjects under PA. The need for a justifiable process biases process-accountable subjects against affective cues. Outcome-accountable subjects have no such need, and do not show the accompanying decrease in judgement accuracy.

2.5 Study 3

In the preceding studies we attempt to establish that PA can lower judgement accuracy when affect is a valid cue. In Study 3 we examine its effect when the validity of the affect cue is strongly reduced. We still employ the advertisement task adapted from McMackin and Slovic (2000), but this time we use a different benchmark. Purportedly the average rating each advertisement received in our first pretest, employed as the benchmark in Studies 1 and 2, is largely based on affect. As a result, the affective evaluation of the advertisements by the participants of Studies 1 and 2 is a relatively valid cue, unlikely to be surpassed by analytic approaches. Before running Study 3 we conduct a new pretest to rate the ads, this time instructing participants to base their rating on reasons and not affect. We then ask the participants of Study 3 to estimate these average ratings. The relative validity of the affect cue should be much lower for this task. An analytic task approach as promoted by PA is therefore more suitable here. As a consequence we expect a reversal of the negative effect of PA found in Studies 1 and 2. Since other task and environmental characteristics are kept constant, such a reversed pattern would support the notion that the negative effect of PA on judgement accuracy found in Studies 1 and 2 is due to affect disruption.

2.5.1 Method

We used a 2 x 2 between-subjects experiment with accountability (process or none) and monetary incentives (present or absent) as factors. A total of 96 undergraduate students from the faculty of Business participated voluntarily in exchange for course credits (56 females; M_{age} = 19.7; SD_{age} = 2.1).

The experimental procedure and the manipulations of accountability and monetary incentives were largely analogous to those of Study 1. Most importantly, the task instruction was adapted to reflect the procedure of the new pretest, such that participants were aware of the fact that the sample of peers was instructed to use an analytic approach[7]. All other task and environmental characteristics were kept constant as much as possible.

[7] A total of 35 participants (11 females; M_{age} = 19.1; SD_{age} = 1.4) took part in the pretest. We sought to achieve the reduction in the validity of the affect cue in two ways. First, participants were explicitly instructed to carefully consider reasons for or against their rating of each advertisement. Second, we introduced a minimum amount of time per rating, such that for each advertisement, participants could only finalize their rating and move to the next advertisement after 30 seconds. Average ratings per advertisement ranged from 3.8 to 7.4.

2.5.2 Results and discussion

The accountability manipulation check asked whether participants expected to be interviewed at the end of the session. We used a two-way ANOVA with accountability and monetary incentives as factors and found only a significant main effect for accountability: $F(1, 92) = 22.973$; $p < .001$. Accountable participants had a stronger expectation to be interviewed ($M = 2.79$; $SD = .87$) than non-accountable participants ($M = 1.94$; $SD = .86$). We also conducted a two-way ANOVA on the incentives manipulation check, which asked whether participants believed a higher score led to a higher reward. The only significant effect found was a main effect of monetary incentives ($F(1, 92) = 43.603$; $p < .001$); participants with a monetary incentive had a stronger corresponding belief ($M = 3.75$; $SD = 1.04$) than those without a monetary incentive ($M = 2.23$; $SD = 1.19$). We conclude our manipulations were successful.

Judgement accuracy was measured as the mean absolute deviation from the average rating in this study's pretest. Like before, lower scores imply less deviation and higher accuracy. We submitted this measure to a two-way ANOVA and found only a main effect of accountability ($F(1, 92) = 5.249$; $p = .024$); there was no significant evidence of either an interaction between accountability and monetary incentives ($F(1, 92) = 1.700$; $p = .196$) or a main effect of monetary incentives ($F(1, 92) = .025$; $p > .5$). On average, accountable participants made more accurate judgements ($M = 1.47$; $SD = .35$) than non-accountable participants ($M = 1.62$; $SD = .27$). This result supports hypothesis 3.

An analysis of the simple effects of accountability at both levels of monetary incentives provides further insight. When monetary incentives were present, accountability had a significant impact on judgement accuracy ($F(1, 92) = 6.461$; $p = .013$, such that accountable participants ($M = 1.42$; $SD = .30$) were more accurate than non-accountable participants ($M = 1.65$; $SD = .24$). Conversely, in the absence of monetary incentives, no significant difference was found ($F(1, 92) = .487$; $p = .487$), although mean deviations were slightly lower for PA ($M = 1.52$; $SD = .40$) than for NA ($M = 1.58$; $SD = .31$).

These results provide further support for the notion that affect disruption underlies the effects found in Studies 1 and 2. Study 3 provides us with a test of the effects of PA and monetary incentives in a task that is highly similar, but differs from the previous studies in a crucial aspect. Changing the task such that the benchmark is based on affect to a much smaller extent reduces the validity of one's own affective evaluation of an advertisement as a judgement cue. If the negative PA effect documented in Studies 1 and 2 is due to affect disruption, this single task modification should lead to a clear shift in results. The results of

Study 3 indeed show that process-accountable participants outperformed the control group regardless of monetary incentives.

2.6 General discussion and conclusions

The main goal of this chapter is to examine the impact of process accountability and monetary incentives on judgement accuracy when affect is a valid judgement cue. Our expectations were as follows. Based on the academic literature on accountability (De Langhe et al., 2011; Lerner & Tetlock, 1999) and on the role of affect in judgement and decision making (Halberstadt & Hooton, 2008; Halberstadt & Wilson, 2008; McMackin & Slovic, 2000) we saw grounds to expect a negative effect of PA on judgement accuracy. The demand for a justifiable judgement process was expected to bias those judgements against affective cues. On the other hand, this effect might be partially or fully offset by a positive motivational effect (Tetlock, 1983, 1985). The extent to which PA increases motivation partly depends on the base level of motivation. Monetary incentives can increase the base level (Bonner & Sprinkle, 2002) and therefore decrease the motivational effect of PA. This implies an interaction effect between PA and monetary incentives. Furthermore, we considered the effects of OA on affective tasks. OA involves a similar social incentive as PA, since in both cases the subject is in the expectation of an encounter with an audience. However, the affect disruption effect is limited to PA and does not apply to outcome-accountable participants. Therefore, the latter group should make more accurate judgements than process-accountable participants, regardless of the presence of monetary incentives.

Specifically, we made the following predictions. First, for judgement tasks in which the subject's affective response to a stimulus provides a relatively valid cue, there is an interaction effect of PA and monetary incentives on judgement accuracy: PA decreases accuracy when monetary incentives are present; and the effect of PA on accuracy is less negative when monetary incentives are absent, relative to present. Conversely, if affect is a relatively invalid cue, the reduced reliance on that cue effectuated by PA should increase accuracy. Finally, we expected judgement accuracy in affective tasks to be higher under OA than under PA, regardless of the level of monetary incentives.

These predictions were tested in three between-subjects experimental studies of judgement accuracy. We used an adaptation of the advertising judgement task described in McMackin and Slovic (2000). In Study 1 we manipulated the presence of PA and monetary incentives. The predicted interaction effect was supported by the data: PA decreased accuracy in the presence of monetary incentives, but not in their absence. Our

interpretation of these results is as follows. For participants with a monetary incentive, relative to those without, baseline motivation is higher and the motivational effect of PA is less relevant. Here, the affect disruption effect dominates. For those without a monetary incentive, the motivational effect of PA becomes more impactful and offsets the affect disruption effect. Study 2 provided a replication of this test and a further extension by incorporating OA as the third level of the accountability factor. Comparing the performance of process-accountable participants to that of the non-accountable control group, we found similar results as in Study 1. In addition, outcome-accountable participants were found to be more accurate than those under PA at both levels of monetary incentives. Conversely, participants under OA outperformed the control group only in the absence of incentives, not in their presence. This pattern supports the assertion that affect disruption is specific to PA, as a consequence of the need for a justifiable process, whereas the motivational effect is shared by PA and OA, being a consequence of the expectation on the part of the subject of an encounter with an audience. In Study 3 we adapted the task to diminish the validity of affect as a judgement cue. Like in Study 1, participants were either process-accountable or not accountable and either had or did not have a monetary incentive for judgement accuracy. As expected, PA no longer decreased accuracy; in fact process-accountable participants outperformed the control group regardless of the level of monetary incentives. The effect of PA thus turns from negative to positive by reducing the validity of the affect cue. Jointly, these results imply that PA disrupts affective judgement, which is detrimental to judgement accuracy depending on the validity of the affect cue and on the level of motivation of the reference group.

This chapter makes two main contributions to the scientific literature. In the first place, we demonstrate that process accountability has a negative impact on judgement accuracy for affective tasks. This extends our knowledge on accountability in an important way. Although a number of studies report negative effects of accountability on judgement accuracy (e.g. Tetlock & Boettger, 1989; Tetlock, Lerner, & Boettger, 1996), the present investigation is the first to our knowledge to explicitly demonstrate that *process* accountability may have dysfunctional effects. Many studies report performance-enhancing effects of PA, both relative to absence of accountability (De Dreu et al., 2006) and relative to OA (Siegel-Jacobs & Yates, 1996). De Langhe et al. (2011) recently showed that the positive effects of PA (relative to OA) are conditional on the task, such that PA improves accuracy on elemental but not configural learning tasks. However, to our knowledge no study to date has shown that OA can lead to more accurate judgements than PA. Furthermore, our research extends the literature on affect in J&DM (Halberstadt & Hooton, 2008; Halberstadt & Wilson, 2008; Kahneman, 2003; Slovic et al., 2002) by

showing that affective judgement and decision making can be disrupted by organisational variables like accountability. While previous research has shown accountability can attenuate the influence of irrelevant affect (Bodenhausen et al., 1994; Lerner et al., 1998), our studies point to a dysfunctional effect when affect is relevant to the judgement at hand.

The second main contribution lies in the interaction between PA and monetary incentives. We predicted and found a negative effect of PA on judgement accuracy only when subjects are motivated by a monetary incentive. The direct implication for theory is that the presence of monetary incentives moderates the effect of PA on judgement accuracy. Under the assumption that this can be characterized as a motivational effect, we expect such an interaction to occur on many tasks for which motivation is a determinant of performance. In addition, this finding raises methodological implications for laboratory studies on accountability. While a wide range of experimental studies reports positive effects on judgement and decision making (De Dreu et al., 2006; Lerner & Tetlock, 1999), very few of these studies offer any extrinsic incentive at all to the control group (Vieider, 2011). In order to be able to generalize findings to organisational settings in which judgement and decision makers are extrinsically incentivized, accountability researchers should take into account the possibility that the current state of the literature masks dysfunctional effects of accountability. A broad investigation of this issue beyond the affective task domain is a clear opportunity for further research.

Our research has important implications for organisational practice as well. We raise an important objection against the notion that holding organisational judgement and decision makers process-accountable leads to superior judgements and choices. In doing so, we add support to the recent claim by De Langhe et al. (2011) that PA is not uniformly beneficial to the organisation across tasks, environments, and individuals. Crucially, we demonstrate that PA may in fact *decrease* accuracy of judgements. This effect is directly observed in an affective task. Furthermore, the findings on the moderating role of monetary incentives suggest that additional negative effects of PA may exist in other task domains, even if experimental research to date has failed to find them. Organisations should carefully consider when and how to implement accountability, and moreover how to combine this with other aspects of the management control system, such as direct monetary incentives.

Chapter 3
Process accountability inhibits insight

Wir sind uns unbekannt, wir Erkennenden,
wir selbst uns selbst: das hat seinen guten Grund.

—Friedrich Nietzsche,
Zur Genealogie der Moral (1887)

Abstract

The ability to find creative solutions is a key competence for modern organisations, and insight problem solving is an important aspect of that. However, the organisational environment may not be fully conducive to insightful solutions. In particular, we suggest process accountability inhibits insight. One of the defining characteristics of insight is unawareness on the part of the solver of how the solution was found. This makes it a difficult approach to justify. For problems which also allow for alternative, more analytic solving strategies we thus expect a processing shift away from insight and towards analytic approaches. We develop this theory, use it to derive predictions in different contexts, and test these predictions in three experimental studies. Study 1 is a behavioural experiment and reveals the negative performance effect of accountability on insight problem solving. In Study 2 we use electroencephalogram (EEG) recording to show accountability leads to a relative increase of left-hemisphere brain activity, which is associated with analytic rather than insight approaches to problem solving. In Study 3 we employ eye-tracking measurement and demonstrate accountability decreases lexical activation time and fosters unequal attention to problem elements. Again both of these effects follow from our hypothesised processing shift. In sum, we find converging evidence that process accountability decreases the propensity to solve problems by insight. At least for some problems this has a negative effect on performance.

3.1 Introduction

In our competition-based market economy great value is attached to creativity. Organisations that know how to innovate and provide new answers to new challenges are better positioned for success in the market place. An important form of creativity is insight: to suddenly see the solution to a problem, without knowing whence it came. Given the mysterious origins and powerful consequences of insight, it is not surprising that the concept has received a great deal of attention in the scientific literature (Bowden, Jung-Beeman, Fleck, & Kounios, 2005). For organisations, too, moments of insight can be very important, as they form the basis of creative solutions and innovations. However, the organisational setting might not lend itself to the generation of insight (Shalley, 1995). We examine the effect of accountability on insight problem solving. There are grounds to expect that process accountability (PA) in particular has a negative influence on the occurrence of insight solutions. Process-accountable agents are required to explain and justify their approach to a task (Beach & Mitchell, 1978), and this demand may be difficult to reconcile with the nature of insight.

In the academic literature on judgement and decision making (J&DM), PA is widely documented to effectuate a processing shift (Lerner & Tetlock, 1999). This shift has been characterized as a tendency to use analytic, deliberate, sequential, reason-based, 'system II' processing (De Langhe, Van Osselaer, & Wierenga, 2011). However, to date it is unclear how PA affects problem solving. For the particular case of insight problems, since insight solutions come seemingly out of nowhere, it would be difficult to justify to others any process that relies on it. The case of insight problem solving is analogous to intuition-based, holistic, 'system I' processing in J&DM, which is restricted by accountability pressure. For problems that can be solved either by insight or analytic strategies, we suggest accountable solvers are likely to use analytic strategies. As a consequence, if the task lends itself more to insight solving, there will be a negative effect on performance.

In this chapter we investigate this line of thought by examining the effect of PA on problem solving in a series of studies using the remote associates test (RAT). This task can be solved with or without insight. We expect process-accountable solvers—relative to a non-accountable control group—to use analytic rather than insight strategies and, consequentially, to solve fewer problems in a given amount of time. In order to investigate our questions empirically, we conduct three experimental studies. Study 1 examines the behavioural effect: does PA lead to lower scores on the RAT? In Study 2 we consider neurological markers for the processing difference; previous literature indicates a special role for the right hemisphere of the brain in insight solving of verbal problems, leading us

to expect lower activity in the right hemisphere for process-accountable solvers. Study 3 presents evidence from an eye-tracking experiment, which provides further indications about the processing difference caused by PA.

The contribution of this project is twofold. In the first place, we provide direct evidence on the effect of PA on insight problem solving. To the best of our knowledge, this is the first investigation to do so. Insight can be crucial for organisations and a better understanding of the facilitation or inhibition of insight by organisational control structures is valuable. Moreover, the fact that the performance effect is negative in our setting provides a counterweight to a stream of literature that has found predominantly positive effects (De Langhe et al., 2011). Secondly, we use neurological and eye-tracking methods to investigate the effect of accountability. The processing shift of PA has thus far been characterised mostly in terms of its behavioural consequences. Deeper knowledge of the biological processes involved would greatly advance our understanding of accountability and when and how to use it.

3.2 Theoretical background

A rich literature in Judgement & Decision Making indicates PA causes a processing shift in the direction of analytic thinking (Lerner & Tetlock, 1999). When faced with the need to justify their approach, people have more focused attention for the task (e.g. Brtek & Modowidlo, 2002), and process available information better (e.g. De Dreu, Beersma, Stroebe, & Euwema, 2006). Relative to non-accountable or outcome-accountable subjects, process-accountable judgement and decision makers behave in a way more consistent with rationality prescriptions and use more systematic, analytic processes (e.g. Simonson & Staw, 1992; Tetlock, 1983, 1985). These processes can be more or less useful for a given task, and so the effect of PA on judgement quality depends on task characteristics (De Langhe et al., 2011).

Our primary goal in the present project is to investigate the effect of PA on insight problems. To the best of our knowledge no research has looked at this directly. Nevertheless, there are grounds to expect a negative effect on problem solving performance. Insight is here defined as the event in which an agent facing a problem arrives at the solution suddenly and without awareness of how that solution was found. The solution simply ‘pops into consciousness’, apparently out of nowhere; it is often accompanied by an ‘Aha-experience’ (Bowden et al., 2005). Insight solutions can thus be characterised by their phenomenology, which differs from non-insight solutions e.g. in terms of the subjective experience of approaching the solution (Metcalfe & Wiebe, 1987).

Some researchers have focused on the cognitive processes involved. An insight solution is generally preceded by a phase of impasse and subsequent restructuring of the problem (Knoblich & Ohlsson, 1999). While in the state of impasse the solver does not know what to do next and seemingly makes no progress; this stands in contrast to analytic problem solving, where the solver is typically working on sequential steps and gradually closes in on the solution. In insight solving, the impasse is broken by a restructuring of the problem representation. Restructuring changes the way the problem is understood, opening up new spaces of possible moves and enabling a quick or instantaneous solution (Ohlsson, 1984). Insight solutions are thus characterized by opaqueness: the solver has no awareness of the process by which the solution occurs to him or her (Bowden et al., 2005). For the process-accountable solver, such a strategy is difficult to justify. Under PA, if analytic alternatives to insight solving are available, these are more likely to be used instead. Whether this is beneficial for performance is an empirical question.

One class of problems that can be approached with both types of strategies, and where we would expect PA to push solvers toward analytic strategies, is the Remote Associates Test (RAT). The RAT was developed by Mednick (1962) as a measure of creative ability. Each problem in the RAT consists of a triad of clues (e.g. 'board'; 'magic'; 'death') which are all associated with a single solution word (e.g. 'black'). The task requires participants to connect remote associations of the clue words in order to find the solution. Performance on the task has been linked to creative performance (Schooler & Melcher, 1995). The RAT can be seen as an insight problem: solvers typically encounter an impasse, during which they have no experience of gradually closing in on the solution, until it suddenly occurs to them (Schooler, Ohlsson, & Brooks, 1993). However, it is also possible to use 'analytic' or 'search' strategies on the RAT (Bowden et al., 2005). These involve the systematic transformation of the problem state until the goal state has been reached, and do not depend on restructuring (Kounios et al., 2008). In the case of the RAT the most straightforward analytic strategy is to single out one cue word, generate associates with that word, and check these as potential solutions sequentially with the other two cue words. Previous research suggests the two problem solving strategies differ importantly in terms of breadth of attention. Analytic strategies are associated with narrow or focused attention, while insight problem solving is facilitated by broad or diffuse attention (e.g. Carson, Peterson, Higgins, 2003; Kasof, 1997; Kounios et al., 2008; Mendelsohn, 1976; Mendelsohn & Griswold, 1964, 1966). More specifically, diffuse conceptual attention promotes a relatively flat gradient of semantic association (Mednick, 1962; see also Kounios et al., 2008). This facilitates the activation of remotely associated concepts. Conversely, focused attention strongly activates closely related concepts.

Neurological evidence indicates a special role of the right brain hemisphere in accessing remote associates (Faust & Lavidor, 2003; Howard-Jones, Blakemore, Samuel, Summers, & Claxton, 2005; Stringaris et al., 2006). It is suggested that the right hemisphere (RH) codes words more coarsely than the left hemisphere (LH), such that the RH weakly activates large semantic fields, while the LH strongly activates small semantic fields (Beeman et al., 1994; Jung-Beeman, 2005; Stringaris et al., 2006). Consistent with this notion, a number of neuroscientific studies on verbal insight found an association between insight solving and increases in RH activity (Jung-Beeman et al., 2004; Kounios et al., 2008; Sandkuehler & Bhattacharya, 2008). The superior temporal gyrus (STG) has been implicated in particular; this area is involved in semantic integration (Mazoyer, Tzourio, & Frak, 1993; Stowe et al., 1999). Jung-Beeman et al. (2004) present evidence from an fMRI experiment and an EEG experiment, both involving problems from the RAT. For insight solutions, relative to non-insight solutions, the fMRI study revealed increased activity in the STG; the EEG study showed gamma power increased in the same area, also implying greater activity. In addition, greater right frontal-temporal activity in the beta-gamma range in resting state EEG has been linked to propensity to have insight rather than analytic solutions (Kounios et al., 2008). Furthermore, several EEG studies of insight have revealed a decrease in alpha power for insight problem solving (Danko, Starchenko, & Bechtereva, 2003; Jung-Beeman et al., 2004; Kounios et al., 2006, 2008; Sandkuhler & Bhattacharya, 2008). This also suggests differences in attentional states are related to the type of problem solving strategy people use. For example, Kounios et al. (2008) find that frontal alpha power in resting state is lower for participants relying on insight strategies than for those using analytic strategies. In another study, pre-trial temporal alpha power was lower if the trial was solved by insight (Kounios et al., 2006). The occurrence of restructuring—which is a constitutive element of insight problem solving—is associated with decreased alpha power at pre-frontal sites (Sandkuehler & Bhattacharya, 2008).

The existing literature on accountability makes it clear PA causes a processing shift in judgement and decision making. Analogously, we expect that in problem solving PA makes people inclined to use different strategies. Solution strategies that remain opaque to the solver are difficult to explain and justify, and will therefore be replaced by more transparent strategies. More specifically, on the RAT we expect PA to lead to an increased propensity for analytic problem solving, fewer insight solutions, and lower scores. These expectations were tested in three experimental studies. They all featured a two-cell design with accountability manipulated between subjects, using the RAT as experimental task. Hypothesis development is presented per study; here we provide a brief summary. Study 1

is a behavioural experiment and served to test the negative effect of PA on RAT scores. In Study 2 we took EEG recordings while participants were working on the RAT. This allowed us to examine differences in hemispheric involvement resulting from the shift in problem solving strategies. Study 3 employed eye-tracking technology to investigate differences in gaze fixation patterns associated with analytic versus insight solving. The chapter concludes with a discussion of the findings and implications for theory and practice.

3.3 Study 1

In Study 1 we tested the basic prediction that the need to justify one's problem solving approach lowers solution rates on insight problems. Our expectation is based on the fact that the process of insight solutions is opaque to the solver, and therefore difficult to justify.

Hypothesis 1: PA lowers performance on insight problem solving.

We conducted a behavioural experiment in the labs of Erasmus University Rotterdam. Accountability was manipulated between subjects at two levels, leading to two conditions: a treatment condition with process accountability (PA) and a control condition with no accountability (NA).

3.3.1 Methods

Students of Rotterdam School of Management signed up for participation voluntarily in exchange for a monetary reward of 5 euros. 104 students participated in total; however, prior to analysis we removed the data from 18 participants because they failed a blue dot test[8]. This left us with a sample of 86 participants (44 females; M_{age} = 21.07; SD_{age} = 2.09).

Upon arrival, students were escorted by the experiment leader to individual, soundproof cubicles each containing a personal computer. The experimental task and instructions were fully computerized. Participants were made familiar with the RAT

[8] The blue dot test is designed to test whether participants read all instructions. A question unrelated to the study is asked, but the preceding instruction tells participants not to answer it. It can be inferred that those who do answer it did not read the instruction, and therefore did not seriously participate in the experiment. We inserted the blue dot test after the experimental manipulation, but found no evidence of an effect of condition on pass rates. The analyses on manipulation checks and RAT scores reported below were replicated with the full sample of 104 participants and no substantial differences were found.

through an explanation and some examples. The task consisted of twelve items of the RAT (Bowers, Regehr, Balthazard, & Parker, 1990; Mednick & Mednick, 1967), presented in random order. Participants were given twelve minutes and were instructed to solve as many items as possible. They also learned from the experimental instructions that the reward amount of EUR 5 could be increased—to a maximum of EUR 10—on the basis of their performance.

The manipulation of accountability was incorporated into the task instructions. Participants were randomly assigned to a condition, without prior awareness of the experiment leader. For those in the PA condition, the instructions mentioned they would be asked to justify their task approach in writing after the main task, and moreover that they would have a face-to-face interview with the experiment leader at the end of the study, in which they would be asked again to justify their task approach. For those in the NA condition, no such instruction was given, and instead anonymity was emphasised. During the task, it was possible to navigate back and forth between the twelve test items. The computer experiment ended with a number of posttest questions, including checks for the accountability manipulation. Participants were asked to what extent they agreed with the following statements: "I expect to have a face-to-face interview at the end of this session" (MC1); and "I expect to be asked about my task approach in an interview" (MC2). Upon completion, participants were picked up from their cubicles by the experiment leader. If applicable, they were asked to justify the process they used during the task. All participants were then debriefed and received their rewards before leaving the lab.

3.3.2 Results and discussion

Manipulation check

To confirm the manipulation of accountability led to expectations of face-to-face interviews about task approach, we submitted MC1 and MC2 to independent-samples t-tests[9]. Scores on MC1 were higher for the PA condition (M = 3.31; SD = 1.47) than for the NA condition (M = 1.89; SD = 1.21). This difference was statistically significant[10]: $t(84) = 4.914$; $p < .001$. For MC2, scores were also higher for the PA condition (M = 3.50; SD = 1.38) than for the NA condition (M = 2.07; SD = 1.04). Again, this difference was

[9] In addition we controlled for effects of age and gender using ANOVAs, but found no statistically significant interactions. Similar tests were carried out whenever appropriate, but not reported in the remainder of this chapter.

[10] All *t*-tests of directional hypotheses in this chapter are one-tailed.

statistically significant: $t(84) = 5.435$; $p < .001$. We conclude our manipulation was successful.

RAT scores

The dependent variable was the number of RAT items correctly solved. All participants correctly solved at least one item; the highest score was ten. In order to test hypothesis 1, we conducted an independent-samples t-test on the RAT scores. Consistent with our prediction, scores were lower in the PA condition ($M = 4.24$; $SD = 2.01$) than in the NA condition ($M = 5.61$; $SD = 2.47$). This difference was statistically significant: $t(84) = -2.825$; $p = .003$. The effect size was calculated as Cohen's d and was found to be .603.

Discussion

The goal of Study 1 was to test the prediction that PA lowers scores on the RAT. Results of a behavioural experiment support this contention. The theoretical explanation we propose for this effect is that PA effectuates a processing shift, facilitating analytic problem solving and inhibiting insight. However, this is not the only explanation consistent with the results of Study 1. It may be that PA affects the effectiveness of problem solving without influencing which strategy is employed. We therefore attempt to shed more light on the underlying cognitive processes using EEG (Study 2) and eye-tracking (Study 3).

3.4 Study 2

Our central claim is that accountability causes a processing shift away from insight solving and toward analytic solving. This processing shift is expected to lead to observable differences in neural activity between accountable and non-accountable participants. Insight solving on verbal tasks is associated with increased use of the right hemisphere (RH) when compared to analytic strategies (Jung-Beeman et al., 2004; Kounios et al., 2008). We expect PA to inhibit this RH activity. In Study 2 we use an electroencephalogram (EEG) recording to test this prediction.

The RH hypothesis of creativity has been around for a long time (e.g. Garrett, 1974; Gowan, 1979; Martindale, Hines, Mitchell, & Covello, 1984), although evidence is mixed and involvement of the RH depends on the type of task (Dietrich & Kanso, 2010). For verbal insight problems like the RAT, however, the literature on language comprehension provides further pointers. While language was initially thought to be largely a left hemisphere (LH) affair, this view has been revised and many language processes are now understood to occur bilaterally (e.g. Bookheimer, 2002). Nevertheless, hemispheric

differences do exist, and neuroscientists have been striving to understand the roles of LH and RH areas in language comprehension. A general picture is emerging in which the RH is especially associated with higher-level language tasks (Bookheimer, 2002). For example, the involvement of the RH increases as the context of a story becomes more complex (Xu, Kemeny, Park, Frattali, & Braun, 2005), and while subjects attend to metaphorical meaning rather than literal meaning (Bottini et al., 1994; Nichelli et al., 1995). In forming semantic relations, close and strong associations are mostly reflected in LH activity, while distant and weak associations are facilitated by RH activity (Beeman & Chiarello 1998; Jung-Beeman 2005). This finding is supported by evidence from split visual field studies, where distant semantic primes exert influence when presented to the left visual field (i.e. RH) but not when presented to the right visual field (Chiarello & Richards, 1992; Nakagawa, 1991). Compared to the LH, semantic activation in the RH is weak, diffuse, broad, and coarse (Chiarello, Burgess, Richards, & Pollock, 1990; Faust & Lavidor 2003).

In a context with multiple input words, greater coarseness increases the likelihood of activating overlapping semantic fields, thereby establishing remote associations (Jung-Beeman, 2005). This is likely to be useful for many creativity- and insight-related tasks, including the RAT. On the other hand, the focused, narrow, and strong semantic activation of the LH is helpful for analytic strategies. When contrasting insight solutions with non-insight solutions, then, we would expect to find higher RH activity. Jung-Beeman et al. (2004) provide support for this notion. Their participants completed a compound RAT and for each trial indicated whether the solution came to them by insight or not. In Experiment 1 the researchers used fMRI to contrast the two problem-solving strategies and found more activity in the anterior part of the superior temporal gyrus (aSTG) for insight solutions. Experiment 2 was designed in the same way, but this time while recording EEG instead of fMRI; here, insight solutions were characterized by gamma band activity in the same anterior temporal area of the RH. Further evidence comes from Kounios et al. (2008), who compared resting state EEGs of people with either high or low propensity to solve anagram problems with insight. Their results are similar: participants with a tendency toward insight solving showed higher RH activity and lower LH activity while resting. In the low-alpha frequency range (8-10 Hz), which is thought to reflect inhibition of cortical activity, insight solvers showed greater power in the LH and smaller power in the RH than non-insight solvers. In the beta and gamma frequency ranges (13-40 Hz), which reflect cortical activity, power was lower in the LH and higher in the RH for insight solvers. The effects reported by Kounios et al. differ per frequency band, but are most prominent in right inferior-frontal sites. Jointly, these results indicate that identifiable hemispheric differences

in cortical activity correspond to the difference between insight problem solving and analytic problem solving.

On the basis of these previous findings, we can now formulate clear predictions for our case. If accountability makes problem solvers less likely to use insight strategies, the EEG should reflect this through hemispheric differences. The RH shows relatively more activity for insight solving, and therefore is expected to show less activity for PA relative to NA. This lower level of activity translates into lower beta and gamma power in the EEG.

Hypothesis 2: PA decreases EEG beta and gamma power in the right hemisphere.

3.4.1 Methods

We conducted a between-subjects experiment with two conditions (PA and NA). Students from Erasmus University Rotterdam signed up voluntarily to participate in a 90-minute experiment in exchange for 15 euros. A total of 48 people participated (28 females; M_{age} = 24.02; SD_{age} = 3.52). Four participants reported to be left-handed on the Edinburgh inventory (Oldfield, 1971) and were removed from the sample prior to analysis of the EEG[11].

Upon arrival at the lab, participants were brought to a shielded room for the EEG study. The researcher applied the electrodes and prepared the EEG recording while the participant filled out a paper questionnaire. The RAT was incorporated into a computerized procedure. The computer assigned participants to one of the conditions randomly and without their knowledge. The RAT started with a general instruction of the task, and participants were informed an extra reward of EUR 25 was available for the two highest scores. Accountability was then manipulated as in Study 1. The task contained 25 RAT trials this time; contrary to Study 1, the trials were now presented consecutively. Each trial started with a blank screen followed by a fixation cross and then presented the clue words. Participants had 45 seconds to respond by bimanual button push. As soon as they did, or after 45 seconds had passed, they were prompted for the solution. After the final trial, those in the PA condition were requested to explain and justify their task approach in writing. The computer procedure then ended. The researcher removed the electrodes and cap from the head of the participant, who was given the opportunity to wash

[11] Data from these participants were included in analysis of behavioural data reported below. To check the robustness of findings, all analyses were replicated without them; results were not substantially affected and none of the conclusions from statistical tests changed.

out their hair. Process-accountable participants were then interviewed about their task approach. Finally, all participants were debriefed, received their rewards, and left the lab.

EEG was recorded using a Brain Products GmbH (Munich, Germany) system composed of a BrainAmp amplifier and actiCAP electrode cap (www.brainproducts.com). Measurement was taken from 30 sites on the scalp and one on either mastoid behind the ears using Ag/AgCl active electrodes mounted in an elastic cap, according to the International 10-10 method of electrode placement. The electrodes on the mastoids were computationally linked and used as reference electrodes. In order to monitor eye blinks an electrooculogram (EOG) was recorded by two electrodes attached to the infraorbital and supraorbital regions of the left eye. The online EEG and EOG signals were recorded with a low-pass filter of 250 Hz. All signals were digitized with a sample rate of 5 kHz and 16-bit A/D conversion.

Initial data processing was done using BrainVision Analyzer 2.0 software (www.brainproducts.com). The data were filtered off-line with a band-pass of 0.1 to 30 Hz (24 dB/octave slope) and re-referenced to the digital average of the mastoid electrodes. We were interested in EEG patterns while participants were solving RAT items. All participants completed all 25 trials, yielding an average of 9:04 minutes of EEG per participant. These data were segmented into epochs of 2,000 ms with an overlap of 1,500 ms. We rejected artifacts per channel and corrected for eye blinks as reflected in the EOG following Gratton, Coles, and Donchin (1983). A Fast Fourier Transformation (FFT) was then applied, using a Hamming window to control for artifacts resulting from data splicing, and segments were averaged per participant.

3.4.2 Results and discussion

Behavioural results

To verify the effectiveness of our manipulation we tested whether accountable participants were more likely to expect an interview (M = 3.71; SD = 1.40) than non-accountable participants (M = 2.42; SD = .97) through an independent-samples t-test, which indeed revealed a significant difference: $t = 3.713$; $p < .001$. We then checked whether those in the PA condition were more likely to expect to be interviewed about their task approach (M = 3.92; SD = .83) than those in NA (M = 2.71; SD = 1.08) and again found a significant difference: $t = 4.340$; $p < .001$. We conclude our manipulation was successful.

Like in Study 1, performance scores were determined as the number of correctly solved RAT items. We subjected these scores to an independent-samples t-test to investigate differences between conditions. The performance of participants on the RAT was lower for

PA (*M* = 7.21; *SD* = 2.90) than for NA (*M* = 8.04; *SD* = 4.07). However, unlike in Study 1, this difference was not statistically significant: *t*(46) = .817; *p* = .105. The effect size, expressed in Cohen's *d*, was .231.

EEG results

We analysed EEG power in beta and gamma frequency bands, which are related to hemodynamic measures of cortical activity (Laufs et al., 2003). For each frequency band, power densities per electrode per participant were natural-log transformed to correct for inherent non-normality (Sterman, Mann, Kaiser, & Suyenobu, 1994). They were subsequently standardized across electrodes to correct for individual differences in power, resulting from e.g. differences in skull thickness (Gevins & Smith, 2000). The resulting scores indicate regional activation differences within participants, making it possible to test the hemispheric hypothesis. Scores were analysed in a repeated-measures ANOVA with Accountability (ACC; two levels) as between-subjects factor and Anterior-Posterior (AP; five levels), laterality (L; two levels), and Hemisphere (H; two levels) as within-subjects factors[12].

For each frequency band we investigated whether interactions between accountability and hemisphere were present. In the beta-1 range (13.00-17.75 Hz) there was a statistically significant ACC x H interaction: *F*(1, 46) = 6.993; *p* = .011. The same pattern was found in the beta-2 range (18.00-24.75 Hz): *F*(1, 46) = 5.775; *p* = .021. In beta-3 (25.00-29.75 Hz), the ACC x H interaction was marginally significant: *F*(x, x) = 3.672; *p* = .062. For the gamma-1 range (30.00-39.75 Hz) there was a statistically significant ACC x H interaction again: *F*(1, 46) = 4.349; *p* = .043. In the gamma-2 (40.00-49.75 Hz) and gamma-3 (50.00-58.00 Hz) ranges, the interaction was not statistically significant, with *F*(1, 46) = 1.358; *p* = .251 and *F*(1, 46) = 1.012; *p* = .320, respectively. For all six frequency bands, the interaction was such that PA showed relatively more LH and less RH activity than NA—as predicted in hypothesis 2. An overview of hypothesis tests and effect sizes can be found in Table 3.1; a further illustration of the findings is given in Figure 3.1. We did not find evidence of cross-level interactions other than ACC x H in any of the frequency bands.

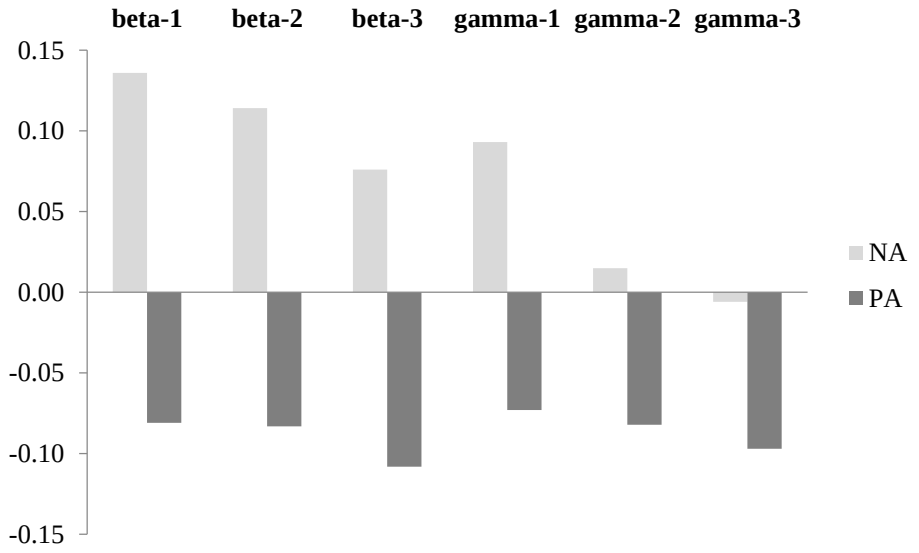
[12] We used the electrodes F3/4, F7/8, FC1/2, FC5/6, C3/4, T7/8, CP1/2, CP5/6, P3/4, and P7/8.

Table 3.1 Results per frequency band of ACC x H

Frequency band		F-statistic	p-value	eta-squared
beta-1	13.00-17.75 Hz	6.993	0.011	0.143
beta-2	18.00-24.75 Hz	5.775	0.021	0.121
beta-3	25.00-29.75 Hz	3.672	0.062	0.080
gamma-1	30.00-39.75 Hz	4.349	0.043	0.094
gamma-2	40.00-49.75 Hz	1.358	0.251	0.031
gamma-3	50.00-58.00 Hz	1.012	0.320	0.024

Note. The statistics reported here all apply to the interaction between accountability and hemisphere, as revealed in a series of repeated measures ANOVAs further containing AP and DV as within-subjects factors. Accountability did not interact at statistically significant levels with any other factor or combination of factors.

Figure 3.1 The effect of PA on right-hemisphere power



Note. The bars represent standardized power (*z*-scores) per frequency band per condition for the RH.

Discussion

In Study 2 two predictions were subjected to testing. First, PA was expected to lower RAT scores, as in Study 1. Second, under PA the relative hemispheric engagement in problem

solving was predicted to differ such that relative RH activity is lower under PA than under NA.

The first prediction is not fully supported by the data. Results indicate RAT scores were indeed lower under PA, but not statistically significantly so. This could be explained by sampling error. Fortunately Study 1 and Study 3 also provide a test of this hypothesis; we discuss the aggregate empirical evidence for it in the general discussion.

The results of Study 2 provide direct support for the notion that the effect of PA on problem solving is not simply a performance effect. The prediction concerning hemispheric differences is supported by the EEG data. In the beta and gamma frequency ranges there was relatively higher LH and lower RH power under PA than under NA. This implies cortical activity in the RH, which is associated with coarse semantic coding and remote associations, is lowered by PA. As previous studies have found greater cortical activity in the RH when contrasting insight solutions with non-insight solutions (Jung-Beeman et al., 2004; Kounios et al., 2008), these results are consistent with the notion that PA inhibits insight.

3.5 Study 3

To further expose the effect of PA on the processes used in problem solving we conducted an eye-tracking experiment. Eye-tracking is a method that enables registration of oculomotor processes in a non-intrusive way, generally through infrared cameras that capture pupil and corneal reflection (Hansen & Ji, 2010). This allows researchers to study eye fixations and saccades and their relations to cognitive processes. Eye-tracking has been applied to many fields of study, including reading (see Rayner, 1998), traffic (e.g. Ho, Scialfa, Caird, & Graw, 2001), aviation (e.g. Sarter, Mumaw, & Wickens, 2007), marketing (see Wedel & Pieters, 2007), and accounting (e.g. Hunton & McEwen, 1997). It could also shed light on the processes underlying the effect of accountability on problem solving.

It is generally assumed that a fixation on some location of a stimulus temporally coincides with cognitive processing of that location (Inhoff & Radach, 1998). This has been called the eye-mind assumption (Just & Carpenter, 1980). In the case of the RAT, each trial contains three obvious areas of interest (AOI): the three cue words. The patterns of fixations in each of these areas and transitions between them, as observed with an eye-tracker, can inform us about ongoing processes of visual attention and stimulus processing (e.g. Glöckner & Herbold, 2011; Sütterlin, Brunner, & Opwis 2008). If it is true that PA increases the propensity to use analytic instead of insight solving, this is likely to be

reflected in differences in eye-tracking measures. We consider two potential differences: first pass dwell time, and proportionality of dwell duration between AOIs.

Our first prediction concerns the start of a trial. If the right-hemisphere (RH) hypothesis of Study 2 is correct, insight strategies differ from analytic strategies in the semantic processing of cue words at trial onset. The coarse and diffuse semantic activation in the RH takes more time to spread than the fine and focused activation in the LH (Abernethy & Coney, 1993; Collins & Coney 1998). Even though semantic processing cannot be observed directly in eye-tracking, the eye-mind assumption enables us to derive a clear prediction. In eye-tracking research on reading, the first fixation on a word is generally taken to reflect lexical activation (Holmqvist et al., 2011). The duration of the first fixation on a given word has been reliably found to e.g. increase with word length and ambiguity (Rayner & Duffy, 1986; Sereno, O'Donnell, & Rayner, 2006), and to decrease with word frequency (Inhoff & Rayner 1986). However, measuring the first fixation does not suffice, as many words require multiple fixations to achieve lexical activation. The related measure of *first pass dwell time* is often used to compute duration of the lexical activation process instead (e.g. Holmqvist et al., 2011; Liversedge, Paterson, & Pickering, 1998). First pass dwell time starts at the beginning of the first fixation in an area of interest and ends when the gaze leaves it. Now, under the assumption that semantic activation of cue words largely coincides temporally with visual fixation on that word, we expect longer first pass dwell times for insight solvers than for analytic solvers. Combining this with our central claim that PA decreases reliance on insight solving yields our next hypothesis:

Hypothesis 3: PA lowers first pass dwell times.

Secondly, we expect a difference in the proportion of dwell time per AOI over the course of the trial. Analytic strategies involve deliberate manipulation of the elements of the problem and evaluation of intermediate problem states (Kounious et al., 2008; Newell & Simon, 1972). In the RAT this implies the generation of words associated with one cue word, which are subsequently tested for association with the other two cue words; or the generation of associations between two cue words, which are then tested for fit with the final cue word. As a consequence the proportion of dwell time per AOI will be non-random, and more specifically the proportion of dwell time for the least-attended AOI will be lowered. For insight strategies, this does not hold. Insight depends on a process of integration of the three cue words and is served by attending all three. This allows the formulation of another hypothesis.

Hypothesis 4: PA leads to lower proportions of dwell time for the least-attended area of interest.

3.5.1 Methods

An experiment was carried out in which accountability was manipulated between subjects to the level of PA and NA. Students of Erasmus University Rotterdam were recruited to participate in a thirty-minute study in exchange for 6 euros. A total of 44 students took part in the study; however, two of them indicated they were already familiar with the task, and were removed from the sample prior to analysis. The remaining 42 participants (27 females; M_{age} = 22.05; SD_{age} = 2.25) were all included in the analysis of behavioural results. For three of these participants the quality of eye-tracking data was insufficient for analysis, and so the eye-tracking data analyses reported here are based on a sample of 39 participants.

After arriving in the lab on individual appointment, participants were brought to a specially prepared room for the eye-tracking study. After a brief introduction on the experimental task and the eye-tracking equipment, a calibration was done and validated. The participant then went through a computer procedure that contained the RAT. First the task was explained, and participants were informed there was an extra reward of 25 euros for the two top performers. Accountability was manipulated as in Study 1. The RAT consisted of the same 25 trials as in Study 2, again presented sequentially, in random order, and with a time limit of 45 seconds. After pushing a button or after time-out, participants were prompted for the solution. After completing the RAT those in the PA condition were asked for a written explanation and justification of their task approach. The computer procedure then ended and participants were asked to complete a short paper-based questionnaire. They were then briefly interviewed when applicable; finally, all participants were debriefed, received their rewards, and left the lab.

We used the SMI RED-m eye-tracking system (www.smivision.com). Stimuli were presented on a computer screen with a resolution of 1600 by 900 pixels, spanning a visual angle of 14°18'. Participants were positioned at 63 cm from the screen. Cue words were presented below each other, horizontally centred and vertically slightly lowered, such that the centre of the screen fell in the blank space between the first and second cue word. Raw eye-tracking data were first processed using the built-in BeGaze event detection algorithm provided by SMI. Minimum fixation duration was set at 80 ms and maximum dispersion at 100 pixels.

3.5.2 Results and discussion

Behavioural results

In order to confirm our manipulation of accountability worked as expected, we submitted the manipulation checks of the post-test questionnaire to independent-samples t-tests. Participants in the PA condition (M = 3.90; SD = 1.14) were more likely than those in the NA condition (M = 2.33; SD = .97) to expect an interview: $t(40) = 4.829$; $p < .001$. Moreover, the expectation to be called upon to justify task approach was higher for PA (M = 3.86; SD = .96) than for NA (M = 3.19; SD = 1.25): $t(40) = 1.936$; $p < .001$. We conclude our manipulation was successful.

Performance scores were again determined as the number of RAT items solved correctly by each participant. Scores ranged from 2 to 12. To test whether scores were lower in the PA condition than in the NA condition, we conducted an independent-samples t-test. As expected, the average score was lower for PA (M = 5.90; SD = 2.14) than for NA (M = 7.52; SD = 1.97), and this difference was statistically significant: $t(40) = 2.552$; p = .008. The effect size as expressed in Cohen's d was .773.

Eye-tracking results

The dataset contained information at two levels: outcome variables at the (lower) trial level and the experimental manipulation at the (higher) participant level. It was possible to conduct our hypothesis tests using repeated-measures ANOVAs, but list-wise deletion of cases would have resulted in the loss of a large amount of data. We therefore preferred to test the hypotheses using hierarchical linear modelling. The influence of PA on trial-level dependent variables was assessed by making the intercept of the trial-level model a function of a dummy variable representing condition at participant level[13].

Lexical activation time was determined per trial as the end time of the first dwell in the last AOI to be visited. In the vast majority of trials, all three AOIs were visited in the first three dwells, so that this measure equated to the end time of the third dwell. To test hypothesis 3—lexical activation time is smaller for PA than for NA—we constructed a two-level hierarchical linear model. For 29 trials the measure could not be computed because of missing data; for a further 20 trials lexical activation time was over 10 seconds,

[13] The results reported here are based on models whose trial-level intercepts have randomly varying residuals. An alternative approach is to make these residuals dependent on participant. This would improve the overall fit of the model, but at the expense of understating the coefficient of the independent variable. Assuming we were successful in the random assignment of participants to experimental conditions, the model assumption of randomly varying intercept residuals allows for an unbiased test of our hypotheses. For robustness, we present the results of the alternative models with non-random residuals in Table 3.3 in Appendix 3.1.

suggesting further missing data[14]. These 49 trials were removed, leaving a sample of 926 trials. Panel A of Table 3.2 shows the result of the hierarchical linear modelling procedure. The experimental condition had a significant negative effect on the dependent variable ($t(923) = -3.712$; $p < .001$): lexical activation time was shorter for PA than for NA, as predicted in hypothesis 3.

Hypothesis 4 states time spent on the least-attended AOI will be lower for PA than NA. Consistent with previous eye-tracking findings on presentation order, overall dwell times were lowest for the third cue word (Galesic, Tourangeau, Couper, & Conrad, 2008). We therefore computed the dependent variable at trial level as follows: total dwell time in AOI3 as a proportion of total dwell time in all AOIs. In four cases there were not enough data to compute the measure; five further cases were judged to be outliers based on visual inspection. This left 966 trials in the sample. Again we constructed a two-level hierarchical linear model using condition as a participant-level explanatory variable. Panel B of Table 3.2 presents the result. PA significantly decreased the proportion of dwell time in AOI3 ($t(963) = -4.172$; $p < .001$), in line with hypothesis 4.

Table 3.2 Main eye-tracking results

Panel A: Lexical activation time (ms)

		coefficient	**st. error**	**t-ratio**	***p*-value**
Intercept	γ_{00}	2561	64	39.840	< .001
ACC	γ_{01}	-350	94	-3.712	< .001

Panel B: Dwell time in AOI3 (proportion of total dwell time)

		coefficient	**st. error**	**t-ratio**	***p*-value**
Intercept	γ_{00}	.316	.006	52.604	< .001
ACC	γ_{01}	-.037	.009	-4.172	< .001

Note. The models were estimated using the HLM for Windows 7 software package (Scientific Software International, Inc, USA). Both models were specified as follows: $Y_{ij} = \gamma_{00} + \gamma_{01}*ACC_j + r_{ij}$, with *ACC* denoting a dummy variable representing experimental condition (PA = 1; NA = 0). The *p*-values are based on two-tailed testing.

[14] The cut-off point of 10 seconds was based on a visual inspection of the distribution. The trials removed on this basis were assumed unreliable. Some such loss of data is unavoidable in using eye-tracking. This filter did not affect the two conditions in a significantly different way.

Discussion

Study 3 examined three hypotheses. First, as before, we examined whether PA lowers RAT scores (hypothesis 1). Second, we predicted PA is associated with shorter lexical activation times (hypothesis 3). The third expectation was that PA lowers the time spent on the least-attended cue word (hypothesis 4).

The first hypothesis was supported by the data. As in Study 1, RAT scores were significantly lower under PA than under NA. The two remaining hypotheses, relating to the eye-tracking measures, were tested using hierarchical linear models. Both were supported by the data: lexical activation times are shorter under PA than under NA, and participants under PA spent less time fixating on the third cue word than those under NA.

3.6 General discussion and conclusions

Our main goal in this chapter was to investigate the effect of PA on the occurrence of insight solutions. We expected that process-accountable solvers would be more likely to use analytic than insight strategies, even if this was detrimental to task performance. Insight solutions are opaque to the solver (Metcalfe & Wiebe, 1987) and therefore inherently difficult to account for. Although to our knowledge no previous research has systematically examined the effect of PA on insight problem solving, the literature on accountability in the domain of J&DM is consistent with this notion. PA has been shown to lead to a shift in the direction of analytic processing (De Langhe et al., 2011; Lerner & Tetlock, 1999). Conversely, insight solutions have been described as intuitive (Pretz & Totz, 2007).

To examine this issue we used the RAT, a task that lends itself both to insight strategies and analytic strategies (Jung-Beeman et al., 2004). In three experiments we compared the performance of process-accountable participants to that of a control group. In addition, to shed light on the cognitive processes involved, Study 2 incorporated an EEG measurement and Study 3 involved eye-tracking. These techniques were able to provide crucial clarification on the process by which PA influences problem solvers. Insight solutions on the RAT have been differentiated from non-insight solutions in EEG research by increased RH involvement (Jung-Beeman et al., 2004; Kounios et al., 2008), which implies more coarse and diffuse semantic processing (Faust & Lavidor, 2003; Jung-Beeman, 2005). We therefore expected relatively less RH involvement for PA than for NA. Since the spread of semantic activation in the RH is slower than in LH (Collins & Coney, 1998), we furthermore expected shorter lexical activation times under PA in the eye-tracking study. Finally, analytic strategies on the RAT are likely to involve inequalities in the attention

given to each cue word; we therefore expected process-accountable participants to spend less time than the control group on the least-attended cue word.

All three studies provide a test of the hypothesis that PA lowers RAT scores. In studies 1 and 3 this is the case to a statistically significant degree; in Study 2 scores are lower under PA than under NA, but this difference is not statistically significant. To assess the overall support for the hypothesis we conducted a meta-analysis on all three studies. Under the conservative assumption of random effects we find a combined Cohen's *d* effect size of .537, which is statistically significantly greater than zero ($z = 3.536$; $p < .001$). The 95%-confidence interval around the combined effect size ranges from .458 to .616. We conclude there is strong support for the hypothesis that PA lowers scores on the RAT.

The analyses of EEG and eye-tracking data indicate that this difference is not simply a drop in performance, but in fact results from a processing shift. The main finding in the EEG of Study 2 is that power in the beta and lower gamma frequency range is relatively lower in the RH for under PA than under NA. This is in line with the expectations we formed based on the literature and on the assumption that PA pushes solvers away from insight and toward analytic solutions. Study 3 provides further evidence on the processing shift with two findings based on eye-tracking. Consistent with the EEG findings of Study 2, lexical activation time is lower under PA than under NA. In addition, PA decreases time spent on the least-attended cue word, which is in line with analytic problem solving strategies on the RAT.

Our findings provide a first step towards understanding the effects of accountability on insight problem solving. Given the relevance of insight and of creative solutions for organisations, it is important to know how they are affected by design choices in management control systems. While accounting scholars have questioned the ethical implications of accountability (e.g. Messner, 2009; Roberts, 2009; Shearer, 2002), very little attention has been paid to possible negative performance consequences. In J&DM literature, process accountability in particular has generally been viewed as a performance-increasing factor (De Langhe et al., 2011). We show PA has a negative effect on the occurrence of insight on the RAT. The demand to explain and justify one's approach to solving a problem may interfere with the most effective way of solving it, consequently lowering performance. This should be recognised and taken into account in the design of management control structures.

More broadly, the present findings help understand the effects of PA at a deeper level. In J&DM the occurrence of a processing shift toward analytic thinking has been documented extensively. However, this stream of research empirically relies on behavioural and self-reported data to a great extent. The use of EEG and eye-tracking

methods helps us to characterise the processing shift in more naturalistic terms. In our setting, PA shifts cortical activity from the RH to the LH and decreases lexical activation time. This indicates the activation of relatively focused and narrow semantic fields, which constrains the accessing of remote associates. The methodological innovation presented here thus enables researchers to conceptualise at a more naturalistic level, which we believe holds great promise for the investigation of accountability.

This study examines the effects of PA for a single task, which limits the generalizability of the processing effect reported here. Future research using EEG and eye-tracking recordings on different tasks in J&DM and problem solving could bring to light a more general theory of the processing shift effectuated by PA. Furthermore, a replication with other neurological methods (e.g. fMRI or lesion studies) may help to get a more definite understanding of the effects of PA. Finally, while our study contrasts PA to the absence of accountability, future research may include an examination of other forms of accountability (e.g. outcome accountability; Siegel-Jacobs & Yates, 1996), or interactions with other management control variables (e.g. incentives; Vieider, 2011).

Appendix 3.1 Supplementary analysis of eye-tracking results

Table 3.3 Eye-tracking: supplementary analysis

Panel A: Lexical activation time (ms)

		coefficient	st. error	t-ratio	*p*-value
Model 1					
Intercept	γ_{00}	2443	134	18.194	< .001
Model 2					
Intercept	γ_{00}	2561	64	39.840	< .001
ACC	γ_{01}	-350	94	-3.712	< .001
Model 3					
Intercept	γ_{00}	2624	180	14.546	< .001
ACC	γ_{01}	-393	265	-1.481	.074

Panel B: Dwell time in AOI3 (proportion of total dwell time)

		coefficient	st. error	t-ratio	*p*-value
Model 1					
Intercept	γ_{00}	.300	.011	26.496	< .001
Model 2					
Intercept	γ_{00}	.316	.006	52.604	< .001
ACC	γ_{01}	-.037	.009	-4.172	< .001
Model 3					
Intercept	γ_{00}	.317	.015	21.051	< .001
ACC	γ_{01}	-.037	.022	-1.687	0.050

Note. This table presents supplementary results of hierarchical linear models of eye-tracking data. For both dependent variables, the models were specified as below.

Model 1: $Y_{ij} = \gamma_{00} + r_{ij}$

Model 2: $Y_{ij} = \gamma_{00} + \gamma_{01} * ACC_j + r_{ij}$

Model 3: $Y_{ij} = \gamma_{00} + \gamma_{01} * ACC_j + u_{0j} + r_{ij}$

Chapter 4
Mu suppression predicts controllers' compromise on fiduciary duties[15]

What's the use of the truth
if you can't tell a lie sometimes?

—Snoop Dogg,
True Lies (2000)

Abstract

Business Unit (BU) controllers have a fiduciary role to ensure the integrity of financial reporting. However, they often face social pressure from unit managers to violate this integrity. We use electroencephalographic (EEG) evidence from 29 professional controllers to predict their ability to withstand such social pressure. Drawing on literature on the mirror neuron system we measured mu suppression during an emotional facial expressions observation task. Compromises on fiduciary duty were measured using scenarios of controllers being pressed by their unit manager to adapt financial reports. We find a positive association between controllers' mu suppression and their inclination to yield to managerial pressure. This association is strongest when unit managers are pursuing personal interests. We conclude that BU controllers' neurobiological characteristics add to the explanation of financial reporting behaviour and discuss implications for accounting research.

[15] This chapter is based on: Eskenazi, P. I., Rietdijk, W. J. R., & Hartmann, F. G. H. Why controllers compromise on their fiduciary duties: EEG evidence on the role of the human mirror neuron system. This paper is under review at *Accounting, Organizations and Society.*

4.1 Introduction

Over the last decades a number of accounting scandals have increased awareness in society, capital markets and business firms of financial reporting integrity violations (Cohen, Dey, & Lys, 2008). Traditionally, accounting researchers have studied financial reporting quality at the firm level, as evidenced by the large literatures on earnings management (e.g. Zang, 2012) and audit failures (e.g. Kanagaretnam, Krishnan, & Lobo, 2010). However, since accounting reports are prepared by accounting professionals inside firms, some recent studies seek to understand the integrity-related roles of these individuals. One relevant such role is that of the Business Unit (BU) controller, who plays an important fiduciary part in safeguarding financial reporting integrity (e.g. Sathe, 1983). In economic models such as that of Indjejikian and Matějka (2009) it is argued that a sufficient condition for truthful reporting is that controllers have no monetary incentive for misreporting; however, some studies indicate various kinds of social incentives can induce misreporting even in the absence of monetary incentives. In particular, these studies show that BU controllers may violate their fiduciary role, and engage in financial misreporting, because of social pressure they encounter from their BU managers (Davis, DeZoort, & Kopp, 2006; Hartmann & Maas, 2010; Sathe, 1983). BU line managers have incentives to misrepresent the performance of their unit and to influence the BU controller's reporting behaviour (Indjejikian & Matějka, 2006). As BU controllers are often involved in managerial decision making processes themselves and typically work in close cooperation with BU management, the incidence of social pressure is hard to avoid (Maas & Matějka, 2009). This makes the individual controller's ability to withstand social pressure, fulfil fiduciary obligations, and ensure reporting integrity a crucial personal competence (Chartered Institute of Management Accountants [CIMA], 2010; Davis et al., 2006; Institute of Management Accountants [IMA], 2011; Sathe, 1983). This need to withstand undue social pressure reflects in the typical depiction of controllers and other accounting professionals as "cold, aloof and impersonal" (DeCoster & Rhode, 1971, p. 651). While such characteristics typically serve as pejorative stereotypes (Bougen, 1994; Friedman & Lyne, 2001; Miley & Read, 2012), their positive interpretation suggests that accounting professionals possess a common and natural immunity against social pressure. In fact, however, accounting professionals often yield to such pressures, and there is no systematic evidence on whether and what specific personal characteristics are at stake.

In this chapter we specifically explore whether BU controllers' ability to withstand social pressure has a neurobiological origin. Our analysis builds on the literature that investigates the role and function of the human mirror neuron system (Rizzolatti &

Craighero, 2004). This system has been demonstrated to play a fundamental role in social processes and to be crucial in understanding feelings and emotions of others. For example, the human mirror neuron system (hMNS) is associated with theory of mind (Gallese & Goldman, 1998), perspective taking (Yang, Decety, Lee, Chen, & Cheng, 2009), and empathy (Carr, Iacoboni, Dubeau, Mazziotta, & Lenzi, 2003). Humans differ in the extent of activation in the hMNS when confronted with emotional stimuli, which explains their behaviour in emotionally laden situations (Kaplan & Iacoboni, 2006; Leslie, Johnson-Frey, & Grafton, 2004). In clinical psychology, hMNS dysfunction has been associated with autism spectrum disorders (Frenkel-Toledo, Bentin, Perry, Liebermann, & Soroker, 2014; Oberman et al., 2005). In the marketing literature, individual differences in hMNS activation explains the degree of customer orientation of sales people (Bagozzi et al., 2011). For BU controllers, we expect that hMNS activation predicts controllers' sensitivity to social pressure by unit managers. As social pressure by definition relies on implicit and emotional cues rather than explicit and rational orders (DeZoort & Lord, 1997; Lord & DeZoort, 2001), we expect a positive association between hMNS activation and controllers' inclination to yield to their managers' pressure to change financial reports.

For a sample of 29 experienced unit controllers, we conducted a scenario-based survey on a validated set of six scenarios describing situations in which BU managers try to influence their BU controllers' financial reporting behaviours. We then examined hMNS activation by electroencephalographic (EEG) recordings during a dynamic emotional facial expressions task (Bastiaansen et al., 2011; Jabbi & Keysers, 2008; Jabbi, Swart, & Keysers, 2007; Schraa-Tam et al., 2012). We determined mu suppression (i.e. event-related desynchronization (ERD) of mu waves in the motor cortex) in response to the emotional facial expressions to obtain a measure of hMNS activation (Oberman et al., 2005; Oberman, McCleery, Ramachandran, & Pineda, 2007; Ulloa & Pineda, 2007). Our findings indicate a moderately strong association between hMNS activation during the emotional facial expressions tasks and controllers' inclination to compromise on fiduciary duties when BU managers socially press them to do so.

This chapter contributes to the literature in at least three ways. First, we extend the literature on the intra-firm origins of financial reporting integrity problems (Hartmann & Maas, 2010; Indjejikian & Matějka, 2006; Maas & Matějka, 2009). We show that there is a strong association between hMNS activation and compromises on fiduciary responsibility. This is especially relevant in light of recent calls for controller involvement in local management and a movement in that direction in practice (Maas & Matějka, 2009). Our findings indicate, somewhat counterintuitively, that the traditional personality type associated with controllers of introverted 'bean counters' is more likely to safeguard

reporting integrity. Second, the chapter introduces a conceptualization of controllers' sensitivity to social pressure rooted in the sensitivity of the brain to emotional stimuli. We emphasise the emotional basis of social pressure and the fact that individuals differ in their susceptibility to emotional influence (DeZoort & Lord, 1997; Lord & DeZoort, 2001). Third, we use an EEG-derived predictor of controllers' social behaviour, which provides the study with a neuroscientific methodological basis. As responses to emotional pressures typically occur non-consciously, they escape traditional personality psychology constructs and instruments. Measures based on self-report rely on the narrative the mind presents to itself rather than the causal mechanism underlying behaviour (see Becker, Cropanzano, & Sanfey, 2011). Importantly, this implies reliance on neuroscientific observation goes beyond enhancing measurement validity of an existing construct, and enables discovery of underlying fundamental drivers of human social behaviour (Becker et al., 2011; Dickhaut, 2009; Dickhaut, Basu, McCabe, & Waymire, 2010; Waymare, 2014). This focus also enables extending the debate on the desired fundamental qualities of accountants and controllers beyond its current focus on behavioural norms, which assume that all controllers' behaviours are consciously chosen.

The remainder of the chapter is structured as follows. In the following section we give the theoretical background of our study and develop hypotheses. We then present the research design and implementation, followed by an analysis of the empirical results. The final section provides a review of the findings, a presentation of conclusions, and a discussion of theoretical and practical implications and limitations of the study.

4.2 Theoretical background

Responsibilities of the BU Controller

An important role characteristic of BU controllers is the combination of local and functional responsibilities (e.g. Hopper, 1980; Indjejikian & Matějka, 2006). The latter type of responsibilities pertains to the fiduciary duty controllers have in enabling corporate control. BU controllers should ensure that corporate management receives objective and reliable reports on the performance of the BU, which requires sufficient independence in opinion, judgement, and reporting from BU managers, who have incentives for misreporting (San Miguel & Govindarajan, 1984). This independence, however, is affected by controllers' local responsibilities to support their BU managers in operational and strategic decision making. Although the quality of local support is believed to benefit from close involvement with BU management (Sathe, 1983), a number of studies show that such involvement may pose a threat to controllers' fiduciary responsibilities. Lord and DeZoort

(2001) and Davis et al. (2006) show that obedience pressure from immediate superiors causes controllers to violate explicit corporate policies. Indjejikian and Matějka (2006) and Maas and Matějka (2009) demonstrate a positive association between emphasis on the controllers' local responsibilities and organisational slack. Hartmann and Maas (2010) find that under such conditions, controllers high in Machiavellianism are likely to create slack when pressed by their BU manager.

The tension between the two responsibilities cannot be removed easily, since exercising effective fiduciary control requires at least some involvement with local management (Sathe, 1983). Moreover, controllers who are more closely involved in local decision making typically also have better and more timely access to the information needed to exercise such control (Maas & Matějka, 2009). This necessary coherence between fiduciary and local tasks is personified in the ideal type of the 'strong controller' (Sathe, 1982, 1983)[16]. Such a controller possesses a skill set that enables providing support for local decision making while safeguarding reporting and other fiduciary duties. This type of controllership has seen a steady rise over the last decades (Maas & Matějka, 2009), representing an evolution of the BU controller's role from 'bean counter' to 'business partner' (e.g. Burns & Baldvinsdottir, 2005; Granlund & Lukka, 1998; Zoni & Merchant, 2007). The inherent source of role conflict of the contemporary controller thus necessitates organisations to find and cultivate professionals that are able to withstand inappropriate social pressure to misreport from their BU managers (Davis et al., 2006; Hartmann & Maas, 2010; Lord & DeZoort, 2001). To what extent it is possible to successfully combine these roles in one professional remains an open question.

Establishing the appropriateness of reporting actions suggested by BU management often requires controllers' personal judgements, as not all reporting choices are monitored or observed by higher management (Maas & Matějka, 2009). This means that controllers have considerable discretion to, for example, accept budgetary slack creation as a part of the normal 'game' of budgeting (Hofstede, 1967; Collins, Munter, & Finn, 1987), or denounce it as a violation of corporate control (Davis et al., 2006; Indjejikian & Matějka, 2006). In making such judgement calls, controllers need to balance their fiduciary responsibility with practical demands. BU managers may try to influence this balance explicitly through obedience pressure or social conformance pressure (Davis et al., 2006; Lord & DeZoort, 2001). They may also exert implicit social pressure by making emotional appeals to controllers to consider personal or corporate consequences of a reporting

[16] Sathe's typology further specifies three less desirable ways to design controllers' roles: prioritizing local over functional responsibilities (the 'involved' controller); prioritizing functional over local responsibilities (the 'independent' controller); or dividing the two sets of responsibilities over two people (the 'split' controller).

decision (DeZoort & Lord, 1997; Lord & DeZoort, 2001). Appeals with affective or emotional loadings create compliance through emotional contagion (Johnson, 2008; Weiss & Cropanzano, 1996). Whether or not such appeals have judgemental and behavioural consequences depends on the emotional susceptibility of the receiver (Bakker & Schaufeli, 2000; Johnson, 2008; Totterdell, 2000). We thus expect that individual controllers' reactions to these forms of social pressure reflect a generic receptivity to such social and emotional cues. Research in neuroscience suggests that this receptivity is predicted by mirror neuron system activation.

Mirror neurons

Over the last decades, studies in neuroscience have documented the role of neurobiological factors in determining humans' affective, cognitive and behavioural responses to social cues. The identification of the hMNS in particular has greatly advanced our understanding of humans' receptivity to social and emotional cues (Fabbri-Destro & Rizzolatti, 2008). The hMNS denotes those parts of the human cortex that have the property to be active both during the execution of an action and the observation of the execution of that action by others. This mirroring property was initially found through single-cell recordings of neuronal firing in the premotor cortex of macaque monkeys (di Pellegrino, Fadiga, Fogassi, Gallese, and Rizzolatti, 1992)[17]. Later studies established the existence of a homologue in the human brain (e.g. Fadiga, Fogassi, Pavesi, & Rizzolatti, 1995). Initially, studies on humans focused on the specific counterparts of the macaque areas (e.g. Decety et al., 1997); further research identified various additional cortical regions involved in the hMNS (Fabbri-Destro & Rizzolatti, 2008; Iacoboni & Dapretto, 2006).

The mirroring properties of the hMNS are considered to play a crucial role in social cognition (Carr et al., 2003), which confirms the essential role of social imitation in human social behaviour (Lieberman, 2007) and in building social relationships (Chartrand & Bargh, 1999). Chartrand and Bargh (1999) found a greater inclination to mimic somebody else's behaviours and postures for experimental subjects who scored higher on self-reported empathy. Studies on hMNS activation demonstrate similarity of cortical activation during deliberate execution and imitation of actions (see e.g. Iacoboni et al., 1999; Koski et al., 2002; Leslie et al., 2004; for a review see e.g. Rizzolatti & Craighero,

[17] The primary finding concerned a specific cluster of neuronal cells (area F5) firing both when monkeys made and observed a grasping movement. This finding has been extensively replicated in macaque mirror neurons involved in mouth actions (Ferrari, Gallese, Rizzolatti, & Fogassi, 2003), and communicative gestures (Rizzolatti, Fadiga, Gallese, & Fogassi, 1996), which suggest that mirror neurons not only reflect the motorics but also the goal of the action (Umiltà et al., 2001; Rochat et al., 2010). Mirror neurons have furthermore been found in other areas such as the inferior parietal lobule (area PFG; Fogassi et al., 2005).

2004). Leslie et al. (2004) established the involvement of the hMNS in imitative motor actions for facial expressions. Iacoboni (2009) suggests similar neuronal action underlies observation and execution of emotional facial expressions. However, these studies also show that hMNS activation is not restricted to deliberate imitation (Yang et al., 2009). Schulte-Rüther, Markowitsch, Fink, and Piefke (2007) and Van der Gaag, Minderaa, and Keysers (2007) show hMNS activation even when emotional facial expressions are merely observed, without active imitation. This suggests a major role of the hMNS in the shared understanding of action, feelings and intentions, required for higher forms of social functioning (Sinigaglia, 2013; Zaki, Weber, Bolger, & Ochsner, 2009). The hMNS is thus considered to play an important role in theory of mind (Gallese & Goldman, 1998), empathy, and emotional contagion (Carr et al., 2003; Leslie et al., 2004).

Hypothesis Development

Individuals differ in the extent to which they display mirroring activities, and this difference explains their social functioning. In particular, a strong association exists between social imitation, hMNS activation, and emotional contagion (see Kaplan & Iacoboni, 2006; Pfeifer, Iacoboni, Mazziotta, & Dapretto 2008; Obermann et al., 2007). The literature points to hMNS activation, measured by fMRI in BOLD signals as well as by EEG in mu suppression, as valid predictors of an individual's susceptibility to emotional contagion. Our theory focuses on situations in which a BU manager exerts social pressure on a controller, which threatens the controller's fiduciary obligations. Based on the neuroscientific evidence on the hMNS as the driver of emotional receptivity, we expect that the extent to which controllers are influenced by such pressure is predicted by their hMNS activation. Individual differences in hMNS activation when confronted with emotional cues reflect individual differences in the level of emotional receptivity. We therefore expect that the propensity to cooperate with the local BU manager is associated with hMNS activation. In economic terms, we may conceive of hMNS activation as the sensitivity of an individual to a social incentive. Differences in sensitivity result in differences in professional judgement. This is summarized in the first hypothesis.

Hypothesis 1: BU controllers who show greater hMNS activation while confronted with emotional stimuli are more likely to yield to their BU manager's demand to misreport.

Importantly, BU managers may exercise pressure from different motives. One possible motive is the BU manager's personal interest. This reflects a situation in which a BU manager may profit from misreporting. Another possible motive is the BU manager's

corporate interest. The latter refers to cases in which corporate reporting policies conflict with the BU manager's judgement. In these cases BU managers' pressure to deviate from corporate policies would not necessarily hurt shareholder interests. In the former type of situation, where self-interest is central, direct consequences for the BU manager are at stake, and the emotional and social pressure is more personal. Here, the BU manager would typically provide self-interested grounds in hopes of gaining a 'personal' favour from BU controllers. Both types of situations may fall within the discretionary space of the controller. However, we expect that those involving managerial self-interest will be influenced more directly by the emotional appeal to BU controllers. We explore the effect of motives by detailing our expectations about the impact of hMNS activation on controllers' behaviour, as formulated in the second hypothesis as follows.

Hypothesis 2: The positive association between BU controllers' hMNS activation and their likelihood to yield to their BU manager's demand to misreport is stronger when BU managers are driven by overt self-interest than when not driven by self-interest.

4.3 Methods

Sample

We recruited professional controllers from the Executive Master of Finance and Control programs of two universities in the Netherlands. These programs are designed for professional controllers and lead to both a Master of Science degree and the professional qualification of Registered Controller. All participants in our sample had several years of relevant working experience in a controller role, ranging from 2 to 25 years and averaging 8.9 years (SD = 7.1). We considered it vital for our study to ensure the cooperation of professional controllers rather than undergraduate students, given the complex and contextual nature of the fiduciary aspect of controllership on which we focus. Using professional controllers satisfies the need that participants recognise the cases described in the scenarios, but comes with restrictions in recruiting participants. Throughout a number of teaching sessions we invited participants to complete a paper-based survey containing scenarios (see below) and to sign up for an EEG measurement in the lab at a university in the Netherlands. Those who participated first completed the survey, and visited the EEG lab within one to five weeks after the survey. Participation in both stages was voluntary, and the EEG participation was rewarded with an amount of EUR 50. We recruited participants during one full academic year of the controlling program. A total of 29 people completed the survey and participated in the EEG measurement procedure (5 females; M_{age}

= 34.7 years; SD_{age} = 7.8 years)[18]. This sample size exceeds the requirements for our statistical analyses, and furthermore implies a relatively high interest in participation, which took place outside office hours.

Scenarios

To measure the propensity of controllers to cooperate with local managers against fiduciary duties, participants responded to a set of situations contained in six scenarios, which were included in the paper-based survey. Each scenario describes a BU controller who is pressed by a BU manager to engage in an action that is not in accordance with fiduciary requirements. Participants indicated on a scale from 1 (= Very unlikely) to 7 (= Very likely) whether they would engage in the action proposed by the BU manager. Table 4.1 provides the structure and an example of the scenarios. The full set of scenarios is reproduced in Appendix 4.1. Each scenario portrays the occurrence of an event beyond the control of the BU manager. This prompts the BU manager to give an emotional response and to propose some action to the BU controller that would ameliorate the situation. This proposition goes against the fiduciary responsibilities of the BU controller. In order to be able to test Hypothesis 2 we developed two types of scenarios. Three scenarios describe a situation in which the BU manager aims to promote self-interest (SELF). The other three situations portray BU managers who press the controller for other reasons than self-interest (NON-SELF). Two paper-based versions with different pseudo-random order were used to control for scenario order effects. The scenarios were developed in structured fashion, each using the same types of components presented in the same order. Before inclusion in the survey, draft versions of the scenarios were pre-tested in a number of interviews with professional controllers, who did not participate in the final study. In seven interviews, each lasting between sixty and ninety minutes, each of the draft scenarios was separately discussed in detail, assessing intelligibility, clarity, recognisability, realism, and relevance. The six scenarios thus validated were submitted to a further pretest—to validate the distinction between the SELF and NON-SELF scenarios—and included in the final survey.

EEG Recording

Participants visited the Erasmus Behavioural Lab on individual appointment for the EEG measurement session. Upon arrival, they were brought to the soundproof and electromagnetically shielded EEG recording chamber, and seated in a comfortable chair[19].

[18] Approval to conduct this study was granted by the board of the university laboratory.

[19] Data were recorded using a BioSemi ActiveTwo amplifier system (www.biosemi.com). Measurement was taken from 32 scalp sites using Ag/AgCl electrodes mounted in an elastic cap according to the International 10-20

Table 4.1 Example scenario

People involved	Ben is BU manager and direct supervisor of BU controller Claire.
Factual situation	Their company is starting the budget rounds for the coming year.
BU manager's commitment	As BU manager, Ben is responsible for meeting the target,
Uncontrollable circumstance	which the BU will fail to meet this year due to unforeseen market circumstances.
Factual consequence for BU manager	Ben fears the risk that the BU will miss its target again next year. This could cost him his job as BU manager.
BU manager's emotional response	Ben tells Claire he is very afraid of losing his job, which would put him in serious personal trouble.
Action proposed by BU manager	He therefore wants to include a safety margin in next year's budget proposal by submitting a lower sales budget than the best estimate.
Trade-off	HQ do not have sufficient market insight to detect this.
Question	Would you include the safety margin in the budget proposal?

Note. This table provides a single scenario by way of example. The full set of scenarios can be found in Appendix A. All scenarios follow the structure and sequence indicated in the left column.

Activation of participants' hMNS was assessed using EEG recording of mu waves while participants were watching movie clips that contained visual emotional stimuli, as further explained below. In resting state, sensorimotor neurons tend to fire synchronously, leading to large amplitude EEG oscillations in the mu frequency band (8-13 Hz). Mu suppression, which is the dampening or disappearance of these oscillations as observable through EEG,

method of electrode placement. Two additional electrodes were placed at the mastoids behind the ears; these were computationally linked and used as reference electrodes. To monitor eye movements and blinks the electrooculogram (EOG) was recorded using four electrodes, attached to the outer canthi of both eyes and to the infraorbital and supraorbital regions of the right eye. The online EEG and EOG signals were recorded with a low-pass filter of 134 Hz. All signals were digitized with a sample rate of 512 Hz and 24-bit A/D conversion.

signifies the activation of sensorimotor neurons. Such activation involves the asynchronous firing of neurons, which occurs in parallel with one's own motor actions (e.g. Pfurtscheller, Neuper, Andrew, & Edlinger, 1997), but also with the observation of the motor actions of others (e.g. Pineda, Allison, & Vankov, 2000). The mu suppression associated with the observation of dynamic emotional expressions of others is therefore indicative of hMNS activation (Oberman et al., 2005; Oberman et al., 2007; Ulloa & Pineda, 2007; Frenkel-Toledo et al., 2014). The visual emotional stimuli, which were originally developed for this purpose by Van der Gaag et al. (2007), consisted of full-colour video clips of dynamic facial expressions by actors. Four different types of clips were used, each representing a within-subject experimental condition: facial expressions of positive emotions; facial expressions of negative emotions; neutral, non-moving facial expressions; and moving abstract shapes[20]. Illustrative still images of the clips are provided in Figure 4.1. There were 72 clips per experimental condition, presented in pseudo-randomly ordered blocks of three clips of the same condition. The full task lasted 19:12 minutes. This experimental task has previously been employed in measuring mirror neuron activation in various studies (e.g. Bastiaansen et al., 2011; Jabbi & Keysers, 2008; Jabbi et al., 2007; Schraa-Tam et al., 2012). The use of dynamic stimuli is in line with recommendations from recent research showing processing differences between dynamic and static representations of facial expressions (Biele & Grabowska, 2006).

Figure 4.1 Experimental stimuli

Note. Example stills of the dynamic stimuli of each condition: (a) positive emotional facial expressions; (b) negative emotional facial expressions; (c) emotionally neutral facial expressions; (d) abstract shapes.

[20] Clips lasted three seconds each and were separated by one-second intervals of black screens. For the conditions containing facial expressions, actors were displayed from the shoulders up, with the face in the center of the image. They all started with a neutral expression, with movement commencing after 0.5 s. The condition of abstract shapes was used as a baseline condition to correct for individual differences in absolute mu power. It consisted of oval figures with striped patterns initially presented statically, then starting to move around the screen after 0.5 s.

4.4 Results

We validated the distinction between the SELF and NON-SELF scenarios as follows. An independent and separate sample of 52 management accounting professionals rated each scenario on two dimensions: the extent to which the BU manager is following his/her self-interest and the extent to which the BU manager is following the interest of the corporation. Table 4.2 presents the mean difference score per scenario between these two dimensions. We aggregated the difference scores of the three SELF scenarios (M = 3.615, SD = 1.426) and those of the three NON-SELF scenarios (M = -.180, SD = 2.130). A paired-samples t-test revealed a statistically significant difference between the two types of scenarios ($t(50) = 11.893$, $p < .001$) such that the perceived level of self-interest driving the BU manager is higher for the SELF scenarios than for the NON-SELF scenarios, in line with our intended focus.

Table 4.2 Scenario validation scores

	mean	**st. dev.**		**mean**	**st. dev.**
SELF			NON-SELF		
Scenario 1	3.769	1.628	*Scenario 4*	-.173	2.691
Scenario 2	3.173	2.102	*Scenario 5*	.135	2.575
Scenario 3	3.904	1.729	*Scenario 6*	-.500	2.429

Note. This table presents means and standard deviations per scenario of the difference between BU managers' self-interest and organisational interest, as perceived by participants. A higher score, therefore, indicates that the participant perceived the BU manager described in the scenario as relatively more driven by self-interest and less driven by corporate interest.

We computed the independent variable mu suppression (MU) as the ratio of mu power between the emotional and abstract shapes conditions[21]. The employment of the abstract

[21] The data were first processed using BrainVision Analyzer 2.0 software (www.brainproducts.com). EEG and EOG data were filtered off-line with a band- pass of 0.1 to 30 Hz (24 dB/octave slope) and were re-referenced off-line to the digital average of the mastoids. Prior to analyzing the EEG data, we corrected for eye blinks and movements as reflected in the EOG (Gratton, Coles, and Donchin 1983). We analyzed the data for electrodes C3, C4, and Cz (Oberman et al., 2005). Data were segmented into epochs of 3,000 ms based on the start and end point of the stimulus clips. Then for each segment the integrated power in the mu range (8–13 Hz) was computed. A Hamming window was used to control for artifacts which may result from data splicing. The resulting segments were averaged per experimental condition.

shapes baseline condition allows us to filter out individual differences in mu power unrelated to mirror neuron activity, for example resulting from differences in scalp thickness or electrode impedances (Pineda & Oberman, 2006). To correct for the inherent non-normality of the ratio variable, we then applied a logarithmic transformation (Oberman et al., 2005). This procedure yielded a measure of mu suppression in which a value of zero indicates no difference in mu power between the emotional and baseline condition, and *lower* values indicate more hMNS activity (Ulloa & Pineda, 2007), associated with *higher* levels of trait empathy (see Yang et al., 2009).

Through the survey we obtained six scores per participant reflecting their self-reported likelihood of engaging in certain actions in cooperation with BU managers. We refer to this variable as COOP. The overall mean score was 3.33 (SD = .87) with means per scenario across participants ranging from 2.89 to 4.11. Descriptive statistics for COOP per scenario are reported in Table 4.3.

Table 4.3 Descriptive statistics for COOP

	mean	**st. dev.**	**min.**	**max.**
SELF				
Scenario 1	4.11	1.76	1	7
Scenario 2	3.00	1.47	1	6
Scenario 3	3.89	1.42	1	6
NON-SELF				
Scenario 4	2.89	1.45	1	6
Scenario 5	3.52	1.53	1	6
Scenario 6	2.78	1.45	1	7

Note. This table provides descriptive statistics for controllers' self-reported likelihood of cooperation with the request of the BU manager in the scenario (COOP). This variable was measured on a scale from 1 (= Very unlikely) to 7 (= Very likely).

To test the main hypothesis that mirror neuron activation is positively associated with cooperation, we computed an aggregate score over the six scenarios for each of the 29 participants and regressed this measure on MU. This yielded a standardized regression coefficient of –.445, which was significantly different from zero ($t(27) = -2.485$; $p = .020$).

Higher mu power while observing emotional stimuli, which indicates a weaker response, is thus generally associated with lower willingness to cooperate[22]. This result supports hypothesis 1.

Our second test aims to establish whether this result holds indiscriminately across the six scenarios or whether, as predicted in hypothesis 2, MU is more strongly associated with COOP for the three SELF scenarios than the three NON-SELF scenarios. We refer to this distinction with the moderating variable scenario type (TYPE). By averaging participants' three scores per scenario type we obtained two measures per participant, which we submitted to a repeated-measures ANCOVA using TYPE as within-subject factor and MU as covariate. This revealed a statistically significant cross-level interaction between MU and TYPE (Wilks' Lambda = .836; $F(27,1) = 5.290$; $p = .029$) as well as a main effect of TYPE ($F(27,1) = 4.567$; $p = .042$) and a main between-subjects effect of MU ($F(27,1) = 5.533$; $p = .026$). MU was more predictive of COOP for the SELF scenarios than for the NON-SELF scenarios, in accordance with hypothesis 2.

We further investigated the strength of the effect using Hierarchical Linear Modelling (HLM). Our research design resulted in a dataset with two levels. The independent variable MU is measured at the level of the participant; the dependent variable COOP is measured at the scenario level and therefore was observed six times per individual; and the moderating variable TYPE is a dummy variable at the scenario level. Thus, our multilevel dataset contains 174 observations at Level 1 and 29 observations at Level 2. To test hypothesis 2 we were interested in a cross-level interaction effect between MU and TYPE in predicting COOP. HLM enables us to model and test this association in a linear model represented by a single equation with a complex error structure (see Bryk & Raudenbush, 1992), avoiding the loss of information from aggregating scenario scores into two values per participant. We present the results of two models here, both estimated using a Generalized Least Squares algorithm. Model 1 addresses the main effect of mu suppression on cooperation. In Model 2, we introduce TYPE as a first-level explanatory variable with a cross-level interaction with MU[23]. In order to get more meaningful

[22] We included two subscales of the Interpersonal Reactivity Index (IRI) developed by Davis (1980) to explore whether MU suppression is correlated with self-reported empathic concern (EC) and perspective taking (PT). EC has been associated with hMNS activation in an fMRI study by Kaplan and Iacoboni (2006) and Pfeifer et al. (2008). PT served an exploratory function. Our data reveal correlations with MU of -.161 for EC and -.119 for PT and with COOP of .138 for EC and .016 for PT. While these effects do not reach conventional levels of statistical significance ($p < .05$) for our sample size ($n = 29$), they suggest some correspondence between self-reported empathy and mu suppression.

[23] We tested additional models to control for the effects of gender, age, and work experience, which were measured at the personal level (i.e. Level 2). Each control variable was tested separately for a main effect on

coefficients, the second-level independent variable MU was centred around its mean (Algina & Swaminathan, 2011), and furthermore the dependent variable COOP was centred around scenario mean, so that scores indicated the participants' deviation from the average score across participants on a particular scenario.

The main results of parameter estimations for both models can be found in Table 4.4. Model 1 reveals that MU is a statistically significant predictor of COOP (γ_{01} = -1.321; t(27) = -2.338; p = .027). This supports the notion that there is a negative main effect of mu power on cooperation, as predicted in hypothesis 1. Model 2 allowed us to further qualify this association. There was a significant interaction between MU and TYPE (γ_{11} = -1.551; t(171) = -2.088; p = .039), such that MU was more strongly related to COOP when TYPE was one rather than zero. The main effect of MU in Model 2, which can be interpreted as the coefficient of MU when TYPE is zero, was now no longer statistically significant (γ_{01} = -.546; t(27) = -.807; p = .427). Jointly, these findings provide support for the moderating effect of TYPE as formulated in hypothesis 2: MU is most predictive of COOP when the manager is explicitly driven by self-interest.

Table 4.4 Parameter estimations for HLM

		coefficient	**st. error**	**t-ratio**	***p*-value**
Model 1					
Intercept	γ_{00}	0.000	.15	0.000	1.000
MU	γ_{01}	-1.321	.57	-2.338	.027
Model 2					
Intercept	γ_{00}	0.000	.18	0.000	1.000
MU	γ_{01}	-.546	.68	-.807	.427
TYPE	γ_{10}	0.000	.20	0.000	1.000
MU*TYPE	γ_{11}	-1.551	.74	-2.088	.039

Note. The models specified below were estimated using the HLM for Windows 7 software package (Scientific Software International, Inc, USA). In both models the dependent variable is the participant's likelihood of cooperation with the BU manager, centred around scenario mean. INCPT denotes the intercept, which is equal to zero as a result of mean

COOP and a cross-level interaction effect with SELF. No evidence was found for the existence of such effects in any of the additional models. Therefore, the models presented here do not include these control variables.

centering. MU is the participant's index of mu suppression. TYPE is a dummy variable, with a value of 1 for the scenarios where the BU manager pursued a self-interest. The *p*-values are based on two-tailed testing.

Model 1: $COOP_{ij} = \gamma_{00} + \gamma_{01}*MU_j + u_{0j} + r_{ij}$

Model 2: $COOP_{ij} = \gamma_{00} + \gamma_{01}*MU_j + \gamma_{10}*TYPE_{ij} + \gamma_{11}*MU_j*TYPE_{ij} + u_{0j} + r_{ij}$

4.5 Discussion and conclusions

The goal of this chapter is to explain BU controllers' propensity to engage in financial reporting behaviour that constitutes a violation of their fiduciary obligations. Based on the mirror neuron system literature on the neurobiological drivers of social behaviour, we expected a positive association between mirror neuron activation during a dynamic facial expression task and controllers' inclinations to yield to social pressure from their BU managers. This pressure has been suggested as a cause of misreporting in some previous studies on financial reporting integrity violations (Davis et al., 2006; Hartmann & Maas, 2010). The results of our study show that controllers differ in their receptivity to such pressure, and that this predicts their subsequent reporting behaviour. In particular, our results indicate a strong positive association between hMNS activation, as measured by mu suppression during the emotion observation task, and controllers' propensity to give in to the social pressure exerted by BU managers. This finding points to the role of the individual neurobiological characteristics of accounting professionals in carrying out fiduciary obligations. Controllers who are relatively sensitive to emotional cues are likely to bias their decisions towards the interests of their managers, and especially so when these interests are personal. This sensitivity drives their inclination to compromise on their fiduciary role of assuring financial reporting integrity.

These findings have a number of implications for our theoretical understanding of the intra-organisational causes of financial misreporting. First, in addition to confirming the role of social pressure as an important antecedent of financial reporting problems at the level of accounting professionals inside the firm (DeZoort & Lord, 1997), we show the importance of a specific individual characteristic. Second, our results contribute to the growing debate on the roles of BU controllers (Hartmann & Maas, 2010; Maas & Matějka, 2009). In addition to job design, structure, and the absence or presence of professional behavioural norms, we recommend extending this debate by a focus on controllers' neurobiological characteristics to explain their reporting behaviours in the face of emotional pressure. This has direct implications for our understanding of what it takes to be a 'good' accounting professional. The well-known picture of the archetypical

accountant who stays "cold, aloof and impersonal" (DeCoster & Rhode, 1971, p. 651) amid an ocean of emotional pressures may reflect a desirable characterization, rather than a disagreeable caricature (Miley & Read, 2012). Note, however, that our sample of controllers shows considerable variation in hMNS activation, with substantial explanatory power on related fiduciary behaviours, indicating that such stereotypes do not adequately describe the entire population of professionals. Third, our findings both confirm available neuropsychological evidence on the role of the hMNS and extend those findings to the field of accounting. In particular, our study adds to the novel basis for explaining accounting systems and accounting behaviour by neurobiological mechanisms as suggested by Dickhaut (2009) and Dickhaut et al. (2010).

Our findings have several practical implications as well. While emotional commitment is generally seen as a desirable social characteristic, and has even been proposed as a cure for unethical accounting behaviour (McPhail, 2001), our study suggests that emotional receptivity may cause excessive alignment between the interests of the BU manager and those served by the reporting behaviour of the BU controller. In other words, controllers low on automatic compliance with emotional pressure may be best equipped to counter the possible personal incentives to misreport financial results. When designing internal control structures, CFOs need to be aware of the reporting risks associated with the development of 'business partner' controllers in firms as advocated in theory and practice (Maas & Matějka, 2009). Our study suggests one way of mitigating these risks is by investing in personal relationships within the control structure. In addition, organisations in practice could consider adopting selection, placement, and other HR procedures for controllers that take into account the neurobiological drivers of controller behaviour. Such procedures may be an important complement to the codes of conduct published by professional controller bodies (CIMA, 2010; IMA, 2011). While these codes acknowledge the importance of personal integrity, they are not likely to be effective against a person's neurobiologically determined inclinations, which typically operate unconsciously.

When interpreting the theoretical and empirical implications of this study, a number of limitations should be considered. First, our investigation focuses on a limited set of the competences, skills and inclinations that controllers typically bring to the work place. Since the activation of the mirror neuron system is predictive of a wider set of social behaviour (Iacoboni, 2009), a further analysis of the impact of emotional contagion should include its potential positive effects. Indeed, if emotional responsiveness is an indication of BU controllers' empathic ability, it may be predictive of controllers' ability to support the other needs of their BU managers, such as the facilitation of business decisions. In our design we explicitly excluded such potential positive effects. Second, our use of an EEG-

based analysis to test a neurobiological theory limits the ease of understanding the implications of our findings. Neuroscience is a rapidly developing field, which continues to discuss the nature, consequences and measurement of fundamental neurobiological processes, including the hMNS. While our theory and method are fully in line with state-of-the-art investigations in this field of neuroscience, this requires some care in interpreting our findings. At the same time it opens up a promising avenue for cross-disciplinary research.

Concerning such and other future studies, we suggest three potentially fruitful avenues. First, while our study focuses on dysfunctional fiduciary behaviour of controllers and disregards their role as support providers to BU management, we propose that future research should address this question. Using additional scenarios with situations crucial to such a support role may be a first step in that direction. Scenarios which present situations in which controllers face a trade-off between their fiduciary and support roles may be a further step to explore the role of emotional and implicit social cues on controllers' behaviour. Second, the findings presented here are based on self-reported behaviour in hypothetical scenarios. While these situations were carefully designed and validated, there is an opportunity for future studies to confirm the association between emotional contagion and controller behaviour using field research. Third, researchers could observe the role of emotional pressure during actual decision-making processes. This would require extending the neuroscientific measurement during the scenario task. Taking the findings, limitations and directions for future research together, we conclude that this study demonstrates the potential synergy of using the theoretical developments in neuroscience in the ongoing quest in the Accounting literature to understand the actual and desired behaviour of controllers and other accounting professionals.

Appendix 4.1 Scenarios

Below we provide the full text of the six scenarios. Scenarios 1 to 3 present situations in which the BU manager is pursuing a clear self-interest, while in Scenarios 4 to 6 the BU manager does not explicitly refer to self-interest. The Pearson correlation of responses per scenario with the respondents' mu suppression score (MU) are included.

Scenario 1
Jim is BU manager and direct supervisor of BU controller Carl. For most of the current year, the BU's performance was quite good. In large part this is due to Jim's excellent management skills. However, a major production problem in December threatens the BU to face a loss this year. This would cost Jim his full bonus for the year. He was counting on the bonus, so this prospect seriously distresses him, as his family situation is problematic. Jim proposes to release part of an existing provision to improve the BU's bottom line. The provision is in a grey area, so that accounting rules allow interpretation both ways.
Correlation with MU: r = -.413; p = .026

Scenario 2
Victor is BU manager and direct supervisor of BU controller Bob. The BU has shown three years of solid performance. Victor has been working very hard in this period and turned the BU into a successful business. However, this year the BU is about to end below the sales target. This would strongly decrease Victor's chances of getting the promotion he was hoping for. Victor is very excited about a possible step up the hierarchy in the company, and is very keen on making the target. Victor asks Bob to authorize a sharp price discount for a sales promotion in December, which would ensure the BU to meet its target, even though sales in early next year would suffer.
Correlation with MU: r = -.299; p = .115

Scenario 3
Ben is BU manager and direct supervisor of BU controller Claire. Their company is starting the budget rounds for the coming year. As BU manager, Ben is responsible for meeting the target, which the BU will fail to meet this year due to unforeseen market circumstances. Ben fears the risk that the BU will miss its target again next year. This could cost him his job as BU manager. Ben tells Claire he is very afraid of losing his job, which would put him in serious personal trouble. He therefore wants to include a safety

margin in next year's budget proposal by submitting a lower sales budget than the best estimate. HQ do not have sufficient market insight to detect this.
Correlation with MU: r = -.406; p = .029

Scenario 4
Mark is BU manager and direct supervisor of BU controller Helen. Mark is planning to hire a consultancy for a project next year, which is dependent on having sufficient budget. Mark has shown enormous enthusiasm and passion for the project. This year's consulting budget has not been used, due to a delay in one of the other projects. HQ might therefore cut next year's budget, in which case the project would have to be cancelled. Mark is very motivated to do everything he can to save it. He proposes to Helen to pay a substantial part of the fee from the current year's budget, even though the real work won't start until next year.
Correlation with MU: r = -.142; p = .464

Scenario 5
David is BU manager and direct supervisor of BU controller Henry. Henry is preparing the innovation budget for next year, using best estimates of costs. David describes several of the innovation projects with great enthusiasm and belief. However, it is likely that HQ will make budget cuts across all BU's. This would render it impossible to carry out some of the projects in the BU's pipeline. David shows real passion to make the projects happen. He therefore proposes to increase the cost estimations somewhat. David says that in order to end up with fair amounts, the controller needs to submit overestimated numbers, in spite of the corporate policy to use best estimates.
Correlation with MU: r = .164; p = .395

Scenario 6
George is BU manager and direct supervisor of BU controller James. The BU is considering a small acquisition which George strongly supports. James is required by HQ to use the standard 25% discount rate. HQ do not allow deviations from the standard discount rate. This yields a slightly negative NPV, leaving the target undervalued: the company has a solid, proven track record, and a 15% rate would be more appropriate. George is absolutely furious about the standard rate of 25%. George proposes to increase projected sales growth beyond Year 3 in order to get a realistic NPV with a reasonable chance of approval by HQ. This sales growth prediction would most likely not be met.
Correlation with MU: r = -.337; p = .074

Chapter 5
Discussion and conclusions

5.1 Summary of the main findings

Process accountability disrupts affective judgement

Judgements under process accountability tend to rely relatively more on reasoned processes (De Dreu, Beersma, Stroebe, & Euwema, 2006) and less on affective evaluations (Lerner, Goldberg, & Tetlock, 1998). This has generally been considered to have a beneficial effect on judgement accuracy (see De Langhe, Van Osselaer, & Wierenga, 2011). However, recent work on the role of affect in judgement and decision making shows that under predictable circumstances affective evaluation contributes to judgement accuracy (Mikels, Maglio, Reed, & Kaplowitz, 2011; Slovic, Finucane, Peters, & MacGregor, 2002). The disruption of affect (Halberstadt & Wilson, 2008), as resulting from process accountability, may therefore have a negative net impact. This is the central hypothesis we set out to examine in Chapter 2. In conjunction we studied the interactive effect of direct monetary incentives. In addition to the affect disruption effect, accountability has a motivational effect which is generally beneficial (Bonner & Sprinkle, 2002). We expected a ceiling effect such that the motivational effect of accountability is smaller in the presence of a monetary incentive than in its absence. To increase the external validity of our investigation and to isolate the affect disruption effect, we included direct monetary incentives in our research design as a moderating variable.

Chapter 2 consists of three behavioural experiments. An adaptation of the advertisement judgement task of McMackin and Slovic (2000) served as the instrument for measuring judgement accuracy. Study 1 shows process accountability interacts with monetary incentives such that accountability lowered judgement accuracy in the presence of monetary incentives, but not in their absence. In Study 2 we replicated these findings and in addition we contrasted process accountability with outcome accountability. The latter was expected to have a similar motivational effect, but not an affect disruption effect. Consistent with our expectation, outcome-accountable participants outperformed process-accountable participants regardless of the presence of monetary incentives. In Study 3 we manipulated the validity of the affect cue. This reversed the effect of process accountability, such that accountable participants now made more accurate judgements than those in the control group.

Process accountability inhibits insight

The problem solving literature describes the case of insight solutions (Bowden, Jung-Beeman, Fleck, & Kounios, 2005). Commonly known as the 'aha!-effect', an insight solution comes suddenly and without introspective access to its process or origin. Since process accountability imposes the need for a solution strategy that can be narrated and justified, we expected a reduced reliance on insight, and an increased reliance on analytic solving strategies, under accountability. This processing shift was expected to manifest itself in solution rates, in contemporaneous EEG, and in oculomotor behaviour.

These expectations were tested in three experimental studies, each of two-celled between-subjects design. We used the remote associates task (Mednick, 1962), which provides a set of problems compatible with insight and analytic solving strategies, and moreover allowing a sufficient amount of trials per participant to test our EEG and eye-tracking hypotheses. In line with our findings in the first investigation, all participants had a monetary incentive to ensure an externally valid baseline motivation. In Study 1 we established the negative effect of process accountability on solution rates. The EEGs of Study 2 showed accountable subjects exhibit relatively lower power in the beta and lower gamma frequency range in the right hemisphere than did control subjects. This implies a more focused level of semantic processing, consistent with our processing shift hypothesis. Further support for this notion was found in Study 3, where eye-tracking analysis indicated shorter lexical activation time for accountable subjects. In addition, these participants spent less time on the least-attended cue word than those in the control condition, as expected for analytic solving strategies. In sum, we found evidence from behavioural, electroencephalographic, and eye-tracking sources jointly indicating that accountability inclines people away from insight solutions and towards analytic strategies of problem solving, to the detriment of performance.

Mu suppression predicts controllers' compromise on fiduciary duties

The academic literature on the organisational roles of the controller describes the tension arising between the fiduciary responsibility of safeguarding reporting integrity and the decision support role (e.g. Hopper, 1980; Indjejikian & Matějka, 2009). Some evidence suggests an increased emphasis on the decision support role heightens the integrity risk (e.g. Maas & Matějka, 2009), although it has also been argued that involvement in local decisions is a condition to effective control of reporting integrity (Sathe, 1982, 1983). We raised the question of the personal competences controllers should have to safeguard reporting in the face of their role tension, and the underlying neurological mechanisms

giving rise to these competences. Based on the mirror neuron system literature (Iacoboni, 2009) we constructed a theory predicting controllers' compromises on functional responsibility based on the extent to which they engage in simulation of others' emotions by means of the mirror neuron system.

To examine our main hypothesis, we measured controllers' propensity to yield to social pressure with a set of scenarios, and on separate occasion recorded their EEG while observing emotional facial expressions. We found a moderately strong correlation between these two variables. Moreover, in line with our supplementary hypothesis, this relation was stronger for scenarios in which managers were overtly pursuing their self-interest than for scenarios where they had non-selfish motives.

5.2 Implications for process accountability

Accountability is not always beneficial for judgement and decision making and problem solving. While this was known for outcome accountability already (De Langhe et al., 2011), we show that specifically for process accountability circumstances exist under which consequences are negative, both relative to OA and NA. This potential for negative impact is perhaps understated in the literature because of the motivational effect of accountability, which may compensate for dysfunctional effects—but only in the absence of monetary incentives. A negative effect seems most likely to occur when the reasoned, deliberative, analytic, sequential approach associated with accountability has doubtful value, as is the case for very complex problems (e.g. Mikels et al., 2011), or when affect is a relatively valid cue (e.g. McMackin & Slovic, 2000), or when insight solutions are a plausible strategy (e.g. Kounios et al., 2008).

Future research should re-examine some of the documented effects of process accountability in the presence of monetary incentives. Such an approach would arguably be more externally valid for the organisational setting, and will potentially lead to revision of some of the assumed benefits of process accountability for judgement and decision making. Likewise, a further targeted examination of the circumstances under which process accountability hampers performance will allow for a more nuanced theoretical view and help derive more specific recommendations for practice.

On the basis of our theories and findings a number of recommendations to practitioners can be made. Organisations should implement process accountability with caution. People are not always aware of their cognitive processes, and pressuring them to provide accounts of their judgement or problem solving approaches may move them away from the optimal approach and thereby lower the accuracy of judgement or the likelihood of solving a

problem. Especially when managers' affective evaluations are likely to be relevant or when insight solving is a desirable strategy, organisations may be better off not to pressure managers to account for their cognitive processes.

5.3 Implications for controller roles

Our findings show that beyond the organisational context (Maas & Matějka, 2009) and direct monetary incentives (Indjejikian & Matějka, 2009) the controller's physiological make-up is an important factor in explaining compromises on reporting integrity. The finding that mirror neuron system activation is associated with controllers' propensity to misreport confirms the importance of social pressure in reporting issues (DeZoort & Lord, 1997). Importantly, this fact is unlikely addressed by behavioural norms and codes of ethical conduct. Our findings thus extend the academic debate through our focus on neurobiological characteristics (cf. Becker, Cropanzano, & Sanfey, 2011).

Although we took care in designing and validating scenarios that were externally valid, there is a clear opportunity for future research to confirm our findings using field observations. Furthermore, other relevant neurobiological characteristics could be considered. For example, approach-avoidance tendencies, which are associated with hemispheric differences (Amodio, Shah, Sigelman, Brazy, & Harmon-Jones, 2004), may add further explanatory power to our model. Finally, in this investigation we focused on the responsibility of controllers in safeguarding reporting integrity. Future research may examine the influence of mirror neuron system activation on controllers' decision support role. Given the importance of effective social interactions for that role, it is plausible that stronger activation relates to more effective decision support.

When it comes to designing the organisation's internal control structure, corporate boards should be aware of the risks resulting from controllers' involvement with business unit management. Especially considering calls for more socially gifted controllers (cf. Sathe, 1983), an increase in practice of emphasis on controllers' decision support role (Burns & Baldvinsdottir, 2005; Granlund & Lukka, 1998), and recent accounting scandals, this warning merits emphasis. The stereotypical controller who takes more pleasure in numbers than in social interactions may not be so bad after all.

5.4 In conclusion

In the research reported here we set out to investigate issues of organisational accountability. We looked at two aspects of management control systems, both of which are meant to mitigate agency problems and improve organisational effectiveness. In both cases we emphasised potential problems and dysfunctional effects associated with these solutions. Our analysis was made possible by developments in relatively naturalistic fields: neuroscience and eye-tracking informed our theories and supplied part of our methods.

We shed new light on process accountability, and showed that it is not universally beneficial. To do so we drew on psychological theories of affect and insight, as well as neuropsychological theories on hemispheric differences in language processing. Furthermore, we used EEG and eye-tracking measurements to get a unique view of the process by which PA influences problem solving. To our knowledge this is the first time PA has been studied in neurological terms.

We also provided new insights on the roles of controllers. While the literature reflects the pervasiveness of the problematic dual roles of controllers, little was known about the personal factors influencing controllers' propensity to compromise on integrity under social pressure. We theoretically explained this propensity as a function of personal neurological make-up and tested our theory using EEG measurements. In this project we were able to do without major psychological constructs by emphasising the direct neurological link between perception and action, and by explaining our variable of interest directly in neurological terms.

A major challenge is to apply novel insights from fields like neuroscience or eye-tracking to problems in management accounting. The various fields are not naturally in conversation, and the translation of theoretical constructs is difficult. Nevertheless, progress in these fundamental sciences is fast, and as an applied science management accounting should strive to be consistent with them and informed by them. Moreover, the challenge posed by naturalistic perspectives also offers an opportunity: to revisit our theoretical constructs, and to come free of the traditional and sometimes unreflective use of conceptions of agency. This is the promise of neuroscience: to replace the humanistic agent with a naturalistic agent. To study man as an animal. Not as *merely* an animal, to be sure, not as an animal like all others—after all, we are dealing with the animal in possession of words, discourse, speech, arguments, reasons, opinions, opposable thumbs, a massive neo-cortex, lighters, wheels, music, and organisations—but an animal nevertheless. The *zōon logon echon:* the accountable animal.

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Summary

Social relations make up an important part of management control structures and are therefore a central topic in management accounting research. In this dissertation we investigate two themes around this topic. In order to do so, we make use of developments in neuroscience and eye-tracking by importing theories and methods to supplement the traditional psychological and economic perspective on management accounting.

Process accountability impairs affective judgement making and insight problem solving. Some mental processes are more difficult to access introspectively than others, and this opacity makes it troublesome to account for them. Nevertheless, these processes can be useful in making judgements and solving problems. We find that process accountability drives people away from affective judgements and insight solutions, leading to impoverished performance on a number of tasks. This goes against the received wisdom in theory and practice that process accountability improves judgements and decisions. We supply unique evidence on the processing shift effectuated by accountability through EEG and eye-tracking measures.

Neuroscience has recently made important advances on emotion recognition. We use this theoretical perspective to explain controller behaviour. We look at a setting where controllers are on the one hand accountable to business unit (BU) managers in their role of providing support for local decision making, and on the other hand have a fiduciary responsibility to ensure sound reporting to higher management. Controllers often work with BU managers on a daily basis and form strong relationships with them; in turn, BU managers often have incentives for misreporting. This brings an integrity threat. Therefore it is important to know what determines a controller's propensity to compromise on integrity under social pressure from BU management. We look at the suppression of EEG mu waves in the sensorimotor cortex while observing emotional facial expressions, and find it explains a substantial part of variation in controllers' responses to professional dilemmas.

In sum, this dissertation marks an attempt to incorporate into management accounting research some developments in quickly developing naturalistic fields like neuroscience and eye-tracking. By using novel methods of measurement and revisiting or replacing traditional theoretical constructs, we contribute to the movement of naturalising accounting.

Samenvatting (Dutch summary)

Sociale relaties vormen een cruciaal deel van management control-structuren en zijn derhalve een belangrijk onderwerp van management accounting-onderzoek. In deze dissertatie behandelen wij twee thema's rond dit onderwerp. Met dat doel maken we gebruik van ontwikkelingen in neurowetenschappen en eye-tracking, door theorieën en methoden te lenen die het traditionele psychologische en economische perspectief op management accounting aanvullen.

Process accountability verhindert het gevoelsmatig vellen van oordelen en het oplossen van problemen door middel van inzicht. Voor sommige mentale processen is introspectie lastiger dan voor andere; dat maakt het moeilijker ze te verantwoorden. Desalniettemin kunnen deze processen nuttig zijn in het vellen van oordelen en het oplossen van problemen. Wij tonen aan dat process accountability de neiging tot gevoelsmatig oordelen en de waarschijnlijkheid van inzichten vermindert, hetgeen leidt tot verlaagde prestaties op verschillende taken. Hiermee gaan we in tegen het heersende beeld dat process accountability oordelen en beslissingen verbetert. Met EEG en eye-tracking bieden we uniek bewijs voor de procesverandering die accountability veroorzaakt.

De neurowetenschappen hebben belangrijke vorderingen gemaakt op het gebied van herkenning van emoties. Wij gebruiken dit theoretisch perspectief om het gedrag van controllers te verklaren in een setting waarin controllers enerzijds verantwoording afleggen aan business unit (BU) managers en anderzijds verantwoordelijkheid dragen voor betrouwbare rapportage naar hoger management. Controllers werken doorgaans op dagelijkse basis samen met BU managers en vormen hechte relaties met hen; BU managers hebben vaak incentives voor onjuiste rapportage. Hierdoor ontstaat een integriteitsrisico. Een belangrijke vraag is wat de bereidheid van controllers bepaalt om ten koste van de integriteit te buigen onder druk van BU managers. We kijken naar de suppressie van mu-golven in de sensori-motorcortex in EEG tijdens het observeren van emotionele gezichtsuitdrukkingen en zijn in staat daarmee een substantieel deel te verklaren van variantie in de reacties van controllers op professionele dilemma's.

Deze dissertatie vormt een poging nieuwe ontwikkelingen op het gebied van neurowetenschappen en eye-tracking te betrekken op management accounting-onderzoek. Dankzij nieuwe meetmethoden en het herzien en vervangen van traditionele theoretische constructen dragen we bij aan de naturalisatie van accounting.

About the author

Your author was born in Amersfoort (1985), emulating such colourful figures as Piet Mondriaan (1872) and Jopie Heesters (1903). Since then he has gone from strength to strength, collecting a Bachelor's degree in International Business from Tilburg University, a CEMS Master's in International Management from RSM and HEC, a quantum of professional experience as controller, and a Master's degree in Philosophy from King's College London.

Philip started the ERIM PhD trajectory in 2011. His empirical research focuses on social relations of accountability in organisations. Using a mixture of traditional and novel methods including behavioural, neuroscientific, and eye-tracking experiments, Philip seeks to contribute to a new approach to accounting research. His research has been presented at international conferences including the annual meetings of *Academy of Management* and *American Accounting Association*, the mid-year meeting of the latter's *Management Accounting Section*, and the *NeuroPsychoEconomics Conference.* A first paper is under review at *Accounting, Organizations & Society*, and further publications in academic journals are planned.

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Erasmus Research Institute of Management - ERiM

THE ACCOUNTABLE ANIMAL

NATURALISING THE MANAGEMENT CONTROL PROBLEM

In this dissertation we investigate two themes around the topic of social relations in management control structures. We use developments in neuroscience and eye-tracking to supplement the traditional psychological and economic perspective on management accounting.

Process accountability changes processes of judgement and problem solving. Some mental processes are more difficult to access introspectively than others, and this opacity makes it troublesome to account for them, even if they are useful for making judgements and solving problems. Process accountability drives people away from affective judgements and insight solutions, lowering performance on various tasks. Our findings go against the received wisdom that accountability improves judgements and decisions. We supply unique evidence on this shift through EEG and eye-tracking measures.

Neuroscience has recently made important advances on emotion recognition. We use this theoretical perspective to explain controller behaviour. It is important to know what determines a controller's propensity to compromise on integrity under social pressure from business unit management. We look at the suppression of EEG mu waves in the sensorimotor cortex while observing emotional facial expressions, and find it explains a substantial part of variation in controllers' responses to professional dilemmas: those who show stronger mu suppression are more inclined to yield to managers' emotional pressure.

In sum, this dissertation marks an attempt to incorporate into management accounting research some developments in quickly developing naturalistic fields like neuroscience and eye-tracking. By using novel methods of measurement and revisiting or replacing traditional theoretical constructs, we contribute to the movement of naturalising accounting.

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