Decision making in a chaotic world: The impact of randomness on confirmatory information processing in personal and economic decision making

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"Chaos in the world brings uneasiness, but it also allows the opportunity for creativity and growth."

(Tom Barrett)

PREFACE

The world's ever-increasing instability and chaos is accompanied by ever-louder calls for order, structure, and predictability, as individuals feel a strong need to assert and maintain a sense of non-randomness in their day-to-day lives. To this purpose, people spend a lot of time cleaning up, organizing paperwork, or scheduling their days; strive to know what to expect from others (and thus to avoid unpredictable social interactions); enjoy living in a stable sociopolitical system; and preferentially choose worldviews and metaphysical beliefs that give their lives meaning and order.

Against this background, it is unsurprising that people often feel overwhelmed when faced with making tough personal or economic decisions in chaotic contexts. In such a decision making situation, people tend to re-establish order and structure before making a choice, since – according to common knowledge – external order contributes to a clear mind. Though the amount of chaos vs. order in one's environment seems to play a key role for decision makers, research has scarcely explored the effects of randomness on decision making processes.

The present thesis aims to close this particular research gap, doing so by addressing the effects of randomness on a specific phenomenon in individual decision making: confirmatory information processing. **Chapter 1** introduces the theoretical background the present research is built upon, discussing the phenomenon of confirmatory information processing (including its relevant theoretical models and current empirical findings). The chapter then presents the conception of randomness underlying the present research and closes by outlining its specific hypotheses. **Chapters 2-4** subsequently present three study series that explore the influence of distinct dimensions of randomness on confirmatory information processing. Finally, **Chapter 5** provides a general conclusion to the present research.

Contents

Abstract

When making a decision, individuals demonstrate a systematic preference for information that supports rather than conflicts with their existing beliefs, standpoints, or decisions. This phenomenon is known as confirmatory information processing and is observable in information search and information evaluation.

Though prior research has provided initial evidence that confirmatory information processing might be affected by randomness that is perceived in the physical, social, and metaphysical environment, these relations have not yet been systematically explored. In order to close this research gap, the present thesis undertook three study series to investigate whether physical randomness (i.e., contextual order), social randomness (i.e., perceived personal control), and metaphysical randomness (i.e., order offered by metaphysical belief systems) affect confirmatory information processing in social and economic decision making. Each of the three study series is presented, theoretically embedded, and discussed in its own distinct chapter.

Collectively, the present data propose that randomness affects confirmatory information processing regardless of the environment that it is perceived in. However, the effects of physical, social, and metaphysical randomness are not uniform. The results of Study Series 1 suggest that high physical randomness decreases confirmatory information processing. In contrast, Study Series 2 consistently suggests that high social randomness increases confirmatory information search, but does not affect confirmatory information evaluation. Specifically, high social randomness triggers feelings of helplessness, which in turn lead to heightened levels of confirmatory information search. Finally, the results of Study Series 3 indicate that low metaphysical randomness counteracts confirmatory information processing tendencies. Mediational analyses suggested that individuals who were primed with religious concepts indicated less commitment to their decision, which resulted in decreased levels of confirmatory information processing. Theoretical and practical implications for all three study series are discussed.

1. Background

1.1 Confirmatory information processing

In everyday decision making, individuals are greeted by a plethora of information, which is publically accessible on the web, on television, or in newspapers. No matter whether people make a personal decision (e.g., Where should I spend my holidays?), or an economic decision (e.g., Which company should I invest in?), there are numerous relevant arguments for and against each possible decision alternative. However, the full range of diverse arguments often remains unexplored, as people tend to prefer information that supports rather than challenges their *a priori* beliefs, standpoints, or decisions. This phenomenon is also referred to as *confirmatory information processing* (Fischer, Greitemeyer, & Frey, 2008).

Following a decision, confirmatory information processing can typically be observed in information search (a phenomenon also called *selective exposure*; Frey, 1986) and/or in information evaluation (a phenomenon also called *biased assimilation*; Ditto & Lopez, 1992; for a recent review, see Fischer & Greitemeyer, 2010; Hart et al., 2009). In information search, people tend to preferentially seek out decision-consistent information while neglecting decision-inconsistent information. Similarly, when it comes to information evaluation, individuals tend to assess decision-consistent information as being of higher quality than decision-inconsistent information.

In general, confirmatory information processing implies both functional and dysfunctional aspects. For example, individuals can benefit from confirmatory information processing, as it helps them to alleviate negative mood states (e.g., Jonas, Graupmann, & Frey, 2006). Furthermore, confirmatory information processing promotes the capacity to act in an efficient way, as "a high degree of selectivity […] often save[s] the decision maker from unproductive confusion, unnecessary delays, and a waste of his resources in a fruitless quest for an elusive, faultless alternative" (Janis & Mann, 1977, p. 13). However,

confirmatory information processing can severely impair decision quality, as people may cling to their decisions even when faced with evidence that contradicts them. In other words, individuals may overlook the potential risks of their preferred choice, which can lead to poor decision outcomes (Janis, 1982; Nemeth & Rogers, 1996). It is thus important to investigate those situational factors and psychological processes that might increase or reduce confirmatory information processing. However, before taking a closer look at research on confirmatory information processing, the question of why people actually engage in it must be addressed.

1.1.1 Theoretical perspectives

Over the years, research has offered a rather inconsistent set of frameworks for explaining confirmatory information processing, with the majority of models tending to focus on confirmatory information search rather than confirmatory information evaluation. Nonetheless, these frameworks give important insights into the psychological processes that might underlie confirmatory information processing. Three major theoretical approaches will be introduced in the following section. These are (a) motivational accounts (i.e., dissonance theory; Festinger, 1957; Frey, 1986), (b) cognitive accounts (Ditto & Lopez, 1992; Ditto, Scepansky, Munro, Apanovitch, & Lockhart, 1998; Lord, Ross, & Lepper, 1979), and (c) recent accounts that combine motivational and cognitive aspects (i.e., the heuristic semantic model; Chaiken, Liberman, & Eagly, 1989).

One traditional (and still major) motivational framework is dissonance theory (Festinger, 1957). According to Festinger (1957), people have a general need for cognitive consistency; thus, when two self-relevant cognitions (e.g., attitudes) do not fit together, individuals experience dissonance. Dissonance creates the aversive state of psychological discomfort (Elliot & Devine, 1994), which motivates individuals to attenuate this aversive state by reducing the discrepancy between the incompatible cognitions. This can be done in various ways such as adding consonant cognitive elements or subtracting dissonant ones (Festinger, 1957; Fischer, Frey, Peus, & Kastenmüller, 2008).

In the context of dissonance theory, a large body of research suggests that confirmatory information search serves as a means of reducing post-decisional dissonance: Once individuals have made a decision between two (or more) alternatives, they are met with the prospect of having chosen badly, as both the positive aspects of the non-chosen alternative and the negative aspects of the chosen alternative become salient. As a consequence,

decision makers experience dissonance. However, this adverse and unpleasant motivational state can be alleviated if the decision maker seeks out information that is consistent with the chosen alternative (i.e., consonant cognitive elements) while neglecting inconsistent information (i.e., dissonant cognitive elements) that would further aggravate the experience of dissonance (Festinger, 1957; Frey, 1986). In sum, dissonance theory postulates that confirmatory information search is a motivational process: Individuals select consistent over inconsistent information, as they intend to defend their decision and thereby attempt to reduce post-decisional dissonance.

In strong contrast to dissonance theory, cognitive theorists argue that confirmatory information processing might arise because people are unable to demonstrate true objectivity when making a decision (Fischer, Jonas, Frey, & Schulz-Hardt, 2005; Fischer, Schulz-Hardt, & Frey, 2008).

From this perspective, decision makers strive to find the qualitatively best pieces of decision-relevant information, but cannot evaluate information quality independent of their own standpoint. Because of this, individuals test inconsistent information more critically and extensively than consistent information, which is why inconsistent information is generally ascribed lower quality than consistent information (biased assimilation; Ditto & Lopez, 1992; Ditto et al., 1998). As a by-product of the systematic devaluation of inconsistent information, decision makers systematically seek out consistent information while neglecting inconsistent information.

Thus, compared to dissonance theoretical explanations, cognitive models not only address selective exposure, but also give insights into the processes of biased assimilation. In addition, cognitive models suggest that confirmatory information search might not necessarily be a deliberate process, but may rather represent an unintended consequence of confirmatory information evaluation (Ditto & Lopez, 1992). Therefore, this perspective suggests that selective exposure is primarily due to cognitive processes.

Though the motivational and cognitive accounts explain confirmatory information processing by exclusive means of their titular processes, more recent frameworks suggest that such views might be too restrictive, as both motivation and cognition can affect confirmatory information processing. One account that combines both motivational and cognitive factors is the heuristic systematic model (HSM; Chaiken et al., 1989).

According to the HSM, people can engage either in systematic or heuristic information processing (Chaiken, 1980, 1987). While systematic information processing is associated

with balanced (i.e., unbiased) information processing following a decision, heuristic information processing is related to confirmatory information processing. Which processing style is triggered depends on both the cognitive capacities of information seekers and their underlying motivations: High cognitive capacities promote balanced information processing, whereas confirmatory information processing is more likely when cognitive capacities are constrained. As far as motivational influences are concerned, the HSM considers three basic motivations that can affect the intensity of information processing: defense, impression, and accuracy motivation. These three motivations will now be discussed in turn.

In line with dissonance theory, the HSM suggests that individuals' motivations to defend or justify their standpoints, beliefs, or decisions typically increase confirmatory information processing. This motivational concern is referred to as defense motivation and serves the intrapersonal goal of protecting the decision maker's self-concept.

In contrast, impression motivation arises from an individual's desire to satisfy interpersonal goals; that is, the decision maker aims to achieve favorable social consequences (Jonas, Schulz-Hardt, Fischer, & Frey, 2006; Jonas, Schulz-Hardt, & Frey, 2005). Impression motivation usually leads to selective information processing, but this kind of selectivity can be adapted to the salient social goal: Either inducing a bias in favor of a significant other's standpoint if one's own opinion has not been publically disclosed yet (Lundgren & Prislin, 1998; Nemeth & Rogers, 1996) or biasing information processing in favor of one's own standpoint if the significant other is already aware of it (Tetlock, 1992).

Finally, accuracy motivation touches upon a decision maker's goal to form an accurate appraisal of their environment. Due to accuracy motivation, individuals critically examine their standpoints or decisions by means of systematically searching for supporting and conflicting information (Lundgren & Prislin, 1998). Although accuracy motivation is often associated with balanced information processing in the context of the HSM, accuracy concerns can promote confirmatory information processing when "judgment-relevant information is scarce or cognitive capacity is constrained" (Chen & Chaiken, 1999, p. 77). In sum, the HSM extends approaches that focus on either motivation or cognition by considering both factors to predict biases in information processing.

Though various theoretical frameworks for approaching confirmatory information processing have been presented during its course of research, one classic paradigm for empirically assessing confirmatory information search and evaluation has persisted over

time. The so-called 'selective exposure paradigm' has its roots in dissonance theory (Festinger, 1957) and is particularly well suited to capture confirmatory information processing. In the next section, this paradigm – and its recent empirical findings – shall be addressed.

1.1.2 The classic paradigm and current research

In the classic selective exposure paradigm, participants work on a decision problem that allows them to choose between two alternatives (e.g., whether a manager named Mr. Miller should have his employment contract extended or not; Fischer, Greitemeyer, et al., 2008). After receiving some background information on the decision problem, participants make a preliminary decision (i.e., they indicate whether they favor or oppose extending the contract).

Participants are then given the opportunity to search for and/or evaluate additional pieces of information on the decision problem. This information supposedly consists of a number of one-page comments written by experts on the topic (e.g., 12 pieces of information). Participants are told that they will receive an overview sheet that presents each comment in the form of a short statement (typically 1-3 sentences), in order to facilitate information search and/or evaluation. Importantly, half of the statements are clearly in favor of one alternative (e.g., "Mr. Miller shows intuition and sensitivity for new trends and developments in the fashion industry. His creative ideas might facilitate entering new sales markets. Therefore, his contract should be extended."), whereas half of the statements explicitly support the other alternative (e.g., "Mr. Miller has just copied competitors' business ideas. Thus, his business strategy has doubtful prospects of success. Therefore, his contract should not be extended."). This ensures that, regardless of the decision maker's preliminary preference, 50% of the statements are consistent with their choice and 50% are inconsistent with it.

After receiving the overview sheet containing summaries of all the available statements, participants indicate which pieces of information they would like to read in more detail later on (i.e., information search) and/or assess the expected quality of all of the pieces of information with regard to their credibility and importance (i.e., information evaluation). They then make a final decision (see Figure 1.1). Confirmatory information search can be observed if participants seek out more consistent information than inconsistent information. Similarly, confirmatory information evaluation occurs if participants assess

consistent information as being of higher quality than inconsistent information. Since recent research has shown that selective exposure and biased assimilation are strongly interconnected, both phenomena have been subsumed under the term ‘confirmatory information processing’ (e.g., Fischer, Fischer, Weisweiler, & Frey, 2010; Fischer, Greitemeyer, et al., 2008).

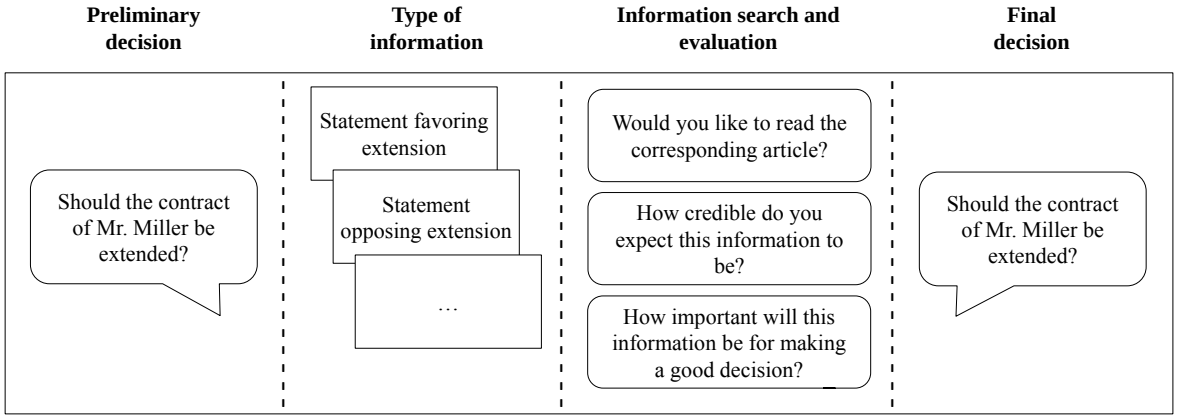

Figure 1.1. The classic selective exposure paradigm.

As far as empirical research on confirmatory information processing is concerned, biases in information search and evaluation have been shown to be widespread in decision making. For example, studies have revealed that selective exposure occurs in individual (Fischer, Greitemeyer, et al., 2008) and group (Greitemeyer, Schulz-Hardt, Brodbeck, & Frey, 2006) decision making and can occur during both preliminary (Jonas, Schulz-Hardt, Frey, & Thelen, 2001) and final (Frey, 1986) decisions. Joining the vast majority of studies, the present research investigates confirmatory information processing in individual decision making following a preliminary choice by utilizing the classic selective exposure paradigm.

Although individuals share a general tendency to prefer decision-consistent over decision-inconsistent information, confirmatory information processing can be affected by a variety of moderators, both related and unrelated to the decision making process. A significant amount of research has been conducted to explore the moderating factors that are tied to the decision making process. For example, researchers have shown that selective exposure is more likely when the amount of available information is limited (Fischer et al., 2005); information is presented sequentially rather than simultaneously (Jonas et al., 2001); the information search process has just begun (Fischer, Lea, et al., 2011); the

decision is gain-framed rather than loss-framed (Fischer, Jonas, Frey, & Kastenmüller, 2008); or when the decision maker focuses on the decision rather than on the information (Jonas, Traut-Mattausch, Frey, & Greenberg, 2008).

However, there is far less research identifying or examining those moderators of confirmatory information processing that are not a direct part of the decision making process *per se*. This includes the potential impact of everyday situational factors, one such factor being the amount of randomness decision makers face in their environment. The present thesis attempts to fill this gap by investigating the effects of randomness on confirmatory information processing. To approach this research question, the next section offers a closer look at the conceptualization of randomness the present research is based on.

1.2 Randomness: A working model

Randomness is typically referred to as a lack of order in one's environment (Rutjens, van der Pligt, & van Harreveld, 2010). Therefore, an exploration of randomness should consider precisely where people are confronted with randomness in their day-to-day lives. This thesis addresses three distinct living environments in which randomness can be found, namely (a) the physical environment, (b) the social environment, and (c) the metaphysical environment (Kay, Whitson, Gaucher, & Galinsky, 2009).

In the physical environment, randomness strongly depends on the amount of contextual order (van Harreveld, Rutjens, Schneider, Nohlen, & Keskins, 2014; Whitson & Galinsky, 2008). For example, contextual disorder (e.g., a conference room full of clutter; a messy desk in a public office) typically conveys the visual impression of high randomness, whereas contextual order (e.g., well-organized filing shelves in an administration department; the tidy office of one's superior) is associated with low randomness. This specific dimension of randomness will be referred to as physical randomness for the remainder of the present thesis.

In the social environment, randomness addresses the extent to which individuals perceive themselves as having personal control over a situation (Kay, Gaucher, Napier, Callan, & Laurin, 2008). People who perceive having low levels of personal control (e.g., following a global financial crisis) typically receive the impression of high randomness,

whereas those who perceive high levels of personal control consider their social worlds to be less random and more predictable. The dimension of randomness that relates to perceived personal control is hereafter referred to as social randomness.

In the metaphysical environment, randomness is strongly connected to questions regarding the origin of the universe and thus the life within it (Rutjens, van der Pligt, et al., 2010). In other words, perceived randomness in the metaphysical environment depends on the degree of sense, order, and structure that is offered by metaphysical belief systems. While worldviews that "acknowledge that the controllability of life's outcomes is limited and allow for uncertainty" (Rutjens, van der Pligt, et al., 2010, p. 1078) give much room for perceptions of randomness (e.g., Darwin's Theory of Evolution), the "belief in God as a controlling agent thwarts notions of randomness in the universe and provides order" (Rutjens, van der Pligt, et al., 2010, p. 1078). Randomness that is experienced in the metaphysical environment will subsequently be called metaphysical randomness.

The question of whether randomness has an impact on human affect, motivation, and cognition has been preoccupying experts for some time. A valuable line of research in this field has used a very broad conception of randomness for investigating its effects. In particular, researchers have primed abstract concepts that are semantically linked to the term 'randomness' (e.g., chaotic, disorder, random, haphazard; Kay, Moscovitch, & Laurin, 2010; Legare & Souza, 2013) in order to induce the impression of randomness. Other lines of research have instead focused on just one of the previously mentioned dimensions of randomness. For instance, researchers have found that contextual order (i.e., low physical randomness) promotes generosity (Vohs, Redden, & Rahinel, 2013); that low perceived levels of personal control (i.e., high social randomness) increase pattern perception (Whitson & Galinsky, 2008); and that religious priming (i.e., low metaphysical randomness) attenuates feelings of authorship (Dijksterhuis, Preston, Wegner, & Aarts, 2008).

Although there have been numerous studies on varying aspects of randomness, prior research has failed to directly compare the consequences of distinct dimensions of randomness for a common outcome variable. In addition, previous research has largely neglected the possible impact of randomness on decision making processes such as confirmatory information processing. Against this empirical background, the central questions that motivate this thesis are: Do (a) physical, (b) social, and (c) metaphysical randomness affect confirmatory information processing in personal and economic decision making and if so, do these different facets of randomness affect confirmatory information

processing in the same way? The detailed outline of the present thesis is covered in the next section.

1.3 Scope of the present thesis

The present dissertation aims to produce a more complete understanding of the effects of randomness on confirmatory information processing following personal and economic decisions. This research is based on a threefold conception of randomness. Concretely, three study series were conducted to empirically explore whether (a) physical randomness, (b) social randomness, and (c) metaphysical randomness affect confirmatory information processing. In all study series, the classic selective exposure paradigm was employed to measure confirmatory information processing. For the decision cases, personal decision problems (e.g., decisions on medical treatments) as well as economic decision problems (e.g., investment decisions) were utilized so that findings would be relevant and applicable to a large number of day-to-day decisions. The study series are presented in the following three chapters.

As a first step in the present research, **Chapter 2** describes a study series on the effect of physical randomness on confirmatory information processing. Based on previous research, it was hypothesized that contextual disorder would decrease confirmatory information processing. This hypothesis was tested over the course of two studies (Studies 1-2). In Study 1, participants in a disorderly room were expected to engage in less confirmatory information processing than decision makers in an orderly room. By means of semantic priming procedures, Study 2 aimed to determine whether a mindset of divergent thinking might be a precondition for the relationship between physical disorder and confirmatory information processing.

The study series described in **Chapter 3** aimed to investigate the impact of social randomness on confirmatory information processing. Building on recent research, four studies explored whether perceiving oneself as having a low level of personal control affects selectivity in information search and evaluation. Perceptions of low control were expected to increase selective exposure while having no impact on biased assimilation (Studies 3-6). In addition, three possible explanations for the effect of low control on confirmatory information search were addressed; namely increased feelings of general

threat (Study 4); a heightened need for cognitive closure (Study 5); and increased levels of helplessness (Study 6). Finally, Study 6 also explored how personal consequences for the decision maker might affect the relationship between low control and confirmatory information search.

Chapter 4 is concerned with the question of whether metaphysical randomness affects confirmatory information processing. The aim of its study series was to investigate whether priming a metaphysical belief system that typically offers a sense of order and non-randomness (i.e., religion) affects confirmatory information processing. More specifically, five studies examined whether religious primes reduce confirmatory information processing in secular decision scenarios (Studies 7-11). In addition, these studies aimed to shed more light on the processes that underlie the effect of religious priming on confirmatory information processing. To that end, it was analyzed whether decreased psychological discomfort (Study 8), the activation of religion-related concepts (Study 9), or a shift of thoughts away from the secular decision (Study 10 and 11) could account for the proposed effect.

The final chapter of the present thesis (**Chapter 5**) summarizes and discusses the present research with particular attention paid to the theoretical and practical implications of its findings. In addition, this chapter includes a discussion of the limitations of the approach taken here as well as suggestions for future undertakings.

2. Physical randomness and decision making: The impact of contextual disorder on confirmatory information processing

2.1 Abstract

The present research encompassed two studies (Studies 1 and 2) investigating whether contextual disorder – a factor that is typically irrelevant to a given decision case yet can significantly influence decision quality – affects confirmatory information processing. Based on prior research, it was hypothesized that contextual disorder would be associated with decreases in confirmatory information processing. Study 1 supported this prediction, revealing that decision makers in untidy environments evinced less confirmatory information processing than decision makers in tidy environments. Study 2 replicated this finding, and also demonstrated that divergent thinking is an important precondition of the relationship between disorder and confirmatory information processing.

2.2 Background

In the aftermath of making a decision, individuals often engage in a phenomenon known as *confirmatory information processing* (Fischer, Greitemeyer, et al., 2008). This refers to a tendency whereby individuals demonstrate a systematic preference for information that supports their decision (i.e., is decision-consistent) over information that conflicts with it (i.e., is decision-inconsistent). Confirmatory information processing can be observed in both post-decisional information search (a phenomenon called *selective exposure*; Frey, 1986) and information evaluation (*biased assimilation*; Ditto & Lopez, 1992; for a recent

review, see also Fischer & Greitemeyer, 2010; Hart et al., 2009). It is important to study this tendency, as it can severely impair the quality of decision making by dissuading the revision of incorrect decisions (Janis, 1982; Kray & Galinsky, 2003). Given that this can result in severe decision failures, it is highly valuable for research to investigate the situational variables and psychological processes that may promote or deter confirmatory information processing and thus its impact upon decision quality. One such situational variable is a disorderly environment.

The current literature on confirmatory information processing has paid much attention to situational factors directly associated with the decision making process. These include decision framing (Fischer, Jonas, et al., 2008); modes of decision making (Fischer et al., 2010); and decision reversibility (Frey, 1986; Hart et al., 2009; Jonas et al., 2001). However, little is known about the influence of external factors that are not part of the decision making process *per se*. Though there has been some empirical research on the effects of extreme situations (such as threatening events) on confirmatory information processing (e.g., Fischer, Kastenmüller, et al., 2011; Jonas, Greenberg, & Frey, 2003), less attention has been paid to everyday decision contexts such as the characteristics of workplaces where important decisions are made. This chapter examines whether the tidiness of a physical environment can affect confirmatory information processing. It is assumed that compared to orderly decision making contexts, disorderly contexts can reduce confirmatory information processing.

2.2.1 Confirmatory information processing

Confirmatory information processing tendencies have been reported in a wide range of domains including attitudes (Lundgren & Prislin, 1998), stereotypes (Johnston, 1996), and self-serving conclusions (Holton & Pyszczynski, 1989). With regard to decision making, confirmatory biases have been consistently found in both individual (Frey, 1986; Jonas et al., 2001) and group decision making (Schulz-Hardt, Frey, Lüthgens, & Moscovici, 2000). The question of *why* people engage in confirmatory information processing can be answered by considering either motivational or cognitive processes.

One major explanatory motivational framework is cognitive dissonance theory. This approach argues that confirmatory information processing is a means of reducing post-decisional dissonance. After making a decision, individuals are faced with the prospect of having chosen badly and this uneasiness and uncertainty manifests as the aversive

motivational state of cognitive dissonance (Festinger, 1957; Frey, 1986). However, this can be alleviated if the individual systematically seeks out information that is consistent with their decisional standpoint and thus reifies it.

From a more cognitive point of view, biased information processing can be explained via a tendency to test information that conflicts with one´s decision more critically than information that supports it (Ditto & Lopez, 1992; Ditto et al., 1998).

In the classic experimental selective exposure paradigm, participants work on a decision problem that requires them to choose between two decision alternatives. For example, they may have to decide whether to support a diet food business or an organic food business, or whether a shop manager's contract should be extended or not (see Fischer, Greitemeyer, et al., 2008). After making a preliminary decision, participants then search for and/or evaluate a number of pieces of additional information, which are either consistent or inconsistent with their preliminary decision. Once this stage is completed, they make a final decision. Confirmatory information processing is typically indicated by the presence of (a) the confirmation bias (i.e., participants seeking out more decision-consistent information than decision-inconsistent information) and (b) the evaluation bias (i.e., participants evaluating decision-consistent information as being of higher quality – more important, more credible – than decision-inconsistent information). Because the confirmation and evaluation biases have been shown to strongly interconnect, recent research has combined both indicators into an overall index of confirmatory information processing (Fischer et al., 2010; Fischer, Greitemeyer, et al., 2008; Fischer et al., 2005). The two present studies investigate confirmatory information processing as a function of contextual disorder.

2.2.2 Contextual disorder and confirmatory information processing

Contextual disorder is prevalent in everyday life, being present in both homes and workplaces. In fact, an entire industry is devoted to it: Professional organizers offer their services to individuals struggling with chaos and chain stores sell organizational aids to assist in the elimination of physical clutter (Abrahmson & Freedman, 2007). Varying lines of research on disorder have emphasized that the consequences of such disorder are mostly negative. For example, studies based on the Broken Windows Theory (Wilson & Kelling, 1982) have provided evidence that it triggers further disorder (e.g., littering) and facilitates the violation of social norms (Keizer, Lindenberg, & Steg, 2008). Furthermore, research in organizational psychology has shown that chaotic working environments are typically

considered indicative of a cluttered mind. In particular, office holders' intelligence is evaluated more negatively when their desks are messy (Elsbach & Pratt, 2007; Sitton, 1984). Because the neatness of employees' workspaces affects the assessment of their professional abilities, disorganized desks might have negative career implications.

However, while disordered environments require more attention to be processed and can thus divert resources away from relevant behaviors (Kaiser, Stein, & Peelen, 2014; McMains & Kastner, 2011), they may be *beneficial* for tasks requiring cognitive processes that rely on open thinking. Evidence for this assumption comes from studies showing that distracting environments can promote fresh insights. One such study was conducted by Baird et al. (2012), who argued that a context associated with higher levels of mind-wandering stimulates creative thinking. Similarly, Dijksterhuis and Meurs (2006) showed that a distraction made participants generate more items diverging from a given cue than subjects who focused on the task instruction. In addition, Vohs et al. (2013, Study 2) reported that participants who were sitting in a disorderly room developed more creative ideas about alternative uses for ping-pong balls than participants who were sitting in an orderly room. Importantly, the researchers also pointed out that disorderly environments can affect preference and choice by leading individuals to break free from conventional routes of decision making (see Study 1). Untidy, disorderly environments can thus be considered environmental contexts that may encourage unconventional and open thought processes.

Similar observations have recently been made in research on confirmatory information processing. In particular, studies have shown that high levels of distraction and creative thought (which typically result from disorder) are also associated with openness to diverging information. With regard to distraction, Fischer et al. (2010) found that participants who were distracted from a decision problem by a short concentration task exhibited weaker tendencies toward confirmatory information processing compared to individuals who were not distracted. As far as creative thought processes are concerned, Schwind, Buder, Cress, and Hesse (2012) showed that decision-inconsistent recommendations in web-based learning environments foster divergent thinking (a thinking style that is strongly related with creativity; see also Guilford, 1967) and also lead to lower levels of confirmatory information search. These results suggest that distraction and creative thinking may go hand in hand with balanced information processing.

2.2.3 The present research

As distracting contexts (such as contextual disorder) have been shown to benefit open-minded and unconventional information processing in different fields of research, it was hypothesized that a disorderly context – namely, an untidy room – leads to lower levels of confirmatory information processing in decision making situations. Two studies investigated this research question. In the first study, we predicted that making a decision in an untidy room would be associated with lower levels of confirmatory information processing than making a decision in a tidy room. In the second study, we attempted to replicate the findings of the first study by using a priming procedure and also investigated the role of divergent thinking.

2.3 Study 1

In this study, participants worked on an information search and evaluation task in either a standard, tidy room (low disorder condition) or a very untidy, messy room (high disorder condition). It was predicted that the participants in the untidy room would be less biased in their information search and evaluation than participants in the tidy room.

2.3.1 Method

Participants and design

Forty (24 female; 16 male) students at the University of Regensburg participated in exchange for course credit (age ranged from 19 to 75 years; $M = 26.83$, $SD = 12.54$). The study consisted of a one-factorial design with two between-subjects conditions (*disorder:* high vs. low).

Materials and procedure

To manipulate the orderliness of the experimental lab, participants worked on the decision case either in a tidy room (low disorder condition) or a very untidy room (high disorder condition). In the high disorder condition, the experimenter had emptied the contents of a waste bin on the floor, rearranged the chairs and the tables in a chaotic way, and scattered other items such as coat hangers, CD covers, and newspapers all over the room. In

contrast, the low disorder condition had the experimental room looking as it would be expected to in any psychological institute: There were two desks with chairs, with newspapers and other objects being neatly arranged on a shelf. Participants were randomly assigned to one of the two rooms/conditions.

Then, participants read about a fictitious decision case. They were asked to imagine that they were the owner of a fashion store and were told that the work of that store's manager, Mr. Miller, had been of mixed success. After reading some background information about Mr. Miller, participants were asked to make a tentative decision as to whether his contract should be extended. Upon making their preliminary decision, participants were informed that additional information about the decision case was available. This additional information consisted of 12 one-page statements written by Mr. Miller's colleagues. Participants received a list that contained the key points of each statement, which had been summarized in 2-3 sentences that made it clear whether the colleague was for or against the extension of Mr. Miller's contract. An example of a summary describing a favorable statement was: "Mr. Miller shows intuition and sensitivity for new trends and developments in the fashion industry. His creative ideas might facilitate entering new sales markets. Therefore his contract should be extended." An example of a summary describing a critical statement was: "Mr. Miller has just copied competitors' ideas. Thus, his business strategy has doubtful prospects of success. Therefore, his contract should not be extended." There were six statements favoring the contract's extension and six statements rejecting it, meaning that, regardless of their preliminary decision, participants were faced with six decision-consistent and six decision-inconsistent statements. Participants evaluated the expected quality of all of the available statements with regard to their credibility ("How credible do you expect this information to be?"; 0 = *not at all*, 10 = *extremely*) and importance ("How important will this information be for making a good decision?"; 0 = *not at all*, 10 = *extremely*). They also indicated whether they would like to read the corresponding article in detail later on. Participants could freely select among the statements (0-12 pieces of information) by ticking a box near each one. We computed difference values for information reliability, information importance, and information search by subtracting the corresponding values for decision-inconsistent information from the values for decision-consistent information. For the following analyses, the three difference scores were transformed into *z*-values and collapsed into an overall index of confirmatory information processing ($\alpha = .84$).

After the participants finished the information search and evaluation task, they were asked to indicate the extent to which they perceived the experimental lab to be untidy (0 = *not at all*, 10 = *extremely*). They were also asked to what extent they experienced cognitive disorder throughout the experimental session ("To what extent did you feel confused during the experimental session?"; 1 = *not at all,* 5 = *extremely*). Participants were then fully debriefed and told that there were no extended versions of the articles, as this was not necessary for the testing of the hypotheses.

2.3.2 Results

Confirmatory information processing

We checked for the typical effect of confirmatory information processing (i.e., the preference for decision-consistent information over decision-inconsistent information) with one-sample *t*-tests against zero. The results indicated a significant confirmatory bias in the low disorder condition ($M = 0.39$, $SD = 0.65$), $t(19) = 2.71$, $p = .01$, but a marginally significant *disconfirmation* bias in the high disorder condition ($M = -0.39$, $SD = 0.90$), $t(19) = -2.00$, $p = .07$.

A one-way ANOVA revealed that participants in the untidy room (high disorder condition; $M = -0.39$, $SD = 0.90$) showed significantly lower levels of confirmatory information processing than those in the tidy room (low disorder condition; $M = 0.39$, $SD = 0.65$), $F(1, 38) = 10.02$, $p = .003$, $\eta^2 = .21$. Cell means and standard deviations for the number of decision-consistent and decision-inconsistent pieces of information searched for (and for the confirmation bias) are shown in Table 2.1.

Table 2.1. Means and standard deviations for information search and combined *z*-transformed confirmation bias (search and evaluation) as a function of experimental condition in Study 1.

	Information search					
	Consistent [a]		Inconsistent [a]		Confirmation bias (combined) [b]	
Disorder	*M*	*SD*	*M*	*SD*	*M*	*SD*
High (*n* = 20)	3.05	2.04	2.50	1.36	-0.39	0.90
Low (*n* = 20)	4.05	1.50	2.55	1.32	0.39	0.65

Notes. [a] Six pieces of information were available in each category. [b] This 'confirmation bias' corresponds to the *z*-transformed combination of the information search bias and information evaluation biases.

Check for interfering effects

We checked for potential interfering effects of gender and age by conducting a 2 (*disorder*: high vs. low) x 2 (*gender*: female vs. male) ANCOVA with age as a covariate and confirmatory information processing as the dependent variable. Participants' age or gender did neither significantly influence confirmatory information processing nor interact with the disorder manipulation (Fs < 0.12, ps > .73).

Perceptions of the environment

Participants perceived the tidy room (M = 8.60, SD = 1.54) as being significantly more tidy than the untidy room (M = 3.00, SD = 2.85), $F(1, 38) = 59.94$, $p < .001$, $\eta^2 = .61$. Participants in the untidy room also reported higher levels of cognitive disorder (M = 1.85, SD = 1.18) than those in the tidy room (M = 1.20, SD = 0.52), $F(1, 38) = 5.06$, $p = .03$, $\eta^2 = .12$. Thus, the manipulation of contextual disorder was successful.

To check whether perceived tidiness or cognitive disorder could mediate the effect of contextual disorder on confirmatory information processing, we correlated perceived tidiness and cognitive disorder with confirmatory information processing, but did not find any significant relationships (rs < .18, ps > .30). It thus seems that these perceptions and judgments do not mediate the relationship between contextual disorder and confirmatory information processing.

2.3.3 Discussion

Study 1 showed that decision-relevant information processing can be affected by the environmental context. Participants in an untidy room were not only significantly less biased in the processing of new information than individuals working in a tidy room, but they also preferred decision-*inconsistent* information over decision-*consistent* information. This finding is in line with previous studies, which have found that distraction can improve decision quality (Dijksterhuis, 2004) and also encourages unconventional thought processes in decision making situations (Vohs et al., 2013).

However, Study 1 had significant limitations. First, an untidy room may not only be an environmental prime for disorder, but also a violation of participants' expectations that a professional university space should be regular and tidy. Previous studies have shown that expectancy violation promotes more flexible and creative cognitive processing (Ritter et al., 2012; see also Mikulincer & Arad, 1999). Ritter et al. (2012) provided evidence that being involved in an unexpected event facilitates cognitive flexibility, which is a characteristic of divergent thinking (see also Guilford, 1967). Thus, it might not have been the untidy room/contextual disorder *per se* that weakened confirmatory information processing tendencies in our high disorder condition, but rather that being in an untidy laboratory room violated participants' expectations of orderliness, which in turn promoted divergent thought processes and led to a reduction in confirmatory information processing.

Second, the restrictions of the disorder manipulation left us without a baseline control group, void of any manipulation of contextual disorder. Consequently, while the replication of the basic confirmatory information processing effect in the low disorder condition suggests that the difference between experimental groups was driven by disorder, we cannot state this with certainty.

Finally, though we did not find that perceived tidiness or cognitive disorder mediated the effect of contextual disorder on confirmatory information processing, the potential role of divergent thinking was not tested directly. To address these shortcomings, we conducted Study 2.

2.4 Study 2

Study 2 attempted to replicate the findings of Study 1 incorporating a control group and using a priming procedure as a more subtle manipulation of contextual disorder. We also sought to elucidate the process underlying our main result more directly by introducing divergent thinking as an additional independent variable. Furthermore, a different decision case was employed with the goal of examining whether our findings would occur in a decision scenario with greater levels of personal involvement. It was hypothesized that if the effect of contextual disorder upon confirmatory information processing was simply due to the mental activation of disorder concepts, participants primed with disorder would exhibit weaker confirmatory information processing tendencies compared to participants given either an orderly or neutral prime. However, if divergent thought processes induced via the violation of participants' expectations were required to reduce confirmatory information processing tendencies, disorder primes would only attenuate confirmatory information processing when a mindset of divergent thinking is salient.

2.4.1 Method

Participants and design

One hundred and eighty-eight participants were recruited at the campus of the University of Regensburg. Twenty-four subjects were excluded from the dataset because of missing data (11), suspicion (6), or the revision of their preliminary decision (7). The final sample consisted of 164 participants (113 female and 51 male, ages ranged from 17 to 79 years; $M = 27.41$, $SD = 12.34$). The study consisted of a 3 (*disorder*: high vs. low vs. control) x 2 (*divergent thinking:* high vs. low) between-subjects design.

Materials and procedure

Participants were informed that they would be taking part in two unrelated studies; the first being a vocabulary pretest for an upcoming experiment (actually the manipulation of divergent thinking and disorder) and the second a public opinion poll on tuition fees (the decision case). Participants were randomly assigned to one of the six experimental conditions.

For the manipulation of divergent thinking, we selected two word pairs (e.g., elephant-hippopotamus and dog-cat) from one of five semantic categories (foods, animals, tools, vehicles, clothes) and presented them in a balanced order. In the high divergent thinking condition, participants were asked to generate as many words as they could come up with that would describe the differences between the two words. This task is similar to the one provided by Coskun (2005), who used it to induce a mindset of divergent thinking in his participants. In the low divergent thinking condition, participants rated how frequently the two words are used in everyday speech (0 = *not at all*, 9 = *very frequently*) and indicated which of them is used more frequently.

To manipulate disorder without violating participants' expectations, we used the scrambled sentence paradigm (Srull & Wyer, 1979). Participants were asked to form 20 grammatically correct four-word sentences by eliminating a redundant word from a set of five words. In the high disorder condition, half of the sentences contained words associated with disorder (e.g., untidy, messy, disordered). In the low disorder condition, half of the sentences contained words related to order (e.g., neat, tidy, ordered). In the control condition we used neutral words, unrelated to messiness or tidiness (e.g., long, silver, dark).

The decision case was based on a highly relevant topic for students – the abolition of tuition fees at Bavarian universities (Germany). Since 2006, students have had to pay tuition fees at universities in several German federal states, including the University of Regensburg in Bavaria. In subsequent years, many federal states abolished tuition fees, but they were still being charged in Bavaria at the time of the study. Tuition fees were thus a major, relevant socio-political topic for students at that time and were the subject of significant debate. After reading some background information, participants stated whether they felt tuition fees should be abolished or not. Upon completing the decision case, participants were informed that additional information about tuition fees was available. This information consisted of 12 one-page statements written by experts on the topic. Participants received an overview that contained the key points of each statement (summarized in 1-2 sentences). Of the 12 pieces of information, six supported abolishing tuition fees and six supported preserving them. Consequently, participants were presented with six pieces of decision-consistent information and six pieces of decision-inconsistent information regardless of their preliminary choice.

An example of an argument supporting the abolition of tuition fees was: "Tuition fees should be abolished because all citizens have the right to study at a university, irrespective

of their social background. Particularly in the education sector, equal opportunities should be created." An example of an argument supporting the preservation of tuition fees was: "Tuition fees should be charged because they provide the opportunity to raise the standards of education at universities (e.g., more qualified teaching staff, intensive supervision)." Subjects rated the quality (credibility and importance) of each statement (0 = *not at all*, 10 = *extremely*) and indicated whether they would like to read the corresponding article.[1] As in Study 1, we computed the difference values for information reliability, information importance, and information search by subtracting the corresponding values for decision-inconsistent information from the values for decision-consistent information. Prior to further analyses, these difference scores were transformed into *z*-values and integrated into an overall index of confirmatory information processing ($\alpha = .85$). After the participants finished the information search and evaluation tasks, they were debriefed with particular reference to the fact that the extended versions of the articles did not truly exist.

2.4.2 Results

Manipulation check

The manipulation of divergent thinking was pretested with 38 (2 conditions x 19) participants, who reported their level of agreement with the following statements: "I am open to other points of view"; "If somebody disagrees with me, I listen to his opinion and think about it"; "I enjoy listening to new ideas"; "Usually I don't try to get to know the deeper meaning of things" (reversed scored); and "I am not interested in divergent ideas" (reversed scored) (0 = *not at all*; 9 = *extremely).* All of the items were integrated into one scale of divergent thinking ($\alpha = .72$). Participants in the divergent thinking group ($M = 6.87$, $SD = 1.07$) reported significantly more divergent thinking than subjects in the control group ($M = 5.82$, $SD = 1.60$), $F(1, 36) = 5.69$, $p = .02$, $\eta^2 = .14$.

Confirmatory information processing

A one-sample *t*-test against zero revealed that there was no evidence of confirmatory information processing in the control condition in which participants were primed with neutral concepts and had no mindset of divergent thinking ($M = 0.08$, $SD = 0.76$), $t(27) = 0.57$, $p = .58$. However, we found a significant *disconfirmation* bias when divergent

[1] In addition, we asked some further questions not relevant to the aim of this study.

thinking and disorder were primed simultaneously (M = -0.31, SD = 0.69), $t(26)$ = -2.35, p = .03. Levels of bias did not significantly differ from zero in the remaining four conditions (ts < 1.13, ps > .27).

Our data revealed a significant interaction between divergent thinking and disorder priming, $F(2, 158) = 3.59$, $p = .03$, $\eta^2 = .04$. No main effects were observed (Fs < 1, ps > .58). Simple effects analyses were therefore carried out separately for the participants in the high and low divergent thinking groups. The nature of the interaction can be seen in Figure 2.1.

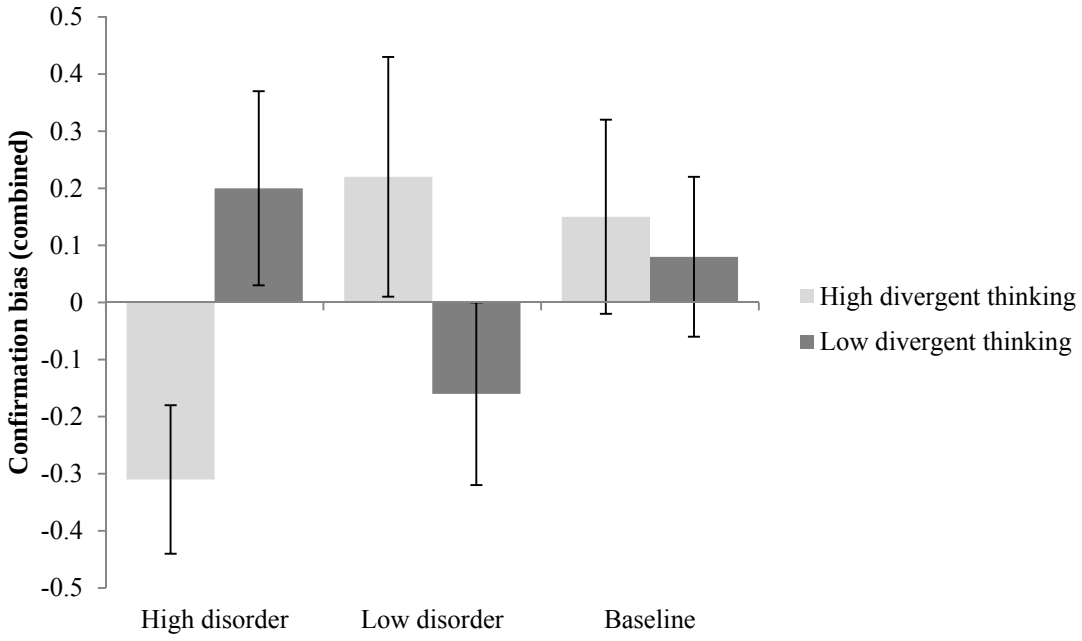

Figure 2.1. Confirmation bias (combined) as a function of experimental condition in Study 2. Error bars represent standard errors.

Simple effects analyses revealed that, in the high divergent thinking conditions, there were marginally significant differences between participants primed with disorder (M = -0.31, SD = 0.69), order (M = 0.22, SD = 1.11), and neutral concepts (M = 0.15, SD = 0.88), $F(2, 158) = 3.01$, $p = .05$, $\eta^2 = .04$. Post hoc tests indicated that high divergent thinking participants who were primed with disorder had a lower level of overall bias compared to high divergent participants primed with order (p = .02) or neutral concepts (p = .05). In contrast, no differences in confirmatory information processing were found between participants primed with disorder (M = 0.20, SD = 0.91), order (M = -0.16, SD = 0.91), or

neutral concepts ($M = 0.08$, $SD = 0.76$) in the low divergent thinking conditions, $F(2, 158) = 1.12$, $p = .33$, $\eta^2 = .01$. Cell means and standard deviations for the number of decision-consistent and decision-inconsistent pieces of information searched for (and for the confirmation bias) are shown in Table 2.2.

Table 2.2. Means and standard deviations for information search and combined *z*-transformed confirmation bias (search and evaluation) as a function of experimental condition in Study 2.

	Information search					
	Consistent [a]		Inconsistent [a]		Confirmation bias (combined) [b]	
Experimental condition	*M*	*SD*	*M*	*SD*	*M*	*SD*
High disorder / High divergent thinking (*n* = 27)	2.67	1.47	2.78	1.31	-0.31	0.69
Low disorder / High divergent thinking (*n* = 29)	3.45	1.70	2.41	1.74	0.22	1.11
Baseline / High divergent thinking (*n* = 27)	3.00	1.54	2.56	1.93	0.15	0.88
High disorder / Low divergent thinking (*n* = 27)	3.59	1.67	2.59	1.45	0.20	0.91
Low disorder / Low divergent thinking (*n* = 26)	2.88	1.82	2.62	1.75	-0.16	0.83
Baseline / Low divergent thinking (*n* = 28)	3.25	1.90	2.54	1.67	0.08	0.76

Notes. [a] Six pieces of information were available in each category. [b] This 'confirmation bias' corresponds to the *z*-transformed combination of the information search bias and information evaluation biases.

Check for interfering effects

We checked for possible interfering effects of gender and age by conducting a 3 (*disorder*: high vs. low vs. control) x 2 (*divergent thinking*: high vs. low) x 2 (*gender:* female vs. male) ANCOVA with age as covariate and confirmatory information processing as the dependent variable. We found a significant main effect for age, $F(1, 151) = 11.66$, $p = .001$, $\eta^2 = .07$, indicating that older participants exhibited stronger confirmatory information processing tendencies than younger participants, $r(164) = .32$, $p < .001$. However, the basic effect of disorder and divergent thinking on confirmatory information processing remained marginally significant when controlling for age, $F(2, 157) = 2.39$, $p = .09$, $\eta^2 = .03$. Participants' gender did not significantly influence confirmatory information processing nor interact with the experimental conditions (Fs < 1.62, ps > .20).

2.4.3 Discussion

Overall, Study 2 indicates that it is not the mere activation of either disorder concepts or divergent thinking that produces an attenuating effect upon confirmatory information processing. Instead, it is the combination of *both* factors that leads to a preference for decision-inconsistent (disconfirmatory) information. When divergent thinking was promoted, participants who were primed with disorder not only tended to engage in lower levels of confirmatory information processing than individuals primed with orderly or neutral concepts, but also preferred decision-inconsistent information to decision-consistent information. In contrast, disorder primes had no effect on confirmatory information search and evaluation when divergent thinking was not salient.

It should be noted that, in Study 2, we did not find the basic effect of confirmatory information processing. However, recent research indicates that various manipulations can influence and reduce bias in information search and evaluation irrespective of the level of confirmatory information processing displayed by control groups (e.g., Jonas et al., 2003). Thus, we do not think that the lack of a significant confirmatory bias can account for our results.

2.5 General discussion

2.5.1 Summary

The present research shows that everyday environmental factors can influence confirmatory information processing. In particular, a messy and untidy environment (i.e., contextual disorder) can lower levels of biased information search and evaluation. In a disorderly environment, people take standpoint-inconsistent information into greater account than when making a decision in an orderly context. In Study 1, we found that participants who engaged in the experimental task in an untidy room exhibited less confirmatory information search and evaluation than participants did in a tidy room. Study 2 indicated that this effect is not simply due to the activation of disorder concepts, but predominantly occurs when participants additionally have a mindset of divergent thinking. Thus, Study 2 provided first evidence that divergent thinking plays a key role in influencing the relationship between contextual disorder and confirmatory information processing. In addition, our studies demonstrated that disorder not only reduces confirmatory information processing, but also makes participants prefer *disconfirmatory* arguments to confirmatory ones.

2.5.2 Implications, limitations, and future research

This research can be considered an extension of research on disorder effects and decision making. Vohs et al. (2013) argued that contextual disorder affects decisional outcomes, as it encourages individuals to seek out unconventional routes of decision making (see Vohs et al., 2013, Study 1). Our research provides additional evidence that environmental context plays a key role in decision making processes. Of particular importance is our finding that disorder makes individuals more open-minded toward decision-inconsistent information. These results could serve as an explanation for the finding of Vohs et al. (2013) that participants in a messy environment prefer unconventional choices to traditional (conventional) ones. It could be argued that traditional choices result from a preference for decision-consistent information, whereas unconventional choices may be due to individuals' increased openness toward decision-inconsistent information. Individuals are generally more familiar with traditional information than unconventional information, as they have been able to gain more

experience and familiarity with such long-established views. Because decision makers cannot evaluate information independently from their prior knowledge (which mainly consists of tradition-supporting information), information that is consistent with traditional views thus has a systematic evaluation advantage over unfamiliar, inconsistent information. As a result, information that supports traditional decisions may be systematically preferred over information that conflicts with them, which in turn bolsters traditional decisions. However, when individuals are stimulated to be open to new, unfamiliar information that is inconsistent with traditional views (e.g., through a disorderly environment), they should subsequently also be willing to consider new, unconventional routes of decision making (see also Ditto & Lopez, 1992; Ditto et al., 1998).

As far as decision quality is concerned, our results converge with those of Fischer et al. (2010), who argued that "if the decision maker is distracted from the decision context […] the integration of initial decision-consistent and inconsistent information should take place more efficiently, balanced, and even-handedly" (p. 880). That is, disordered (and thus distracting) environments can benefit decision making, as messiness can lead people to weigh the pros and cons of their decisions more carefully. Because decision-inconsistent information is considered more frequently when making a decision in a messy environment, decision quality is likely to be improved (see also Dijksterhuis, 2004).

In line with Schwind et al. (2012), our results also indicate that divergent thinking plays a key role in balanced information processing. Schwind et al. (2012) obtained evidence that decision-inconsistent recommendations induce divergent thinking and subsequently balanced information search. Extending these findings, we showed that divergent thinking provides an ideal starting point for balanced information processing and impacts both information search and information evaluation.

There are clear limitations to the current research. The present data supports the notion that the mental activation of disorder concepts *per se* does not reduce confirmatory information search and evaluation: In Study 2, divergent thinking was shown to be a prerequisite for the effect of contextual disorder on confirmatory information processing. That is, contextual disorder may have weakened biased information processing only because divergent thinking was promoted via the violation of our participants' expectations. Stated differently, disorder primes should work best for balanced information processing if individuals' openness toward diverging information is promoted in some way (e.g., by the violation of participants' expectations) or in situations where individuals are open to different opinions (e.g., when a person has little prior knowledge of an issue). In

contrast, disorder should not promote balanced information processing when individuals have prior extreme attitudes toward an issue: If individuals hold rigid views, disorder primes may not be sufficient to prevent biased information processing.

It would be highly beneficial for future research to investigate the psychological processes that underlie the effect of disorder on confirmatory information processing, as we did not find any indication that perceived tidiness or cognitive disorder (Study 1) mediated the effects of contextual disorder on confirmatory information processing. These processes may be located in an increased level of cognitive openness for the unexpected. That is, untidy environments may induce a sense of cognitive openness (for the new and unexpected, such as an extremely messy environment), which can lead to more systematic and less biased information processing. Thus, being surprised by an unexpectedly chaotic environment (in contrast to an expectedly chaotic environment) may lead participants to open up to unconventional and/or decision-inconsistent information. Thus, a fruitful endeavor for future studies might be to further clarify the role played by surprise within the disorder-to-information-processing effect. Other possible mechanistic explanations could be an increased need for cognition, an increase in tolerance, or a reduced decision focus in disorderly environments.

In sum, the current research can be considered a starting point for exploring the effects of different attributes of external environments on decision making and confirmatory information processing. From a practical perspective, our research questions the ‘clean desk’ policy that is widely promoted in companies and offices. The present studies suggest that one should not strive toward tidiness in places where important decisions are made. Somewhat contrary to common sense, conference rooms – the places where most important decisions in economics and politics are made – should be messy in order to reduce confirmatory information processing and thus increase the likelihood of good, balanced decision making.

3. Social randomness and decision making: The impact of low perceived control on confirmatory information processing[2]

3.1 Abstract

The present research (Studies 3-6) investigated the potential impact of low perceived control on confirmatory information search and evaluation. We hypothesized that perceptions of having low control would increase confirmatory information search (a more motivational process) but would not affect confirmatory information evaluation (a more cognitive process). Four studies consistently supported this hypothesis. Furthermore, our findings revealed that perceiving oneself as having low control increases feelings of helplessness and that this is the underlying mechanism that leads to strengthened confirmatory information search. The present research also suggests a possible boundary condition for the proposed effect: serious, personal decision consequences.

3.2 Background

It is not uncommon for individuals to have to make important decisions under highly unpredictable – and thus uncontrollable – conditions. For example, a medical diagnosis may require individuals to choose between multiple treatment options; economic uncertainty may leave investing fraught with risk; and war might necessitate that politicians minimize human costs by utilizing only the most effective strategies. Given that individuals are naturally motivated to reduce feelings of uncertainty when faced with

[2] A modified version of this research is currently submitted for publication together with Peter Fischer.

threats to their personal control over a situation (e.g., Rutjens, van der Pligt, & van Harreveld, 2012), confirmatory information search may be appealing to decision makers due to its potential ability to alleviate aversive states (e.g., Jonas, Graupmann, et al., 2006). However, confirmatory information search also carries severe negative implications, as individuals who engage in it may overlook the potential risks of their preferred decision outcome when they neglect decision-inconsistent information. Avoiding decision-inconsistent information can impair decision quality and lead to severe decision failures (Janis, 1982; Kray & Galinsky, 2003). The question we pose in this research is thus whether individuals who perceive themselves as having low levels of control exhibit increased levels of confirmatory information search compared to individuals who feel that they possess high levels of control over their environment.

3.2.1 Confirmatory information search and evaluation

Research has consistently shown that individuals systematically prefer information that is consistent with their existing attitudes, standpoints, and decisions over information that is inconsistent with them (Frey, 1986; Jonas et al., 2001; Lundgren & Prislin, 1998). This confirmatory tendency has been found to occur during both information search and information evaluation. As far as decision making is concerned, confirmatory information search (a phenomenon that is also known as *selective exposure*; Frey, 1986) occurs when individuals seek out decision-consistent information while avoiding decision-inconsistent information. Similarly, confirmatory information evaluation (a phenomenon also called *biased assimilation*; Ditto & Lopez, 1992; for a recent review, see Fischer & Greitemeyer, 2010; Hart et al., 2009) occurs when individuals assess information that is consistent with their decision as being of higher quality than decision-inconsistent information.

These two phenomena can be explored using the classic selective exposure paradigm. In this paradigm, participants are required to choose between two different decision alternatives. For example, they may have to make a preliminary decision regarding whether or not a shop manager's employment contract should be prolonged (e.g., Fischer, Greitemeyer, et al., 2008). Subsequently, each participant is given the opportunity to search for and evaluate additional pieces of information, which are either consistent or inconsistent with their prior decision. Once they finish this stage, participants make a final decision. While selective exposure is typically indicated by the presence of confirmation bias (i.e., the extent to which decision makers seek out more consistent than inconsistent pieces of information), biased assimilation is typically suggested by a visible evaluation

bias (i.e., the extent to which decision makers evaluate consistent information as being of higher quality than inconsistent information).

Previous work on selective exposure has been carried out within both motivational and cognitive frameworks. One dominant motivational account for selective exposure is dissonance theory (Festinger, 1957; Frey, 1986). According to dissonance theory, making a decision causes individuals to become aware of the negative implications of their chosen alternative as well as the potential positive implications of the non-chosen alternative. This creates an aversive state of dissonance, which the individual may attempt to reduce by seeking out decision-consistent information and avoiding decision-inconsistent information. From this motivational perspective, consistent pieces of information are systematically preferred because they are more pleasant to process than inconsistent pieces of information, which exacerbate dissonance (Festinger, 1957; Frey, 1986; Jonas, Graupmann, et al., 2006; Kruglanski & Klar, 1987).

A more cognitive perspective argues that the selective exposure effect is due to confirmatory information evaluation processes (Fischer et al., 2005; Fischer, Schulz-Hardt, et al., 2008). When making a decision, individuals attempt to find the qualitatively best pieces of information. However, they also evaluate information quality dependent on their own standpoint, so that standpoint-consistent information is typically assessed as having higher quality than standpoint-inconsistent information (Lord et al., 1979). As a result of such biased information evaluation processes, individuals systematically seek out consistent (i.e., 'high-quality') information while neglecting inconsistent (i.e., 'low-quality') information (Ditto & Lopez, 1992; Ditto et al., 1998). In sum, this cognitive perspective assumes that biased assimilation is a precondition of selective exposure (see also Fischer et al., 2010; Fischer, Schulz-Hardt, et al., 2008).

To date, various situational variables that strengthen confirmatory information search and evaluation have been identified. As predicted by motivational frameworks for studying selective exposure, factors that typically add to the aversive state of dissonance (e.g., negative mood; Jonas, Graupmann, et al., 2006) increase biased information search. In contrast – and in line with cognitive accounts of confirmatory information search – situational factors that touch upon cognitive processes (i.e., the differential assessment of decision-consistent and decision-inconsistent information) affect information evaluation, which can in turn have an impact on information search (e.g., Fischer et al., 2005; Fischer, Schulz-Hardt, et al., 2008). In the present research, we investigate both confirmatory information search and evaluation as a function of perceived control in order to

demonstrate that the proposed effect is more motivational (i.e., affects information search) than cognitive (i.e., affects information evaluation [and information search]) in nature.

3.2.2 Control and confirmatory information search

Personal control is generally referred to as an individual's ability to manipulate some aspect of their environment (Schulz, 1976). The desire to pursue and maintain control over the environment is a fundamental human motivation (Kelley, 1971; Kelly, 1955; Seligman, 1975; Skinner, 1995). While perceiving a sense of control positively affects one's physical and psychological wellbeing (e.g., Langer & Rodin, 1976), the experience of having low control is aversive and anxiety-provoking (e.g., Heckhausen & Schulz, 1995). Thus, people are highly motivated to reassert a sense of control in situations where control deficiencies become salient (e.g., Brehm, 1966). However, when individuals are unable to regain a sense of control objectively, they adopt alternative strategies to compensate for it (Kay et al., 2008; cf. Rothbaum, Weisz, & Snyder, 1982). For example, Whitson and Galinsky (2008) showed that a threat to personal control significantly increased illusory pattern perception or "the identification of a coherent and meaningful interrelationship among a set of random or unrelated stimuli" (p. 115). According to Kay et al. (2009), such compensatory control strategies buffer against the aversive state of low control, as they affirm individuals' beliefs in an orderly and predictable world.

Recent research has shown that compensatory control strategies can be based on external or personal sources (for an overview, see Kay, Gaucher, McGregor, & Nash, 2010). When drawing from external sources of compensatory control, individuals may rely on either controlling agents (e.g., religious deities) or non-agentic sources that provide a sense of order (e.g., human progress, scientific theories; Kay et al., 2008; Rutjens, van der Pligt, et al., 2010; Rutjens, van Harreveld, & van der Pligt, 2010). Most relevant to the present research, individuals can also defend themselves against feelings of having low levels of control by means of personal sources of compensatory control such as *epistemic personal control*.

Epistemic personal control refers to a tendency for people to bolster their personal confidence in the truth of their personal views when they experience decreased levels of control (Kay, Gaucher, et al., 2010). For example, McGregor, Zanna, Holmes, and Spencer (2001, Study 1) found that a threat to personal certainty caused individuals to spontaneously exaggerate their convictions regarding issues that were unrelated to the

threat manipulation. This finding suggests that individuals might insulate themselves from distressing thoughts caused by perceiving themselves as having little control over a situation by strengthening their senses of certainty in other domains (see also McGregor & Jordan, 2007; McGregor & Marigold, 2003; McGregor, Nail, Marigold, & Kang, 2005).

In a very similar vein, previous studies on selective exposure have shown that confirmatory information search is an effective means of increasing confidence in one's standpoints and decisions (for an overview, see Hart et al., 2009). Thus, the present research focuses on confirmatory information search as a potential source of epistemic personal control. We propose that when individuals perceive themselves as having low levels of control over a situation, they may attempt to compensate for it by bolstering their confidence in a prior decision and do so by systematically preferring decision-consistent information over decision-inconsistent information.

Recent evidence for this assumption comes from studies showing that various motives to increase confidence trigger confirmatory information search. For example, Hart, Adams, Burton, Shreves, and Hamilton (2012) demonstrated that the trait 'need for cognitive closure' (Kruglanski, Webster, & Klem, 1993; Kruglanski, 1990; Webster & Kruglanski, 1994), an epistemic motivational factor that can be defined as the "desire for a definite answer on some topic, any answer as opposed to confusion and ambiguity" (Kruglanski, 1989, p.13), is positively related to the search for decision-consistent information. In addition, Sawicki and colleagues have argued that confirmatory information search (particularly for unfamiliar information) bolsters one's attitude and thus reduces attitude uncertainty (Sawicki et al., 2011) and attitude ambivalence (Sawicki et al., 2013). Similarly, individuals who are highly confident in their attitudes typically exhibit decreased levels of selective exposure (Albarracín & Mitchell, 2004; for an overview, see Hart et al., 2009). Furthermore, there is empirical evidence that threatening events, which are typically associated with high levels of uncertainty (e.g., terrorist threat), increase confirmatory information search (Fischer, Kastenmüller, et al., 2011, Studies 3-5; Frey & Stahlberg, 1986; Jonas et al., 2003; Lavine, Lodge, & Freitas, 2005).

In sum, recent research indicates that confirmatory information search may function as a means of strengthening confidence in one's decisions and thus as a source of epistemic personal control. However, previous research did not directly investigate the impact of low control on confirmatory information search. The present research aims to close this gap.

3.2.3 The present research

The present research aimed to investigate whether an experimental induction of low control would strengthen individuals' preferences for decision-consistent over decision-inconsistent information following a decision and to test whether this effect could be traced back to processes of epistemic personal control. Since epistemic personal control can be considered a key motivational drive that arises when an individual's sense of control is threatened, we expected the proposed effect to be more motivational (i.e., affects information search) than cognitive (i.e., affects information evaluation [and information search]) in nature.

However, it must be noted that a threat to personal control may also affect confirmatory information search, as it could impair cognitive processing. One could argue that perceiving a threat to personal control restrains cognitive capacities, in turn triggering heuristic information processing. Importantly, such cognitive heuristics are usually associated with confirmatory information processing (Chaiken, 1980, 1987). In other words, increased levels of confirmatory information search following a threat to personal control might not necessarily be due to the motivational drive of epistemic personal control, but could instead result from biases in information evaluation that originate in heuristic information processing. Thus, from a cognitive perspective, both confirmatory information evaluation and confirmatory information search should be affected by a mindset of heuristic information processing following a threat to personal control. However, since we expected the proposed effect to be more motivational (i.e., resulting from the desire to restore perceived control by means of epistemic personal control) than cognitive (i.e., resulting from reduced cognitive capacities) in nature, we hypothesized that perceptions of low vs. high control would differentially affect selective exposure, but would not influence biased assimilation (Studies 3-6).

Concretely, we tested whether low perceived control increases confirmatory information search in Study 3. In Study 4, we tried to rule out the possible alternative explanation that a general feeling of threat (as opposed to the specific experience of having low levels of control) might drive the proposed effect. In Study 5, we investigated whether a heightened need for cognitive closure could account for the effect of low perceived control on confirmatory information search. In Study 6, we addressed a specific boundary condition (i.e., serious personal consequences of a decision) and tried to shed more light on whether participants' increased feelings of helplessness underlie the proposed effect.

3.3 Study 3

In this study, we hypothesized that perceptions of low control would increase confirmatory information search, but would not affect information evaluation. More specifically, we predicted that participants who experienced having low levels of control would show higher levels of confirmatory information search than participants who experienced high control.

3.3.1 Method

Participants and design

Sixty-four participants were recruited near the campus of the University of Regensburg. Two subjects with missing data and six subjects who revised their preliminary decision at the end of the experiment were excluded from the dataset, which left a final sample of 56 participants (28 female and 28 male, age ranged from 19 to 77 years; $M = 28.71$, $SD = 13.60$). The experiment was based on a one-factorial design with two between-subjects conditions (*control*: low vs. high). Participants were randomly assigned to one of the experimental conditions.

Material and procedure

Upon their arrival, participants were informed that they would be taking part in two unrelated studies. The first study was a recall task (actually the experiment's control manipulation) and the second study was a questionnaire concerning personnel decisions (the decision case). Utilizing a procedure from Whitson and Galinsky (2008), we manipulated perceived control by asking participants to recall a personal experience. Participants in the low control condition received the following instructions: "Please recall a particular incident in which you did not have any control over the situation. Please describe the situation in which you felt a complete lack of control over the situation – what happened, how you felt, etc." Participants in the high control condition received identical instructions, except that they were asked to think about an incident in which they were in complete control of the situation (see Whitson & Galinsky, 2008, Study 3).

Subsequently, participants worked on a fictitious decision scenario that dealt with the case of Mr. Miller, who was the manager of a fashion store (e.g., Fischer, Greitemeyer, et al., 2008; Frey, 1986). They were told that Mr. Miller had run the store for one year to

mixed effect and then received some background information about him (which was balanced with regard to its positive and negative aspects). Participants were then asked to decide whether or not Mr. Miller's contract should be extended. Upon making their preliminary decision, participants had the opportunity to consider additional information regarding the decision problem. This information consisted of 12 one-page comments written by Mr. Miller's colleagues, each of which has been summarized in a 2-3 sentence thesis. Participants received an overview sheet that included the main thesis of each comment. These statements made it clear whether the colleague voted for or against the extension of Mr. Miller's contract. An example of a favorable statement was: "Mr. Miller shows intuition and sensitivity for new trends and developments in the fashion industry. His creative ideas might facilitate entering new sales markets. Therefore, his contract should be extended." A critical opinion was: "Mr. Miller has just copied competitors' business ideas. Thus, his business strategy has doubtful prospects of success. Therefore, his contract should not be extended."

In sum, six statements supported and six statements rejected the contract's extension, meaning that participants received equal amounts of decision-consistent and decision-inconsistent information. Participants were asked to indicate which pieces of information they would like to read in more detail after the experiment being free to select as many as they wanted (0-12 pieces of information). We subtracted the number of pieces of decision-inconsistent information selected from the number of pieces of decision-consistent information selected and used this difference as a dependent variable (confirmation bias; Frey, 1986). In addition, participants assessed the expected quality of all of the pieces of information according to their credibility ("How credible do you expect this information to be?"; 0 = *not at all*, 10 = *extremely*) and importance ("How important will this information be for making a good decision?"; 0 = *not at all*, 10 = *extremely*). Since the credibility and importance assessments were highly correlated ($\alpha = .91$), they were integrated into a single scale of information evaluation. The evaluation bias was calculated as the difference between the average evaluated quality of decision-consistent and decision-inconsistent pieces of information. After participants finished the information search and evaluation tasks, they made a final decision.[3] Participants were then fully debriefed.

[3] In both this and the subsequent studies within this chapter, we asked some additional questions for exploratory purposes. However, because they were not relevant to the aim of this research, they are not reported here.

3.3.2 Results

Confirmatory information search

We checked for the typical effect of confirmatory information search (i.e., the preference for decision-consistent information over decision-inconsistent information) using one-sample *t*-tests against zero. In the low control condition, no significant confirmation bias occurred (M = -0.23, SD = 1.45), $t(29) = -0.88$, $p = .39$. In the high control condition, we found a significant *disconfirmation* bias (i.e., the preference for inconsistent over consistent information) (M = -1.12, SD = 1.48), $t(25) = -3.85$, $p = .001$.

When testing the specific hypothesis, a one-way ANOVA (*control*: low vs. high) with confirmatory information search as the dependent variable revealed that participants in the low control condition exhibited weaker tendencies toward disconfirmatory information processing (M = -0.23, SD = 1.45) than participants in the high control condition (M = ‑1.12, SD = 1.48), $F(1, 54) = 5.04$, $p = .03$, $\eta^2 = .09$. Cell means and standard deviations for the number of decision-consistent and decision-inconsistent pieces of information searched for (and for the confirmation bias) are shown in Table 3.1.

Table 3.1. Means and standard deviations for information search and confirmation bias as a function of experimental condition in Study 3.

	Information search					
	Consistent [a]		Inconsistent [a]		Confirmation bias	
Experimental condition	*M*	*SD*	*M*	*SD*	*M*	*SD*
Low control (n = 30)	2.00	1.72	2.23	1.61	-0.23	1.45
High control (n = 26)	2.19	1.55	3.31	1.54	-1.12	1.48

Notes. [a] Six statements were available in each category.

Confirmatory information evaluation

One sample *t*-tests against zero revealed that both experimental groups showed a significant evaluation bias (*t*s > 3.88, *p*s < .001).

More importantly, a one-way ANOVA (*control*: low vs. high) with confirmatory information evaluation as the dependent variable revealed no significant difference between the low control group ($M = 1.39$, $SD = 1.96$) and the high control group ($M = 1.35$, $SD = 1.54$), $F(1, 54) = 0.01$, $p = .94$. Cell means and standard deviations for the decision-consistent and decision-inconsistent pieces of information evaluated (and for the evaluation bias) are presented in Table 3.2.

Table 3.2. Means and standard deviations for information evaluation and evaluation bias as a function of experimental condition in Study 3.

	Information evaluation					
	Consistent [a]		Inconsistent [a]		Evaluation bias	
Experimental condition	*M*	*SD*	*M*	*SD*	*M*	*SD*
Low control (*n* = 30)	6.58	1.38	5.19	1.25	1.39	1.96
High control (*n* = 26)	6.70	1.11	5.35	1.08	1.35	1.54

Notes. [a] Six statements were available in each category.

Check for interfering effects

We checked for interfering effects of gender and age by conducting a 2 (*control*: low vs. high) x 2 (*gender*: female vs. male) ANCOVA with age as a covariate and confirmatory information search as the dependent variable. However, we found neither a significant main effect nor any significant interactions for these checking variables (*F*s < 0.13, *p*s > .71). Thus, our findings were not related to the participants' gender or age.

3.3.3 Discussion

Study 3 provided initial evidence that levels of perceived control affect decision-relevant information search. Participants who wrote about an event in which they had experienced

low control exhibited lower levels of *disconfirmatory* information search (i.e., more selectivity) than participants who wrote about an event in which they had felt in complete control. As expected, information evaluation did not differ as a function of perceived control. In sum, the results support the hypothesis that perceiving oneself as having a low level of control may motivate individuals to restore perceptions of order in other life domains by means of a more confirmatory information search.

However, it might not have been the perception of low control *per se* that weakened disconfirmatory information search. One could also argue, for example, that recalling a low-control situation induced feelings of threat, and that this threat might reduce disconfirmatory information search (i.e., increase selectivity). This explanation is in line with research showing that people exhibit increased levels of confirmatory information search when they are subjected to a threatening event (e.g., Jonas et al., 2003). We conducted Study 4 to provide evidence that it is the specific experience of low control – and not threat in general – that drives the effect of low control on selective exposure.

3.4 Study 4

Study 4 had two aims: to replicate the findings of Study 3 and to test whether threat might be an alternative explanation for these findings. We hypothesized that it would not be a feeling of general threat that drives the proposed effect, but rather the perceptions of low control that often go hand in hand with threatening events. Therefore, we provided participants with a threatening scenario in either a low control context or a high control context and then presented them with a decision case. We predicted that participants in the low control condition would exhibit higher levels of confirmatory information search than participants in the high control condition. Similar to Study 3, the control manipulation was not expected to differently affect confirmatory information evaluation.

3.4.1 Method

Participants and design

Forty individuals (27 female and 13 male, age ranged from 19 to 40 years; $M = 23.05$, $SD = 3.92$) participated in this experiment, which was based on a one-factorial design with two between-subjects conditions (*control*: low vs. high).

Material and procedure

As in Study 3, participants were informed that they would participate in two completely unrelated studies. In both conditions, participants recalled a personal experience that was threatening. Participants in the low control condition received the following instruction: "Please recall a particular incident in which something threatening happened to you and you did not have any control over the situation. Please describe the situation in which you were threatened and felt a complete lack of control over the situation – what happened, how you felt, etc." By contrast, participants in the high control condition were told: "Please recall a particular incident in which something threatening happened to you and you were in complete control of the situation. Please describe the situation in which you were threatened but you felt complete control over the situation – what happened, how you felt, etc." (see Whitson & Galinsky, 2008, Study 4).

Study 4 utilized the same decision scenario as Study 3 (the Mr. Miller decision case). As in Study 3, we collapsed assessments of information credibility and importance into a scale of information evaluation ($\alpha = .95$) and calculated confirmation bias and evaluation bias as indicators of confirmatory information search and evaluation. After making a final decision, participants were fully debriefed.

3.4.2 Results

Manipulation check

Following previous research (Whitson & Galinsky, 2008), two independent raters who were blind to the conditions coded each situation in accordance with the criterion "How much did the participant experience or feel threat in the situation?" (1 = *very little*, 7 = *very much*). Inter-rater agreement was acceptable ($\alpha = .73$), so we collapsed the two sets of ratings into a single score of expressed threat. The experimental conditions did not differ with regard to the extent of threat expressed, $F(1, 36) = 1.48$, $p = .23$. The two raters also coded each situation for control by answering the question "How much did the person experience or feel control in the situation?" (1 = *very little*, 7 = *very much*). We averaged the coders' ratings ($\alpha = .88$) to yield a single score of expressed control. In the low control condition, participants expressed significantly lower levels of control ($M = 1.84$, $SD = 0.69$) than participants in the high control condition ($M = 4.45$, $SD = 1.18$), $F(1, 36) = 69.35$, $p < .001$, $\eta^2 = .66$. Thus, the manipulation was successful.

Confirmatory information search

As far as the basic effect of confirmatory information search is concerned, we found a significant confirmation bias only in the low control condition ($M = 0.95$, $SD = 1.70$), $t(19) = 2.50$, $p = .02$. In contrast, no confirmation bias occurred in the high control condition ($M = -0.15$, $SD = 0.67$), $t(19) = -1.00$, $p = .33$.

In accordance with our hypothesis, a one-way ANOVA (*control*: low vs. high) with confirmatory information search as the dependent variable indicated that participants who experienced low control showed significantly increased levels of confirmatory information search ($M = 0.95$, $SD = 1.70$) compared to participants who experienced high control ($M = -0.15$, $SD = 0.67$), $F(1, 38) = 7.24$, $p = .01$, $\eta^2 = .16$. For an overview, see Table 3.3.

Table 3.3. Means and standard deviations for information search and confirmation bias as a function of experimental condition in Study 4.

	Information search					
	Consistent [a]		Inconsistent [a]		Confirmation bias	
Experimental condition	*M*	*SD*	*M*	*SD*	*M*	*SD*
Low control ($n = 20$)	3.90	1.69	2.95	1.19	0.95	1.70
High control ($n = 20$)	3.65	1.69	3.80	1.82	-0.15	0.67

Notes. [a] Six statements were available in each category.

Confirmatory information evaluation

One sample *t*-tests against zero revealed a significant evaluation bias for the low control group ($M = 1.10$, $SD = 2.05$), $t(19) = 2.41$, $p = .03$, while no significant evaluation bias occurred in the high control group ($M = 0.22$, $SD = 1.04$), $t(19) = 0.95$, $p = .35$.

However, we found no significant differences in confirmatory information evaluation between the low control ($M = 1.10$, $SD = 2.05$) and the high control ($M = 0.22$, $SD = 1.04$) conditions, $F(1, 38) = 2.95$, $p = .09$. For an overview, see Table 3.4.

Table 3.4. Means and standard deviations for information evaluation and evaluation bias as a function of experimental condition in Study 4.

	Information evaluation					
	Consistent [a]		Inconsistent [a]		Evaluation bias	
Experimental condition	*M*	*SD*	*M*	*SD*	*M*	*SD*
Low control (n = 20)	6.74	1.26	5.64	1.46	1.10	2.05
High control (n = 20)	5.67	1.10	5.45	1.15	0.22	1.04

Notes. [a] Six statements were available in each category.

Check for interfering effects

We checked for interfering effects of gender and age by conducting a 2 (*control*: low vs. high) x 2 (*gender*: female vs. male) ANCOVA with age as a covariate and confirmatory information search as the dependent variable. No significant main effect or interactions occurred for these checking variables (Fs < 1.09, ps > .30). These results suggest that our findings were not related to the participants' gender or age.

3.4.3 Discussion

Once again, our results indicated that individuals who experience low control exhibit greater tendencies toward confirmatory information search than individuals who experience high control. In addition, Study 4 ruled out the possibility that a general feeling of threat might underlie this basic effect. Though participants in both conditions recalled a threatening situation, those who experienced low control proved more likely to select consistent over inconsistent information. Thus, an increased feeling of general threat is unlikely to account for differences in confirmatory information search following a control manipulation.

However, there is another possible alternative explanation, which needs to be addressed. From a lay epistemic point of view (lay epistemic theory; Kruglanski, 1989, 1990; Kruglanski & Ajzen, 1983) experimentally induced feelings of low control might have strengthened participants' needs for cognitive closure (i.e., the desire for a firm answer to an ambiguous situation; Webster & Kruglanski, 1994) and could have thereby increased

confirmatory information search. This assumption is in line with Whitson and Galinsky (2008, Study 1), who showed that control motivation promotes participants' personal needs for structure (i.e., the desire for cognitive simplicity and structure; Neuberg & Newsom, 1993), which is strongly related to the need for cognitive closure (Clow & Esses, 2005; Neuberg, Judice, & West, 1997; Neuberg, West, Judice, & Thompson, 1997). In addition, Hart et al. (2012) provided evidence that the trait 'need for closure' is positively associated with selective exposure to information. Thus, it seems plausible that recalling a low control situation could have strengthened participants' needs for cognitive closure, and that this might have subsequently increased confirmatory information search. We addressed this alternative explanation in Study 5.

3.5 Study 5

In Study 5, we used a more direct manipulation of perceived control. Furthermore, we also employed a more realistic decision scenario to ensure that our previous findings were not due to either a specific manipulation or a specific decision context. In addition, we tested the potential mediating role of participants' needs for cognitive closure.

3.5.1 Method

Participants and design

Fifty students from the University of Regensburg volunteered to participate in this study. Three subjects were excluded, either because they revised their preliminary decision (2) or demonstrated suspicion (1). Thus, analyses were conducted using data from 47 participants (28 female and 19 male, age ranged from 18 to 54 years; $M = 23.66$, $SD = 6.89$). The experiment was based on a one-factorial design with two between-subjects conditions (*control*: low vs. high).

Material and procedure

As in the previous studies, participants were informed that they would be completing two unrelated studies. The first study was a concept identification task (the control manipulation) and the second study was a questionnaire on treatments for disc herniation (the decision case). The concept identification task (Pittman & Pittman, 1979; Whitson &

Galinsky, 2008) was conducted on a computer. Participants were first given the following information: "This is a concept identification task. The computer will select a concept, and – through the feedback the computer provides – it is your job to determine what this concept is. You will be presented with pairs of symbols, each containing complementary values of five dimensions. In each pair of symbols, one correctly represents the concept the computer has selected, and one incorrectly represents the concept. It is your job to decide which side of the screen displays the correct symbol. Each time you select a symbol, the computer will tell you if you are correct or incorrect and present you with another pair. You will be exposed to ten pairs in total. You should learn the correct answer from the computer's feedback and choose correctly as often as possible. First, you will participate in a practice trial with ten pairs of symbols (just like the real trials). This is to give you a chance to get used to the task." (see Whitson & Galinsky, 2008, Study 1).

In addition to the written command, the researcher orally reiterated the instruction on the basis of a sample pair of symbols to make sure that participants fully understood the task. Following the practice block, participants completed the actual task, which consisted of another four blocks (each with 10 pairs of figures). After each block, participants indicated what they considered to be the correct concept for the block, but they did not receive feedback regarding their response. In the low control condition, participants received random feedback following each pair of figures – half of the time the computer indicated that they had responded correctly, and half of the time it denoted their responses as being incorrect. We ensured that the last pair of symbols was always followed by feedback claiming the participant was incorrect. Since the feedback was non-contingent to participants' responses, subjects were unable to correctly identify a concept. In the high control condition, participants completed the task without receiving any computer feedback. Participants were told that without feedback, it was impossible to learn the correct value, and they were asked to simply make their best guess regarding the concept the computer had selected. We emphasized that performance did not matter, and that the task was all about intuitive answers. After finishing the concept identification task, participants indicated the extent to which they felt they lacked control during the task ("Even when I tried, I was unable to get my way in this task"; 1 = *strongly disagree*, 6 = *strongly agree*). In addition, we measured participants' needs for cognitive closure with a German short scale (Schlink & Walther, 2007) that consisted of 16 items (e.g., "I don't like unpredictable situations"; 1 = *strongly disagree*, 6 = *strongly agree*).

In the second part of the experiment, we used a medical decision case that presented two alternative treatments for disc herniation (i.e., surgical treatment vs. non-surgical treatment). Participants were informed that this decision case was part of a medical study concerning the public acceptance of different treatments for disc herniation. After reading some background information on the condition and the two treatments (which was balanced with regard to its positive and negative aspects), participants were asked to make a preliminary decision between the surgical and non-surgical therapies for treating disc herniation.

Next, participants were given the opportunity to consider additional information on the topic. This information consisted of 12 one-page extracts from medical journals and scholarly literature on disc herniation. Participants received a list that contained the main thesis of each extract (1-2 sentences). Of the 12 pieces of information, six favored surgical treatments and six rejected them. As a result, six statements were consistent with each participant's preliminary choice, and six statements were inconsistent with it. An example of a statement favoring surgery was: "After surgery, patients can fully participate in leisure activities because their spine regains flexibility and resilience within a short period of time." A statement opposing surgery was: "After surgery, scar tissue can increase pressure on the nerve inside the vertebral canal, which can cause severe pain." Participants indicated whether they would like to read the corresponding extract later on and rated the quality of each statement (credibility and importance; 0 = *not at all*, 10 = *extremely*). We integrated assessments of credibility and importance into a single scale of information evaluation ($\alpha = .79$) and calculated confirmation bias and evaluation bias as indicators of selective exposure and biased assimilation.

Following information search and evaluation, participants made a final decision and answered a number of questions that addressed potential confounding variables. These variables were 'acute and chronic pain', 'prior knowledge of disc herniation', 'personal involvement in disc herniation', and the 'involvement of significant others in disc herniation'. Participants were then fully debriefed and dismissed.

3.5.2 Results

Manipulation check

Participants in the low control condition reported a significantly higher lack of control ($M = 4.12$, $SD = 1.48$) than participants in the high control condition ($M = 2.96$,

SD = 2.06), $F(1, 45) = 5.03$, $p = .03$, $\eta^2 = .10$. Thus, the control manipulation was successful.

Confirmatory information search

Participants in the low control condition exhibited a significant preference for decision-consistent rather than decision-inconsistent pieces of information (*M* = 1.00, *SD* = 1.82), $t(23) = 2.70$, $p = .01$. However, we found no significant confirmation bias in the high control condition (*M* = -0.09, *SD* = 1.88), $t(22) = -0.22$, $p = .83$.

More importantly, participants who experienced low control exhibited marginally increased tendencies of confirmatory information search (*M* = 1.00, *SD* = 1.82) compared to participants in the high control condition (*M* = -0.09, *SD* = 1.88), $F(1, 45) = 4.06$, $p = .05$, $\eta^2 = .08$. For an overview, see Table 3.5.

In addition, participants who experienced low control indicated a marginally higher need for cognitive closure (*M* = 3.48, *SD* = 0.75) than participants in the high control condition (*M* = 3.11, *SD* = 0.68), $F(1, 45) = 3.23$, $p = .08$, $\eta^2 = .07$. We subsequently tested whether the effect of low control on confirmatory information search was mediated by differences in the need for cognitive closure. A bootstrapping analysis (1,000 bootstrap samples; Preacher & Hayes, 2004) revealed that this was not the case. The true indirect effect was estimated to lie between -.10 and +.77 with 95% confidence. Since zero is in the confidence interval, we cannot conclude that the real indirect effect became significant at $p < .05$. Thus, differences in need for cognitive closure do not appear to mediate the effect of low control on confirmatory information search.

Table 3.5. Means and standard deviations for information search and confirmation bias as a function of experimental condition in Study 5.

	Information search					
	Consistent [a]		Inconsistent [a]		Confirmation bias	
Experimental condition	*M*	*SD*	*M*	*SD*	*M*	*SD*
Low control (*n* = 24)	4.63	1.53	3.63	1.31	1.00	1.82
High control (*n* = 23)	4.39	1.27	4.48	1.34	-0.09	1.88

Notes. [a] Six statements were available in each category.

Confirmatory information evaluation

The low control group showed a significant evaluation bias ($M = 1.36$, $SD = 1.63$), $t(23) = 2.70$, $p < .001$, whereas the high control group exhibited no significant evaluation bias ($M = 0.85$, $SD = 2.28$), $t(22) = 1.79$, $p = .09$.

In accordance with our hypothesis, we found no significant differences between the low control ($M = 1.36$, $SD = 1.63$) and high control ($M = 0.85$, $SD = 2.28$) conditions regarding confirmatory information evaluation, $F(1, 45) = 0.79$, $p = .38$. For an overview, see Table 3.6.

Table 3.6. Means and standard deviations for information evaluation and evaluation bias as a function of experimental condition in Study 5.

	Information evaluation					
	Consistent [a]		Inconsistent [a]		Evaluation bias	
Experimental condition	*M*	*SD*	*M*	*SD*	*M*	*SD*
Low control ($n = 24$)	7.36	1.16	6.00	1.14	1.36	1.63
High control ($n = 23$)	7.06	1.65	6.21	1.18	0.85	2.28

Notes. [a] Six statements were available in each category.

Check for interfering effects

We checked for potential interfering effects of gender and age by conducting a 2 (*control*: low vs. high) x 2 (*gender*: female vs. male) ANCOVA with age as a covariate and confirmatory information search as the dependent variable. No significant main effects or interactions with the control manipulation occurred for gender or age (Fs < 0.73, ps > .40). In addition, we found no significant effects for the covariates 'acute and chronic pain', 'prior knowledge of disc herniation', 'personal involvement in disc herniation', and 'involvement of significant others in disc herniation' (Fs < 1.57, ps > .21). Thus, these variables have not systematically affected our findings.

3.5.3 Discussion

Like the previous studies, Study 5 showed that experiences of low control strengthen confirmatory information search (but not confirmatory information evaluation). As far as participants' needs for cognitive closure are concerned, we found no indications that differences in the need for cognitive closure might underlie the effect of low control on confirmatory information search.

Now that we have ruled out possible alternative explanations of our basic effect, we attempt to shed more light on the psychological process underlying it. We hypothesize that confirmatory information search serves as a means of compensatory control, and that selective exposure may help bolster individuals' decision confidence by affirming their perceptions of order and predictability when faced with low control situations. As reported by Kay, Gaucher, et al. (2010), "compensatory control appears to be specifically mediated by a kind of negative affect related to anxious uncertainty" (p. 43). Against this theoretical background, we hypothesized that the negative affective experience of low control (i.e., a feeling of helplessness) would mediate the effect of low control on confirmatory information search. Study 6 thus tested whether it is an increased feeling of helplessness that underlies our basic effect.

In the previous studies, we consistently found that perceptions of low control strengthen selective exposure, which points to an epistemic personal control function of confirmatory information search. However, in specific decision contexts, it might be more functional to engage in *balanced* information search in order to regain a sense of order and predictability (Pittman & D'Agostino, 1989). One such potential boundary condition could lie in decisions that imply serious personal consequences for the decision maker (e.g., a risk to personal health). Such decisions may lead to an increased fear of failure (and thus a fear of losing even more control) in individuals who experience low control (see also Fischer, Kastenmüller, et al., 2011). Consequently, individuals who perceive a threat to their personal control should be highly motivated to avoid the aversive consequences of a wrong decision and should therefore exhibit increased efforts to make the right choice when the personal consequences of a decision are high. As a result of this heightened *accuracy motivation*, individuals who experience low control should be more cautious – and thus more balanced – in their search for decision-relevant information (Chaiken et al., 1989; Ditto et al., 1998; Hart et al., 2009). Study 6 addresses this potential boundary condition for the effect of low control on confirmatory information search.

3.6 Study 6

Study 6 was designed to (a) investigate the psychological process underlying the effect of low control on confirmatory information search and to (b) test a potential boundary condition for this effect. We hypothesized that differences in participants' feelings of helplessness would mediate the basic effect of low control on confirmatory information search. We also expected that low control would only increase confirmatory information search when the personal consequences of the decision were low. To experimentally test this assumption, we introduced two versions of a single decision case, which differed only in the seriousness of the personal consequences they implied (*consequences:* low vs. high). We also opted to incorporate a baseline condition (void of any manipulation of control) to further emphasize that the differences between the experimental groups in the previous studies were driven by perceptions of low control (*control:* low vs. high vs. baseline).

3.6.1 Method

Participants and design

One hundred and fifty-one participants were recruited near the campus of the University of Regensburg. Fifteen subjects were excluded from the dataset due to missing data (3), suspicion (1), or revising their preliminary decision (11). This left a final sample of 136 participants (75 female and 61 male, age ranged from 18 to 62 years; $M = 24.92$, $SD = 6.99$). The experiment was based on a 3 (*control*: low vs. high vs. baseline) x 2 (*consequences*: low vs. high) between-subjects design.

Material and procedure

Participants were told that they would be completing two unrelated tasks. Similar to Studies 3 and 4, we manipulated control by using the Whitson and Galinsky's recall task (2008, Study 3) and then asked participants to indicate the extent to which they felt helpless ("How helpless do you feel currently?"; 1 = *not at all*, 5 = *extremely*). In the no-manipulation baseline condition, participants instead recalled their last visit to a supermarket. In order to manipulate perceived personal consequences, we created two versions of the same decision case, which differed only in regard to the implied seriousness of the final decision's personal consequences. Utilizing the disc herniation decision case from Study 5, we informed all of the participants that the questionnaire was part of a

medical study. They then received identical background information on disc herniation and on the two treatments (i.e., surgical vs. non-surgical treatment).

In the low consequences condition, participants were given instructions identical to those in Study 5 and were told that the questionnaire was a survey on the public acceptance of different treatments for disc herniation. They were then asked whether they favored surgical or non-surgical treatments. In contrast, in the high consequences condition, participants were asked to imagine that they suffered from a disc herniation themselves and should decide which of the two treatments they wanted to start. We checked for the consequences manipulation by asking participants the following question: "How serious do you think the consequences of your decision will be?" (0 = *not serious at all*, 10 = *extremely serious*).

All participants were then informed that additional information on the decision problem was available. These pieces of information were either consistent or inconsistent with the participants' preliminary decision and were presented in statements of 1-2 sentences (see Study 5). Participants rated the credibility and importance of all statements (0 = *not at all*, 10 = *extremely*) and indicated whether they would like to read the corresponding text in detail. The assessments of credibility and importance were collapsed into a single scale of information evaluation ($\alpha = .87$). As in the previous studies, the confirmation bias and the evaluation bias served as dependent variables. After making their final decision and answering some questions on potential confounding variables ('acute and chronic pain', 'prior knowledge of disc herniation', 'personal involvement in disc herniation', and the 'involvement of significant others in disc herniation'), participants were fully debriefed.[4]

[4] In Study 6, we also measured positive and negative affect with the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) to ensure that differences in positive or negative affect did not mediate the effect of low control on selective exposure. Mediation analysis using a bootstrapping method (1,000 bootstrap samples; Preacher & Hayes, 2004) did not reveal any reliable indirect effect of low control on confirmatory information search for positive affect [-.13, .45] or negative affect [-.25, .22] when outcome relevance was low (95%-CI). These results are consistent with research showing that perceptions of low control do not affect mood (Kay et al., 2008; Rutjens, van Harreveld, et al., 2010).

3.6.2 Results

Manipulation check

Participants in the high consequences condition rated the consequences of the decision case as being significantly more serious ($M = 7.01$, $SD = 2.28$) than participants in the low consequences condition ($M = 5.62$, $SD = 2.68$), $F(1, 134) = 10.73$, $p = .001$, $\eta^2 = .07$. Thus, the manipulation of perceived consequences was successful.

Confirmatory information search

Separate *t*-tests against zero were conducted for all of the experimental conditions in order to check for the typical effect of confirmatory information search. A significant confirmation bias only occurred for low control subjects in the low consequences condition ($M = 1.39$, $SD = 1.50$), $t(22) = 4.45$, $p < .001$. In the remaining five experimental conditions, we found no confirmation bias that significantly differed from zero (ts < $\left| 1.45 \right|$, ps > .16).

To check the specific hypotheses, we ran a 3 (*control*: low vs. high vs. baseline) x 2 (*consequences*: low vs. high) analysis of variance (ANOVA). The analysis revealed a significant interaction between the control manipulation and the manipulation of consequences, $F(2, 130) = 3.87$, $p = .02$, $\eta^2 = .06$. No main effects were observed (Fs < 2.12, ps > .14). The nature of the interaction can be seen in Figure 3.1.

Simple effects analyses were conducted to clarify this interaction. In the low consequences conditions, we found marginally significant differences in confirmatory information search between the low control group ($M = 1.39$, $SD = 1.50$), the high control group ($M = 0.45$, $SD = 1.47$), and the baseline group ($M = 0.17$, $SD = 1.67$), $F(2, 130) = 2.73$, $p = .07$, $\eta^2 = .04$. Post hoc tests indicated that when consequences were low, participants who had recalled an event in which they experienced little control exhibited (marginally) higher tendencies toward confirmatory information search compared to either individuals who had thought about a situation where they had experienced a high level of control ($p = .09$) or individuals who had thought about their last visit to a supermarket ($p = .03$). However, in the high consequences conditions, there were no significant differences in confirmatory information search between the low control ($M = -0.32$, $SD = 2.01$), high control ($M = 0.61$, $SD = 2.21$), and baseline conditions ($M = 0.35$, $SD = 2.08$), $F(2, 130) = 1.50$, $p = .23$. For an overview, see Table 3.7.

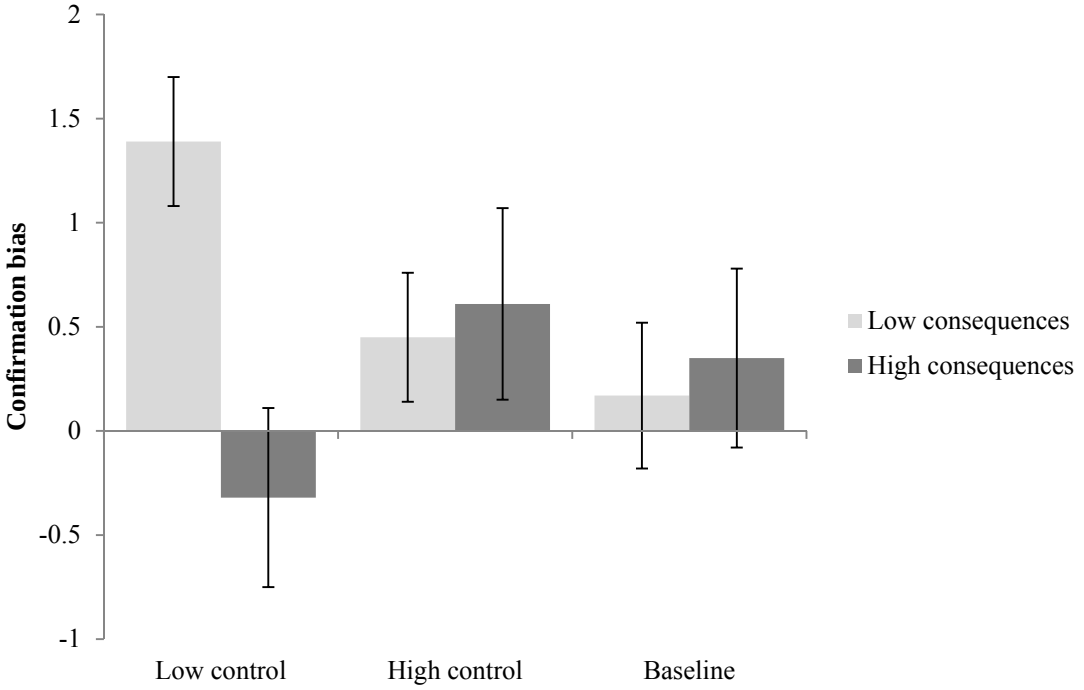

Figure 3.1. Confirmation bias as a function of experimental condition in Study 6. Error bars represent standard errors.

As far as the psychological process underlying our basic effect is concerned, we found significant differences in participants' reported levels of helplessness between the low control group ($M = 1.61$, $SD = 1.10$), the high control group ($M = 1.25$, $SD = 0.53$), and the baseline group ($M = 1.15$, $SD = 0.36$), $F(2, 131) = 4.89$, $p = .01$, $\eta^2 = .07$. More specifically, simple effects analyses showed that participants in the low control condition felt more helpless than either participants in the high control condition ($p = .02$) or participants in the baseline condition ($p = .003$).

We thus tested whether the effect of low control (coded as a binary variable, 0 = baseline/high control and 1 = low control) on selective exposure was mediated by differences in participants' helplessness. To test this hypothesis, a bootstrapping analysis based on 1,000 bootstrap samples was conducted (Preacher & Hayes, 2004). This analysis yielded a significant direct effect of low control on confirmatory information search ($t = 2.73$, $p = .008$), which was reduced to marginal significance ($t = 1.84$, $p = .07$) when controlling for the mediator 'helplessness'. In addition, the true indirect effect was estimated to lie between +.02 and +.71 with 95% confidence. Because zero is not in the confidence interval, we can conclude that the real indirect effect became significant with

$p < .05$. Thus, it appears that differences in individuals' feelings of helplessness mediate the effect of low control on confirmatory information search.

Table 3.7. Means and standard deviations for information search and confirmation bias as a function of experimental condition in Study 6.

	Information search					
	Consistent [a]		Inconsistent [a]		Confirmation bias	
Experimental condition	*M*	*SD*	*M*	*SD*	*M*	*SD*
Low control / Low consequences ($n = 23$)	4.61	0.99	3.22	1.54	1.39	1.50
High control / Low consequences ($n = 22$)	4.64	1.18	4.18	1.47	0.45	1.47
Baseline / Low consequences ($n = 23$)	4.35	1.70	4.17	1.59	0.17	1.67
Low control / High consequences ($n = 22$)	4.09	1.51	4.00	1.14	-0.32	2.01
High control / High consequences ($n = 23$)	4.22	1.54	3.61	1.47	0.61	2.21
Baseline / High consequences ($n = 23$)	4.35	1.72	4.00	1.86	0.35	2.08

Notes.[a] Six statements were available in each category.

Confirmatory information evaluation

Separate *t*-tests against zero were conducted for all of the experimental conditions to check for the typical effect of confirmatory information evaluation. With regard to low decision consequences, we found a significant evaluation bias when participants perceived low control ($M = 1.78$, $SD = 1.89$), $t(23) = 4.51$, $p < .001$, and high control ($M = 1.34$, $SD = 2.35$), $t(22) = 2.68$, $p = .01$. However, no significant evaluation bias occurred in the baseline condition ($M = 0.94$, $SD = 2.68$), $t(23) = 1.68$, $p = .11$. For the high consequences conditions, we did not find a significant evaluation bias for the low control group ($M = 0.13$, $SD = 2.45$), $t(22) = 0.24$, $p = .81$. However, the high control group ($M = 0.94$,

SD = 2.19) and the baseline group (*M* = 0.93, *SD* = 2.10) exhibited confirmatory information evaluation tendencies that differed marginally from zero (*t*s > 2.05, *p*s = .05).

We also ran a 3 (*control*: low vs. high vs. baseline) x 2 (*consequences*: low vs. high) analysis of variance (ANOVA). In accordance with our hypotheses, the analysis revealed no significant main effects or interactions (*F*s < 3.06, *p*s > .08). For an overview, see Table 3.8.

Table 3.8. Means and standard deviations for information evaluation and evaluation bias as a function of experimental condition in Study 6.

	Information evaluation					
	Consistent [a]		Inconsistent [a]		Evaluation bias	
Experimental condition	*M*	*SD*	*M*	*SD*	*M*	*SD*
Low control / Low consequences (*n* = 23)	6.95	1.44	5.17	1.94	1.78	1.89
High control / Low consequences (*n* = 22)	7.27	1.23	5.93	1.68	1.34	2.35
Baseline / Low consequences (*n* = 23)	7.29	1.76	6.35	1.73	0.94	2.68
Low control / High consequences (*n* = 22)	6.20	1.63	6.07	1.66	0.13	2.45
High control / High consequences (*n* = 23)	6.66	1.71	5.72	1.48	0.94	2.19
Baseline/ High consequences (*n* = 23)	7.12	1.38	6.18	2.08	0.93	2.10

Notes. [a] Six statements were available in each category.

Check for interfering effects

We checked for the potential interfering effects of gender and age by conducting a 3 (*control*: low vs. high vs. baseline) x 2 (*consequences*: low vs. high) x 2 (*gender*: female vs. male) ANCOVA with age as a covariate and confirmatory information search as the dependent variable. No significant main effects or interactions were found for gender or age (Fs < 2.13, ps > .14). We also found no significant effects for the covariates 'acute and chronic pain', 'prior knowledge of disc herniation', 'personal involvement in disc herniation', and 'involvement of significant others in disc herniation' (Fs < 2.41, ps > .12).

3.6.3 Discussion

In summary, Study 6 showed that individuals who were experimentally induced to experience low control did not exhibit increased levels of confirmatory information search in a decision case that implied serious personal consequences for the decision maker. Instead, experiencing low control strengthened confirmatory information search only when the personal consequences of the decision were low. This effect was mediated by differences in participants' helplessness: Individuals who perceived low control indicated higher levels of helplessness (compared to individuals in the high control and baseline conditions), which in turn increased confirmatory information search.

3.7 General discussion

3.7.1 Summary

Across four studies, we found consistent support for our hypothesis that perceptions of low control increase confirmatory information search. In particular, individuals who experienced low control showed increased tendencies toward confirmatory information search compared to individuals who perceived high control. In contrast to the effect of low control on confirmatory information search, we found no evidence that confirmatory information evaluation was affected by the manipulation of control. Additionally, we ruled out alternative explanations for the effect of low control on selective exposure based on either an increased perception of general threat (Study 4) or a heightened need for cognitive closure (Study 5), which could have resulted from the induction of low control. In Study 6, we demonstrated that individuals who had recalled a low control event experienced increased levels of helplessness, which then strengthened confirmatory

information search. In addition, we established a boundary condition on the current findings: Perceptions of low control did not affect confirmatory information search in a decision scenario that implied serious personal consequences for the decision maker.

3.7.2 Implications, limitations, and future research

A clear limitation of the current research is that we did not find the basic effect of confirmatory information search (or else found *disconfirmatory* information search tendencies; see Study 3). This seems to conflict with previous studies on selective exposure, which have provided evidence that control groups usually display a confirmation bias. However, recent research has found that various manipulations can affect confirmatory information search relatively irrespective of whether or not control groups exhibit significant confirmatory information search tendencies (Jonas et al., 2003). Thus, this limitation is unlikely to affect the main finding of the present research. In addition, it should be noted that the mediation test in Study 6 was based on a correlational analysis. For this reason, we cannot definitely determine the causal direction of the mediation effect.

The theoretical implications of the current research are threefold. First, our findings provide evidence that the effect of low control on selective exposure is more likely motivational than cognitive in nature. People who experience low control tend to select information in a more confirmatory way, but they do not show increased tendencies of confirmatory information evaluation compared to individuals who experience high control. If this basic effect were due to changes in cognitive processing, perceptions of low control would be expected to affect both information evaluation and information search. This is because perceiving a threat to personal control impairs cognitive functioning and thus promotes heuristic information processing. In turn, heuristic information processing can trigger biases in information evaluation and thus strengthen confirmatory information search (Chaiken, 1980, 1987; Ditto & Lopez, 1992; Ditto et al., 1998). However, since we did not find that low control affected confirmatory information evaluation, our results suggest that a motivational process may drive the effect of low control on confirmatory information search. Our findings are in line with the dominant motivational account of selective exposure – namely, dissonance theory. According to dissonance theory, factors that add to post-decisional dissonance increase selective exposure. Against this theoretical background, our results suggest that the aversive experience of low control might strengthen negative feelings of dissonance and subsequently increase an individual's motivation to reduce these feelings by means of confirmatory information search.

Second, our studies support and extend the research of Jonas, Graupmann, et al. (2006), who argued for a mood-regulating function of selective exposure. Jonas, Graupmann, et al. (2006) provided empirical evidence that confirmatory information search serves not only as a means of dissonance reduction, but can also attenuate negative mood. Our studies can be considered a first hint that selective exposure may not solely serve to regulate general negative affect (Jonas, Graupmann, et al., 2006), but might also bring relief to individuals who suffer from the specific feelings of low control and situational unpredictability.

Third, the present studies complement previous research that has investigated compensatory control processes (for an overview, see Kay, Gaucher, et al., 2010). Our findings provide an important extension to this research, as they demonstrate that selective exposure might also function as a compensatory control mechanism that alleviates the aversive state of low control by affirming perceptions of order. In particular, we found that it is the affective experience of low control (i.e., a feeling of helplessness) that drives its effect on confirmatory information search. This mediation effect is in line with Kay, Gaucher, et al. (2010), who argued that processes of compensatory control should be mediated by such negative affective reactions. Thus, our findings suggest that increased levels of confirmatory information search might help people to re-establish a sense of order and predictability when they experience low control. More specifically, selective exposure might serve as an epistemic personal control strategy (see Kay, Gaucher, et al., 2010) that allows people to create a confirmatory reality and thus to dispel uncertainty. Although our work offers first evidence for a key role played by selective exposure in epistemic personal control, further research is needed to more closely examine the links between control, (un)certainty, and selective exposure.

On a more practical level, our results have important implications for decision making under uncontrollable conditions. Previous research has often connected selective exposure with poor decision outcomes (e.g., Janis, 1982; Kray & Galinsky, 2003), as it leads to the maintenance of suboptimal or even incorrect decisions (Greitemeyer & Schulz-Hardt, 2003). Severe decision failures can thus result from confirmatory information search. However, researchers have also underlined *benefits* of selective exposure, such as preventing indecisiveness (Beckmann & Kuhl, 1984; Wicklund & Frey, 1981). In other words, selective exposure "protects the current intention (or tentative decision) from being replaced by competing behavioral tendencies" (Beckmann & Kuhl, 1984, p. 224) and thus helps individuals to "deduce a course of action" (Beckmann & Kuhl, 1984, p. 225). In sum, our findings indicate that individuals who experience low control exhibit increased levels

of selective exposure, and that these increases might promote their capacity to act, but at the potential cost of suboptimal decision making. From an evolutionary perspective, this effect seems to be highly functional for individuals who face uncontrollable events (e.g., existential threats). We would, for example, expect that a person who is persecuted by an aggressor should quickly arrive at a final choice when deciding whether to flee in one direction or the other (even if there might be one suboptimal alternative) as opposed to standing still at the crossroads while carefully weighing all of the pros and cons of both options. Similarly, recent research has shown that experiencing low levels of control drives cognitive processes (e.g., analytical thinking) that facilitate effective action (Zhou, He, Yang, Lao, & Baumeister, 2012).

Does the action-promoting quality of selective exposure imply that de-biasing techniques are unneeded when decision makers face uncontrollable events? Although selective exposure seems to be highly adaptive in real threat situations that require fast decision making, there are various low control decision contexts in which confirmatory information search may be rather dysfunctional. In the present research, we showed that not only the direct experience of low control (Study 5) but also the mere salience of a low-control situation (Studies 3, 4, 6) can increase selective exposure. This implies that even non-acute threats to personal control (e.g., media coverage of economic threats) may strengthen confirmatory information search in everyday decision making (e.g., investment decisions), and potentially lead to decision failures. Thus, when facing non-acute threats to personal control, it seems reasonable to counteract selectivity by means of de-biasing techniques. One such de-biasing technique could lie in reminding oneself of the supposed consequences that come along with the decision (see Study 6). Future research is needed to further investigate the effectiveness of de-biasing techniques in low-control decision making.

Another question arising from our findings is whether individuals' perceptions of low control might have played some role in previous research on threat and selective exposure. Recently, various threats have been found to increase selective exposure (Fischer, Kastenmüller, et al., 2011, Studies 3-5; Lavine et al., 2005). However, these studies have so far neglected potential differences in participants' perceived control. Based on our findings, one might suggest that threat only increases selective exposure when people perceive low control (see Study 4). Thus, future research should investigate whether the relationship between threat and selective exposure is moderated by levels of experienced control (see also Greenaway, Louis, Hornsey, & Jones, 2013). In conclusion, the current

research extends our knowledge of the effects of low control on decision making and confirmatory information search and evaluation. Our findings suggest that decision makers who experience low control tend to bolster their confidence in a decision by engaging in confirmatory information search. Although this phenomenon seems to be highly functional in low control situations that demand quick decisions, it also implies the risk of low-quality decision making.

4. Metaphysical randomness and decision making: The impact of religious priming on confirmatory information processing[5]

4.1 Abstract

The present research (Studies 7-11) investigated the impact of religious priming on confirmatory information processing, which is a tendency to prefer standpoint-consistent information to standpoint-inconsistent information in information search and evaluation. It was consistently found that religious priming reduces confirmatory information processing in secular decision scenarios. Alternative explanations based on psychological discomfort processes (Study 8) or the activation of mortality or fairness concepts were ruled out (Study 9). We also found that reminders of religion guided individuals' thoughts away from secular decisions and toward religious ideas, leading to decreased tendencies of confirmatory information processing (Studies 10 and 11).

4.2 Background

Religious beliefs are often thought to be linked with closed-mindedness. Consistent with this perception, researchers have observed that holding such beliefs is positively related to the intolerance of ambiguity (Duriez, 2003; Sagioglou & Forstmann, 2013) as well as the outright neglect of information that is inconsistent with them (Hart et al., 2009). This

[5] A modified version of this research is currently submitted for publication together with Peter Fischer.

neglect may have significant real-world consequences. For example, Moore and Kraemer (2005) report that parents and administrators who believe in creationism "have become increasingly active in pressuring biology teachers to avoid evolution" (p. 463) in school lessons.

However, recent research has also indicated that the association between religious belief and closed-mindedness may not be so simple. Believers have been found to be open to new information in multiple respects (Neyrinck, Vansteenkiste, Lens, Duriez, & Hutsebaut, 2006) and have the ability to live with inconsistencies (Assor, Cohen-Malayev, Kaplan, & Friedman, 2005). These studies are a first suggestion that it is not religiosity or religious concepts *per se* that facilitate closed-mindedness – instead, religious convictions may actually promote *open-mindedness* toward standpoint-inconsistent information, with the provision that this information does not conflict with the religious beliefs.

The question we pose in this chapter is thus whether religion makes individuals more open to information that is inconsistent with their initial standpoints when making *secular* decisions. In five experimental studies, we test whether religious salience attenuates confirmatory information processing.

4.2.1 Confirmatory information processing

In relation to decision making, confirmatory information processing refers to a tendency for individuals to systematically prefer decision-consistent information over decision-inconsistent information in both information search (a phenomenon called *selective exposure*; Frey, 1986) and information evaluation (a phenomenon called *biased assimilation*; Ditto & Lopez, 1992; for a recent review, see also Fischer & Greitemeyer, 2010; Hart et al., 2009). Although confirmatory information processing may have some important functional aspects (such as preventing indecisiveness; Beckmann & Kuhl, 1984), research has mainly focused on its negative implications for decision making. This is because confirmatory information processing is strongly associated with poor decision outcomes, by dissuading or counteracting the revision of incorrect decisions (Greitemeyer & Schulz-Hardt, 2003). Given the potential ramifications of poor decision making (e.g., in a political or business context), it is of great importance to investigate those factors and psychological processes that may make individuals more open – and thus less confirmatory – in information processing.

In the standard research paradigm for examining confirmatory information processing, participants work on a decision problem that requires them to make a preliminary decision by choosing one of two alternatives (e.g., whether the contract of a manager should be extended or not; Fischer, Greitemeyer, et al., 2008). Afterwards, participants are given the opportunity to search for and/or evaluate additional information that either supports or opposes their initial decision. Confirmatory information processing may be observed in information search if participants systematically search for decision-consistent information and/or neglect decision-inconsistent information (e.g., Jonas et al., 2001). In information evaluation, it may be observed if participants assess information that is consistent with their decision as being of higher quality than decision-inconsistent information (Greitemeyer & Schulz-Hardt, 2003).

These effects of confirmatory information processing can be explained by considering either motivational or cognitive perspectives. One major motivational framework is dissonance theory, which suggests that confirmatory information processing is a means of reducing post-decisional dissonance. According to this perspective, individuals experience cognitive dissonance – an adverse and undesirable motivational state – after making decisions, as both the positive aspects of the non-chosen alternative and the negative aspects of the chosen alternative become salient. To reduce the unpleasantness and discomfort of dissonance, individuals systematically prefer decision-consistent information over decision-inconsistent information (Festinger, 1957; Frey, 1986).

A more cognitive point of view argues that biases in information processing can be explained by any given individual's inability to be truly objective when making decisions. Even if individuals strive to find the qualitatively best pieces of information to aid them in decision making, they cannot evaluate information quality independently of their own standpoints and subsequently tend to ascribe greater quality to decision-consistent information than decision-inconsistent information (Lord et al., 1979). As a result, decision-consistent information is systematically preferred over decision-inconsistent information (Ditto & Lopez, 1992; Ditto et al., 1998). Building on this theoretical foundation, previous research has shown that confirmatory information search and confirmatory information evaluation are strongly interconnected (Fischer, Greitemeyer, et al., 2008; Fischer et al., 2005), and both phenomena have been recently subsumed under the term *confirmatory information processing*. In the present research we investigate confirmatory information processing as a function of religious salience.

4.2.2 Religion and confirmatory information processing

Religion can be defined as "cognition, affect, and behavior that arise from the awareness of, or perceived interaction with, supernatural entities that are presumed to play an important role in human affairs" (McCullough & Willoughby, 2009, p. 71). Although conventional wisdom has held that religion will steadily lose its ground in society, it still plays an important role in peoples' lives, as religious traditions strongly influence the cultural contexts humans live in (Hommel & Colzato, 2010). For example, religion might affect individuals via their exposure to religious ideas and imagery (e.g., religious terminology in advertisements or in popular music).

Initial evidence for the assumption that religion decreases confirmatory information processing has been found in studies that investigated believers' personalities. Individuals who pursue certain types of religiosity have been shown to share characteristics that are associated with balanced information processing. According to Saroglou (2002b), open and mature religiosity and spirituality is associated with high openness to experience – a general appreciation of unusual and new ideas – and greater variety in personal experience (McCrae, 1996). Similarly, spirituality-emotional religion goes hand in hand with low decisiveness and low closed-mindedness (Saroglou, 2002a). Thus, individuals who believe in spirituality-emotional religion feel only a limited need to "striv[e] for closure in judgment and decision making" (Webster & Kruglanski, 1994, p. 1050) and do not mind when "their knowledge is confronted by alternative opinions or inconsistent evidence" (Webster & Kruglanski, 1994, p. 1050).

Further evidence for the assumption that religion may attenuate confirmatory information processing comes from a line of research indicating that faith in God serves as a "source of compensatory control" (Kay, Gaucher, et al., 2010, p. 37) when individuals have to deal with aversive circumstances (see also Kay et al., 2008, 2009). In particular, Inzlicht, McGregor, Hirsh, and Nash (2009, Study 2) showed that belief in God "minimizes the experience of error" (p. 385). The researchers demonstrated that high degrees of religiosity are associated with smaller increases in error-related negativity (ERN). Error-related negativity is an event-related potential, which is generated in the anterior cingulate cortex (ACC) after individuals have made a mistake. Importantly, Inzlicht and Tullett (2010) demonstrated that religious primes lead to decreases in event-related negativity (ERN) for believers and thus determined the direction of causality for this effect. Inzlicht et al. (2009) concluded that religion serves as a buffer against the experience of conflict, as it fosters "a type of thinking that constrains thought and

perception away from inconsistencies" (p. 385). These results suggest that reminders of religion might help individuals to deal with inner conflicts.

Importantly for the present research, Baumeister, Bauer, and Lloyd (2010) have argued that religion may have favorable effects on decision making. When making a decision, individuals often have to choose between two or more options, with some arguments favoring one alternative and additional ones supporting the other(s). Upon making a decision, individuals often have to face conflicts, as decision-inconsistent information (i.e., arguments that support the non-chosen options) becomes salient. Such conflicts have aversive implications such as uncertainty and post-decisional dissonance, which individuals are usually motivated to avoid. According to Baumeister et al. (2010) "religion may appeal [in these decision making situations] because of its potential to alleviate the emotional burden that stems from the plethora of choices" (p. 75). This is because it "prescribes certain actions" (p. 73), and can therefore provide "a sense of moral certainty" (p. 75) of having made the right choice (i.e., a choice that is in line with religious prescriptions).

Building upon this research, we hypothesize that religion might not only help individuals to manage conflicts by providing guidelines for which option to choose, but may also be beneficial in helping individuals deal with the conflicts that arise when standpoint-inconsistent information becomes salient following a decision. One prominent way to reduce such conflicts is by engaging in confirmatory information processing. Thus, we hypothesize that if religion helps people to deal with inconsistencies and discrepancies following a decision, it should also decrease an individual's tendency to neglect decision-inconsistent information, subsequently reducing confirmatory information processing.

4.2.3 The present research

In the present research, we expected individuals to exhibit decreased tendencies of confirmatory information processing when religious concepts are salient. As religion provides a means for dealing with the experience of conflict (Inzlicht et al., 2009; Inzlicht & Tullett, 2010), we suggested that reminders of religion might help individuals to stay open to information that is inconsistent with their decisions. More specifically, a state of religious salience should lead inconsistent information to be searched for more frequently and evaluated more positively because reminders of religion draw participants' foci away from post-decisional conflicts. In five studies, we experimentally tested whether religious

priming reduces confirmatory information processing and investigated the potential underlying psychological processes.

4.3 Study 7

In Study 7, we hypothesized that reminders of religion would reduce confirmatory information processing. We predicted that participants who thought about religion would exhibit lower levels of confirmatory information search and evaluation in a secular decision making scenario than participants who recalled an event unrelated to religion.

4.3.1 Method

Participants and design

Sixty-eight students participated in this experiment, which was based on a one-factorial design with two experimental between-subjects conditions (*prime*: religious vs. non-religious). Two subjects with obvious systematic response tendencies and three subjects who revised their preliminary decision were excluded from the dataset, which left a final sample of 63 participants (43 female and 20 male, age ranged from 17 to 57 years; $M = 23.35$, $SD = 5.50$).

Materials and procedure

Subjects were randomly assigned to either a religious prime or a non-religious prime control condition. The priming procedure was similar to the type of manipulation that has been successfully used to induce mortality salience (see Rosenblatt, Greenberg, Solomon, Pyszczynski, & Lyon, 1989). Participants in the religious prime condition were asked to write down the first thing that came to their minds when thinking about religion. In the control condition, subjects wrote about their last visit to a supermarket.

Following the manipulation, participants completed a fictitious decision case regarding whether or not the contract of a manager (Mr. Miller) should be extended (Fischer et al., 2005; Frey, 1986). After reading some background information about Mr. Miller (which was balanced with regard to positive and negative aspects), participants made a preliminary decision by indicating whether they favored or opposed the extension of Mr.

Miller's contract. They were then informed that additional information about the decision case was available. This information was written by Mr. Miller's colleagues and included 12 one-page comments. Participants received a list that included the main thesis of each one-page comment summarized in 2-3 sentences. These summaries made it clear whether or not the colleague supported extending Mr. Miller's contract. An example of a favorable comment was: "Mr. Miller shows intuition and sensitivity for new trends and developments in the fashion industry. His creative ideas might facilitate entering new sales markets. Therefore, his contract should be extended." An example of a critical comment was: "Mr. Miller has just copied competitors' business ideas. Thus, his business strategy has doubtful prospects of success. Therefore, his contract should not be extended." There were six comments favoring the extension and six comments opposing it, ensuring that, regardless of each participant's preliminary decision, half of the comments were consistent with it and half inconsistent with it. Participants evaluated the expected quality of all of the comments according to their credibility ("How credible do you expect this information to be?"; 0 = *not at all*, 10 = *extremely*) and importance ("How important will this information be for making a good decision?"; 0 = *not at all*, 10 = *extremely*). They also indicated whether they would like to read the corresponding comments in detail later on. Participants could select freely from the available comments. We computed difference values for information credibility, information importance, and information search by subtracting the corresponding values for decision-inconsistent information from the values for decision-consistent information. For the following analyses, the three difference scores were transformed into *z*-values and collapsed into an overall index of confirmatory information processing ($\alpha = .90$).

After the participants finished the information search and evaluation, they made a final decision as to whether Mr. Miller's contract should be extended.[6] Participants were then fully debriefed and told that there were no extended versions of the articles.

[6] In both this and the subsequent studies within this chapter, we asked some further questions, which were not relevant to the aim of this research.

4.3.2 Results

Confirmatory information processing

We checked for the typical effect of confirmatory information processing (i.e., the preference of decision-consistent information over decision-inconsistent information) using one-sample *t*-tests against zero. The results showed no basic effect of confirmatory information processing for the control condition ($M = 0.22$, $SD = 0.87$), $t(32) = 1.43$, $p = .16$. In contrast, we found a marginally significant *disconfirmatory* bias (i.e., a preference for decision-inconsistent information over decision-consistent information) when religious concepts were salient ($M = -0.29$, $SD = 0.86$), $t(29) = -1.86$, $p = .07$.

A one-way ANOVA (*prime*: religious vs. non-religious) with confirmatory information processing as the dependent variable revealed that participants in the religious prime condition exhibited stronger disconfirmatory information processing tendencies ($M = -0.29$, $SD = 0.86$) than participants in the control condition ($M = 0.22$, $SD = 0.87$), $F(1, 61) = 4.06$, $p = .02$, $\eta^2 = .08$.[7] For an overview of the results, see Table 4.1.

Table 4.1. Means and standard deviations for information search and combined *z*-transformed confirmation bias (search and evaluation) as a function of experimental condition in Study 7.

	Information search					
	Consistent [a]		Inconsistent [a]		Confirmation bias (combined) [b]	
Prime	*M*	*SD*	*M*	*SD*	*M*	*SD*
Religious ($n = 30$)	3.73	1.76	2.73	1.82	-0.29	0.86
Non-religious ($n = 33$)	4.45	1.20	2.76	1.35	0.22	0.87

Notes. [a] Six pieces of information were available in each category. [b] This 'confirmation bias' corresponds to the *z*-transformed combination of the information search bias and information evaluation biases.

[7] Recent research has shown that religious primes foster prosocial decision making (e.g., Shariff & Norenzayan, 2007). Thus, we also tested whether activating religious concepts affected participants' initial decisions in the present studies. However, we found no statistically significant effects (*p*s > .19).

Check for interfering effects

We checked for interfering effects of gender and age by conducting a 2 (*prime*: religious vs. non-religious) x 2 (*gender*: female vs. male) ANCOVA with age as a covariate and confirmatory information processing as the dependent variable. We found a significant main effect for age, $F(1, 58) = 7.89$, $p = .007$, $\eta^2 = .12$, indicating that older participants exhibited stronger confirmatory information processing tendencies than younger participants, $r(63) = .38$, $p = .002$. However, the basic effect of religious priming on confirmatory information processing remained marginally significant when controlling for age, $F(1, 58) = 3.84$, $p = .05$, $\eta^2 = .06$. Gender did not significantly influence confirmatory information processing, nor interact with the prime manipulation (Fs < 2.34, ps > .13).

4.3.3 Discussion

Overall, Study 7 provided initial evidence for our hypothesis that religious salience attenuates confirmatory information processing. Participants who thought about religion exhibited stronger *disconfirmatory* tendencies in information processing than participants who concentrated on a non-religious topic, preferring decision-inconsistent over decision-consistent information when reminded of God.

However, Study 7 had significant limitations. First, neither information regarding religious affiliation nor information regarding religiosity was collected. It is therefore unclear whether our results were affected by such variables. Second, the highly fictitious decision case we employed means that we cannot conclude with certainty that religious salience decreases confirmatory information processing in decision contexts where the participants feel more involved. To address these shortcomings, we sought to control for religious affiliation and the strength of personal religiosity in Study 8. We also used an alternative manipulation and a decision scenario that we felt would elicit greater personal involvement.

A potential explanation for our findings that religious primes attenuate confirmatory information processing could be that religious primes lead to decreases in cognitive dissonance. High levels of such dissonance (which arises after making decisions) have been shown to trigger confirmatory information processing (Festinger, 1957; Frey, 1986). Reminders of religion might buffer this unpleasant state; for example, previous studies have demonstrated that religion leads to subjective wellbeing (e.g., Hackney & Sanders, 2003) and provides relief from emotionally aversive conditions such as death anxiety (e.g.,

Jonas & Fischer, 2006; Vail et al., 2010). We addressed this possible explanation in Study 8.

4.4 Study 8

4.4.1 Method

Participants and design

Seventy-two undergraduate students participated in this study. Three subjects were excluded from the dataset because of systematic response tendencies (1), suspicion (1), or the revision of their preliminary decision (1). The final sample consisted of 69 participants (50 female and 19 male, age ranged from 19 to 29 years; $M = 23.12$, $SD = 1.91$). 92.8% of the subjects indicated identification with a religious affiliation (76.8% Catholicism, 13% Evangelism, 2.9% other denominations). The experiment was based on a one-factorial design with two experimental between-subjects conditions (*prime*: religious vs. non-religious).

Materials and procedure

We employed a priming task similar to the one used by Gervais and Norenzayan (2012). The task required participants to evaluate thirteen different adjectives (e.g., accepting controlling) on differing criteria. Participants in the religious prime condition indicated how well each adjective describes God (1 = *not at all*, 9 = *very well*), whereas participants in the non-religious prime control condition rated how frequently the adjectives are used in everyday speech (1 = *not at all*, 9 = *very often*). Participants were randomly assigned to one of the two conditions.

Participants were then asked to work on a decision case regarding the holdings of the Regensburg University library, namely, whether its traditional paper books should be converted to – and replaced by – eBooks. It was assumed that participants' status as students at the University would lead them to feel high levels of involvement with this decision case. Furthermore, participants were told that there were ongoing debates regarding whether digital books should gradually replace bound books in the University

library. Having been presented with the background information, participants made a preliminary decision as to whether or not the paper books should be converted to eBooks.

Afterwards, participants completed an eleven-item affect questionnaire (Elliot & Devine, 1994) in which they indicated their levels of positive affect, negative self-directed affect, and psychological discomfort on 11-point Likert scales (0 = *does not apply at all*, 10 = *applies very much*). We collapsed the affect items into three affect indices: the positive affect index (happy, good, friendly, optimistic; α = .85); the negative self-directed affect index (angry toward myself, dissatisfied with myself, guilty, self-critical; α = .85); and the index of psychological discomfort (uncomfortable, uneasy, bothered; α = .91).

On completing the affect measure, participants were given the opportunity to consider additional information relating to the decision case. This information consisted of 12 one-page comments written by experts in new media and learning. Participants received a list that presented the key points of each comment in a brief summary (1-2 sentences). Of the twelve comments, six supported the conversion to eBooks and six arguments opposed it. An example of an argument supporting the conversion to eBooks was: "The production of bound books requires an enormous amount of paper. Therefore, eBooks are less environmentally damaging than paper books." An example of an argument opposing the conversion was: "Paper books provide a better overview of the text, so you can navigate faster within the document. Therefore, reading paper books is much more convenient than reading eBooks." Subjects rated the quality (credibility and importance) of each statement (0 = *not at all*, 10 = *extremely*) and indicated whether they would like to read the corresponding article later on. We computed difference values for information credibility, information importance, and information search by subtracting the corresponding values for decision-inconsistent information from the values for decision-consistent information. For the following analyses, the three difference values were transformed into *z*-values and integrated into an overall index of confirmatory information processing (α = .71). After completing the information search and evaluation, participants indicated their final decision.

Next, participants filled out the German translation of the Religious Orientation Scale (Allport & Ross, 1967; Zwingmann, Hellmeister, & Ochsmann, 1994). This scale was formulated to measure extrinsic and intrinsic religious orientation. Extrinsic religiosity is described as being a means to an end or as using religion to achieve secular goals. In contrast, intrinsic religiosity is internally motivated and an end in itself. Each religiosity concept was measured with six items. The extrinsic scale (α = .70) contains items such as

"A primary reason for my interest in religion is that my church is a congenial social activity" (1 = *not at all true*, 9 = *exactly true*), whereas an example of an item in the intrinsic scale (α = .85) is "I try hard to carry my religion over into all my other dealings in life" (1 = *not at all true*, 9 = *exactly true*). Afterwards, participants were fully debriefed and informed that there were no extended versions of the articles.

4.4.2 Results

Confirmatory information processing

We checked for the typical effect of confirmatory information processing with one-sample *t*-tests against zero. The results indicated a marginally significant confirmatory bias in the non-religious prime control group ($M = 0.23$, $SD = 0.67$), $t(33) = 1.97$, $p = .06$, and a marginally significant *disconfirmatory* bias in the religious prime group ($M = -0.26$, $SD = 0.83$), $t(34) = -1.83$, $p = .08$.

In accordance with our hypothesis, a one-way ANOVA (*prime*: religious vs. non-religious) with confirmatory information processing as the dependent variable indicated that participants in the religious prime condition exhibited significantly weaker confirmatory information processing tendencies ($M = -0.26$, $SD = 0.83$) than participants in the control condition ($M = 0.23$, $SD = 0.67$), $F(1, 67) = 7.03$, $p = .01$, $\eta^2 = .10$. For an overview of the results, see Table 4.2.

Table 4.2. Means and standard deviations for information search and combined *z*-transformed confirmation bias (search and evaluation) as a function of experimental condition in Study 8.

	Information search					
	Consistent [a]		Inconsistent [a]		Confirmation bias (combined) [b]	
Prime	*M*	*SD*	*M*	*SD*	*M*	*SD*
Religious (*n* = 35)	2.11	1.28	2.69	1.43	-0.26	0.83
Non-religious (*n* = 34)	3.12	1.85	2.79	1.70	0.23	0.67

Notes. [a] Six pieces of information were available in each category. [b] This 'confirmation bias' corresponds to the *z*-transformed combination of the information search bias and information evaluation biases.

Check for interfering effects and psychological processes

We considered potential effects of gender, religious affiliation, and age. A 2 (*prime*: religious vs. non-religious) x 2 (*gender*: female vs. male) x 4 (*religious affiliation:* Catholicism vs. Evangelism vs. other denominations vs. no religious affiliation) ANCOVA with age as a covariate was performed. Participants' age, gender, or religious affiliation did not significantly influence confirmatory information processing nor interact with the priming manipulation (Fs < 0.69, ps > .56).

Additionally, we performed a regression analysis with confirmatory information processing as the dependent variable and manipulation of salience (one dummy code), intrinsic religious orientation (standardized), and the two-way interaction as predictors. This analysis yielded no main effect or interaction (ps > .55), indicating that intrinsic religiosity is unlikely to moderate the effect of religious salience on confirmatory information processing. Similar results were obtained for extrinsic religiosity (ps > .17).[8] With respect to the affect measure, we conducted a 2 (*prime:* religious vs. non-religious) x 3 (*affect*: positive affect, negative self-directed affect, psychological discomfort) mixed

[8] In Study 10, we again checked whether levels of personal religiosity moderated the effect of religious priming on confirmatory information processing. In line with the results of Study 8, regression analyses yielded no significant main effects or interactions (ps > .05), indicating that neither intrinsic religiosity nor extrinsic religiosity are probable moderators. Therefore, we opted not to report these analyses again when discussing Study 10.

model ANOVA with affect as a within factor. The analysis revealed a significant main effect of affect, $F(1.54, 134) = 113.56$, $p < .001$, $\eta^2 = .63$ (with Greenhouse-Geisser correction), illustrating that participants experienced more positive affect ($M = 6.67$, $SD = 1.71$) than psychological discomfort ($M = 2.02$, $SD = 2.34$) or negative self-directed affect ($M = 2.26$, $SD = 2.17$). Importantly, we found no interaction between the priming manipulation and affect, $F(1.54, 134) = .06$, $p = .91$. In sum, the experimental design had no effect on the affect measures.

4.4.3 Discussion

Study 8 provided evidence that reminders of religion can also reduce confirmatory information processing in decision scenarios with higher personal involvement. Religious affiliation had no impact on the effect of religious priming on confirmatory information processing. Furthermore, the strength of personal religiosity did not moderate this effect. As far as cognitive dissonance is concerned, we found no indications that changes in psychological discomfort mediate the effect of religious priming on confirmatory information processing. We also ruled out positive emotions or negative self-directed affect as possible mediators.[9]

However, there is another alternative explanation for the effect of religious priming on confirmatory information processing, which must be addressed. Since the human brain is an interconnected network, the activation of a specific concept can spread to related concepts. Due to such "unintended processing effects" (Bargh & Chartrand, 2000, p. 270), religious primes are liable to activate mental concepts that are closely connected to religion, such as mortality or fairness (Rounding, Lee, Jacobson, & Ji, 2012).

With regard to mortality, activating religious concepts might have led participants to think about their own deaths. Recent research has supported a strong association between death and religion; for example, Norenzayan and Hansen (2006) demonstrated that reminders of death led Christian participants to report increased faith in supernatural

[9] We measured participants' personal discomfort, negative self-directed affect, and positive affect again in Study 10. Mediation analyses using a bootstrapping method (1,000 bootstrap samples) for small samples (Preacher & Hayes, 2004) did not reveal any reliable indirect effect of religious priming on confirmatory information processing for psychological discomfort [-.16, .06], negative self-directed affect [-.18, .02], or positive affect [-.16, .10] (95%-CI). This finding further indicates that differences in psychological discomfort, negative self-directed affect, or positive affect are unlikely to mediate the basic effect of religious priming on confirmatory information processing.

agents. As thoughts of mortality are experienced as threatening (Jonas & Fischer, 2006; Vail et al., 2010), coactivated mortality concepts could have induced a "cautious mindset" (Fischer, Greitemeyer, et al., 2008, p. 390) when processing decision-relevant information. Thus, reminders of religion may lead to decreases in confirmatory information processing by making thoughts of mortality salient.[10]

Another plausible explanation that we have to take into account is that religious salience might have spread to fairness concepts. Since morality and fairness are deeply rooted in religion (Baumeister et al., 2010), participants might have adopted a mindset of 'fair' decision making and information processing following a religious prime. More specifically, participants might have been motivated to weigh pros and cons carefully in order to avoid being unfair or discriminatory. As a consequence, participants could have become more balanced in their search for and evaluation of information (Johnston, 1996; Lundgren & Prislin, 1998).

Alternative explanations regarding mortality salience and fairness salience were thus addressed in Study 9. Furthermore, it is possible that our use of rather explicit priming techniques in Studies 7 and 8 may have introduced experimental demand effects. We therefore opted to employ more subtle priming procedures in the remaining studies.

4.5 Study 9

In Study 9, we hypothesized that participants in the religious prime condition would exhibit weaker confirmatory information processing tendencies than individuals who were primed with non-religious, mortality, or fairness concepts.

[10] Research on mortality salience and confirmatory information processing is not uniform. For example, Jonas et al. (2003) suggested that confirmatory information processing may be unaffected or even increased when participants are primed with mortality.

4.5.1 Method

Participants and design

One hundred and twenty-eight students participated in this study. Ten subjects were excluded from the final sample due to missing data (2), suspicion (3), or the revision of their preliminary decision (5). The final sample consisted of 118 participants (106 female, 12 male, age ranged from 18 to 44; $M = 21.00$, $SD = 3.17$). 93.2% of the subjects indicated identification with a religious affiliation (78.8% Catholicism, 12.7% Evangelism, 1.7% other denominations). The study was based on a one-factorial design with four experimental between-subjects conditions (*prime*: religious vs. non-religious vs. mortality vs. fairness). Subjects were randomly assigned to one of the four conditions.

Materials and procedure

We used the scrambled sentence paradigm (Srull & Wyer, 1979) as our priming manipulation. This task presents participants with ten sets of five randomly presented words and requires them to construct grammatically correct, four-word sentences by eliminating one word from each set. In the religious prime condition, half of the scrambled sentences contained words associated with religion (prophets, spirit, divine, God, sacred; see Shariff & Norenzayan, 2007) and half of the sentences did not. In the non-religious control condition, we used words that were unrelated to religion and formed no coherent concept (scientists, cloth, great, bound, much). Participants in the mortality prime condition unscrambled sentences that contained words related to death (coffin, lethal, skull, corpse, murder), and participants in the fairness prime condition were met with words that have fairness connotations (moral, values, fair, responsibility, conscience).

After completing the scrambled sentence task, participants were asked to imagine that they had the opportunity to invest 10,000 € in one of two companies, which both had sound financial footing, yet mixed prospects. The two companies were the 'Nor-AG' (a developer, manufacturer, and distributor of printing machines) and the 'Mag-AG' (which performed the same roles, but for milling machines). Participants were told that both companies really existed, but had been made anonymous for data protection purposes. After reading some background information about the two companies, participants made a tentative decision regarding which one they would invest in.

Next, participants were given the opportunity to consider additional information pertaining to the decision case. They were informed that this additional information

consisted of 12 one-page comments written by economic analysts. Participants received a list that contained a two-sentence summary of each comment's main argument. Overall, six pieces of information supported an investment in the Nor-AG (three pieces of information in favor of the Nor-AG and three pieces of information against the Mag-AG), and six pieces of information supported an investment in the Mag-AG (three pieces of information in favor of the Mag-AG and three pieces of information against the Nor-AG). Therefore, each participant was faced with six pieces of decision-consistent information and six pieces of decision-inconsistent information, irrespective of their preliminary choice. An example of an argument supporting investing in the Nor-AG was: "According to the company report, the Nor-AG had a successful last quarter concerning incoming orders. Thus, investors may well expect a high dividend." An example of an argument opposing an investment in the Mag-AG was: "In contrast to competitors' products, products of the Mag-AG only appeal to a small consumer group. This is why sales of the Mag-AG have stagnated." Participants evaluated the credibility and importance of all of the available pieces of information (0 = *not at all*, 10 = *extremely*) and indicated whether they wished to read the corresponding full-page comments in detail. We computed difference values for information credibility, information importance, and information search by subtracting the corresponding values for decision-inconsistent information from the values for decision-consistent information. For the following analyses, the three difference values were transformed into *z*-values and subsumed under an overall index of confirmatory information processing ($\alpha = .73$). After the participants completed the information search and evaluation, they were asked to make a final investment decision. Upon doing so, the experiment ended, and participants were fully debriefed.

4.5.2 Results

Confirmatory information processing

One sample *t*-tests against zero revealed that participants in the non-religious control condition had a confirmatory bias ($M = 0.22$, $SD = 0.68$), which differed from zero on a marginally significant level, $t(29) = 1.80$, $p = .08$. In contrast, participants in the religious prime condition exhibited a significant *disconfirmatory* bias ($M = -0.38$, $SD = 0.80$), $t(29) = -2.62$, $p = .01$. Confirmatory information processing in the mortality ($M = 0.13$, $SD = 0.80$) and fairness ($M = 0.04$, $SD = 0.69$) prime conditions did not significantly differ from zero (ts < .76, ps > .45).

A one-way ANOVA (*prime*: religious vs. non-religious vs. fairness vs. mortality) with confirmatory information processing as the dependent variable revealed a significant effect of the priming manipulation, $F(3, 114) = 3.53$, $p = .02$, $\eta^2 = .09$. Post hoc tests showed that participants in the religious prime condition exhibited a significantly lower confirmatory bias than either participants in the non-religious control condition ($p = .003$), participants in the mortality prime condition ($p = .01$), or individuals in the fairness prime condition ($p = .04$). We found no differences in confirmatory information processing between the non-religious control, fairness prime, and mortality prime conditions ($ps > .35$). For an overview of the results, see Table 4.3.

Table 4.3. Means and standard deviations for information search and combined *z*-transformed confirmation bias (search and evaluation) as a function of experimental condition in Study 9.

	Information search					
	Consistent [a]		Inconsistent [a]		Confirmation bias (combined) [b]	
Prime	*M*	*SD*	*M*	*SD*	*M*	*SD*
Religious ($n = 30$)	2.50	1.41	3.13	1.57	-0.38	0.80
Non-religious ($n = 30$)	3.83	1.76	3.40	1.59	0.22	0.68
Fairness ($n = 29$)	3.14	1.48	3.21	1.66	0.04	0.70
Mortality ($n = 29$)	3.76	1.64	3.55	1.62	0.13	0.92

Notes. [a] Six pieces of information were available in each category. [b] This 'confirmation bias' corresponds to the *z*-transformed combination of the information search bias and information evaluation biases.

Check for interfering effects

A 4 (*prime*: religious vs. non-religious vs. fairness vs. mortality) x 2 (*gender*: female vs. male) x 4 (*religious affiliation*: Catholicism vs. Evangelism vs. other denominations vs. no religious affiliation) ANCOVA with age as a covariate was performed. We found no main effects for or interactions with the experimental manipulation for religious affiliation, gender, or age ($Fs < 1.38$, $ps > .25$).

4.5.3 Discussion

Study 9 utilized a more implicit priming technique than the one used in Studies 1 and 2, but replicated their findings: In comparison to a control group, a group primed with religion demonstrated reduced levels of confirmatory information processing. This enables us to rule out manipulation-related demand characteristics as an explanation of the effect of religious salience on confirmatory information processing. Furthermore, we showed that the more balanced information processing tendencies exhibited by individuals exposed to a religious prime cannot be explained by the coactivation of mortality or fairness concepts – neither mortality nor fairness primes resulted in more balanced information processing, but religious primes did. Now that we have ruled out possible alternative explanations, in Studies 10 and 11, we attempt to shed more light on the psychological process that we believe underlies our main findings.

4.6 Study 10

In this experiment, we investigated whether reminders of religion might attenuate confirmatory information processing by buffering post-decisional conflicts and diverting participants' thoughts away from their decisions. Previous research has provided evidence that confirmatory information search can be influenced by whether the individual *focuses* on the decision or not. For example, Jonas et al. (2001) demonstrated that participants who concentrated on a prior decision exhibited increased commitment to it, and that this increase in commitment then triggered a confirmatory information search. In contrast, shifting participants' foci away from the decision decreased participants' commitment to it and thus reduced confirmatory information search. The authors concluded that differences in commitment to a decision mediate the effect of decision focus on measures of confirmatory information processing, as commitment reflects "the decision's salience in the mind" (Jonas et al., 2008, p. 1181; see also Pomerantz, Chaiken, & Tordesillas, 1995). Against this theoretical background, we argue that if religious primes take an individual's focus off the decisional conflict, they should also weaken the individual's commitment to the preliminary decision. We measured commitment in two experimental conditions and hypothesized that religious priming would decrease personal commitment to a decision, subsequently attenuating confirmatory information processing.

4.6.1 Method

Participants and design

Eighty-five subjects participated in this experiment. Nine participants were excluded due to incomplete questionnaires (1), systematic response tendencies (1), or the revision of their preliminary decision (7). Seventy-six participants (56 female and 20 male, age ranged from 13 to 59 years; $M = 25.95$, $SD = 9.30$) remained in the final sample. 97.4% of the participants stated that they were affiliated with Christian religion (86.8% Catholicism, 10.5% Evangelism). The experiment was based on a one-factorial design with two experimental between-subjects conditions (*prime*: religious vs. non-religious).

Materials and procedure

Following previous research, we used a word search puzzle to prime participants with religious concepts (see Bargh, Gollwitzer, Lee-Chai, Barndollar, & Trötschel, 2001; Pichon, Boccato, & Saroglou, 2007). Participants received a piece of paper with an 11 x 11 matrix of letters and a list of seven words and were tasked with finding the words within the matrix and highlighting them with a pen. The experimenter explained that the words could be placed horizontally, vertically, or diagonally and could be written either forwards or backwards. In the religious prime condition, three of the seven words were associated with religion (prophet, faith, God), whereas the non-religious prime control condition included three items related to sports (dancing, training, swimming). In both conditions, the remaining four words were distractors with no coherent theme (stairs, office, handkerchief, hammer; see Pichon et al., 2007). Participants were randomly assigned to either the religious prime condition or the non-religious prime control condition.

After completing the word search, subjects proceeded to the decision case, which was identical to the one employed in Study 7 (the Mr. Miller decision case). As in the previous studies, we transformed the three difference values (credibility, importance, search) into *z*-values and integrated them into an overall index of confirmatory information processing ($\alpha = .79$). We checked for commitment by asking participants to indicate the extent to which they (a) were sure that they had made the right choice, (b) identified with their decision, and (c) felt bound by their decision (0 = *not at all*, 10 = *extremely*). Since these three variables were highly correlated ($rs > .43$, $ps < .01$), they were collapsed into a scale of commitment ($\alpha = .78$). On completing the experiment, participants were thanked and thoroughly debriefed.

4.6.2 Results

Confirmatory information processing and commitment

Participants in the control group exhibited no confirmatory bias ($M = 0.24$, $SD = 0.91$), $t(37) = 1.60$, $p = .12$. In contrast, we found a marginally significant *disconfirmatory* bias when religious concepts were salient ($M = -0.20$, $SD = 0.70$), $t(38) = -1.80$, $p = .08$.

Participants in the religious prime condition exhibited significantly decreased tendencies of confirmatory information processing ($M = -0.20$, $SD = 0.70$) compared to participants in the control condition ($M = 0.24$, $SD = 0.91$), $F(1, 74) = 5.66$, $p = .02$, $\eta^2 = .07$. Furthermore, participants who were primed with religious concepts reported significantly less commitment to their initial decision ($M = 5.34$, $SD = 1.99$) than participants who were primed with non-religious concepts ($M = 6.68$, $SD = 1.90$), $F(1, 74) = 8.89$, $p = .004$, $\eta^2 = .11$.

We thus tested whether the effect of religious priming on confirmatory information processing was mediated by differences in commitment. A bootstrapping analysis (1,000 bootstrap samples) was performed (Preacher & Hayes, 2004), yielding a significant direct effect of priming on confirmatory information processing ($t = -2.38$, $p = .02$), which was reduced to non-significance ($t = -1.55$, $p = .12$) when controlling for the mediator 'commitment'. The true indirect effect was estimated to lie between -.42 and -.04 with 95% confidence. Because zero is not in the confidence interval, we can conclude that the real indirect effect became significant at $p < .05$. Decreased commitment to the chosen decision alternative thus appears to mediate the effect of religious priming on confirmatory information processing. For an overview of the results, see Table 4.4.

Table 4.4. Means and standard deviations for information search and combined *z*-transformed confirmation bias (search and evaluation) as a function of experimental condition in Study 10.

	Information search					
	Consistent [a]		Inconsistent [a]		Confirmation bias (combined) [b]	
Prime	*M*	*SD*	*M*	*SD*	*M*	*SD*
Religious (*n* = 39)	3.51	1.71	3.28	1.52	-0.20	0.70
Non-religious (*n* = 37)	3.92	1.64	2.92	1.57	0.24	0.91

Notes. [a] Six pieces of information were available in each category. [b] This 'confirmation bias' corresponds to the *z*-transformed combination of the information search bias and information evaluation biases.

Check for interfering effects

A 2 (*prime*: religious vs. non-religious) x 2 (*gender:* female vs. male) x 4 (*religious affiliation:* Catholicism vs. Evangelism vs. other denominations vs. no religious affiliation) MANCOVA with age as a covariate was computed for confirmatory information processing and commitment. We found that male participants were marginally more committed to their decision than female participants, $F(1, 65) = 4.12$, $p = .05$, $\eta^2 = .06$. However, with regard to commitment, gender did not interact with the experimental conditions, $F(1, 65) = 0.72$, $p = .40$. No further main effects were observed for gender, religious affiliation, or age (Fs < 2.52, ps > .08). Importantly, the results also indicated that gender, religious affiliation, and age did not interact with the priming manipulation (Fs < 1.96, ps > .16).

4.6.3 Discussion

As predicted, we found that differences in commitment mediated the effect of religious priming on confirmatory information processing. Subtle reminders of religion decreased participants' levels of commitment to their decisions, which in turn reduced levels of confirmatory information processing. These results support the assumption that religious primes take participants' foci away from the decision and its associated conflict. However, it should be noted that a limitation of Study 10 is that our mediation test was based on a

correlational analysis, which prevents us from unambiguously determining the causal direction of the mediation effect. In order to gather further evidence for the assumption that religious salience draws participants' foci away from the decision, we thus conducted Study 11.

4.7 Study 11

In Study 11, we investigated whether religious primes encourage individuals to focus on religious ideas rather than their secular decisions, thus reducing confirmatory information processing. This assumption suggests that religious primes may not be able to attenuate confirmatory information processing in decision scenarios that are related to religion, as reminders of religion cannot divert participants' thoughts away from a decision that is tied to religion. Hence, we included both a secular and a religion-related decision case subsequently in this study.

4.7.1 Method

Participants and design

Fifty-three subjects participated in this experiment, which was based on a 2 (*prime:* religious vs. non-religious) x 2 (*decision case:* secular vs. religious) with repeated measures on the last factor. Five subjects had to be excluded from the dataset because of missing data (2) or the revision of their initial decision (3). This left a final sample of 48 participants (32 female and 16 male, age ranged from 17 to 58 years; $M = 26.42$, $SD = 9.12$). We did not ask participants to indicate their religious affiliation, as affiliation did not produce any interfering effects in our prior studies.

Materials and procedure

The priming procedure was identical to that in Study 9 (the scrambled sentence paradigm; Srull & Wyer, 1979). Following the manipulation, participants completed two decision cases that were presented in a randomized order. We used the Mr. Miller decision case as our secular decision problem (see Studies 7 and 10) and also employed a new decision case involving religiously motivated terrorism.

This case asked whether or not fundamental rights should be limited to protect against religiously motivated terrorism. Participants received general information about the topic and were informed that the German Federal Government was going to increase various security measures against this type of terrorism. However, this security increase would necessitate the restriction of some fundamental rights (e.g., inviolability of the privacy of correspondence, mail, or telephone; inviolability of the home). After making a preliminary decision, participants received a list summarizing 12 pieces of additional information in short statements (2 sentences). Half of the statements supported limiting fundamental rights to protect against terrorism and half opposed it. An example of a supportive statement was: "When fundamental rights are limited, it is easier to identify, detain, and incapacitate potential terrorists. Thus, fundamental rights should be limited." An example of a statement opposing the limitation of fundamental rights was: "The limitation of fundamental rights increases the risk that the members of minority groups will be discriminated. Thus, fundamental rights should not be limited." Overall, half of the pieces of information were consistent – and half inconsistent – with the participants' preliminary decision, regardless of the option they had chosen. As in the previous studies, participants indicated the expected credibility and importance of each piece of information (0 = *not at all*, 10 = *extremely)* as well as whether they wished to read an extended version of the corresponding argument. Participants could select freely from the available pieces of information and eventually made their final decisions. On doing so, the experiment was concluded, and participants were fully debriefed and told that no extended versions of the articles existed. Furthermore, it was ensured that nobody left the laboratory with any negative emotions related to terrorism.

For each decision case, we computed difference values for information credibility, information importance, and information search by subtracting the corresponding values for decision-inconsistent information from the values for decision-consistent information. For the following analyses, the three difference values were transformed into *z*-values and integrated into an overall index of confirmatory information processing (Mr. Miller decision case: $\alpha = .88$; religious terrorism decision case: $\alpha = .87$).

4.7.2 Results

Confirmatory information processing

One sample *t*-tests against zero revealed that participants in the non-religious control condition exhibited no significant tendencies of confirmatory information processing, either in the secular decision case ($M = 0.24$, $SD = 0.91$), $t_{secular}(22) = 1.28$, $p = .21$, or in the religious decision case ($M = -0.10$, $SD = 0.91$), $t_{religious}(22) = -0.54$, $p = .60$. Similarly, in the religious priming condition, we found no significant biases for the secular decision case ($M = -0.22$, $SD = 0.85$), $t_{secular}(24) = -1.32$, $p = .20$, or the religious decision case ($M = 0.09$, $SD = 0.88$), $t_{religious}(24) = -0.54$, $p = .60$.

A 2 (*prime*: religious vs. non-religious) x 2 (*decision case*: secular vs. religious) mixed model ANOVA with repeated measures on the last factor and confirmatory information processing as the dependent variable revealed a significant interaction between prime and decision case, $F(1, 46) = 5.50$, $p = .02$, $\eta^2 = .11$. No main effects were observed (Fs < 0.41, ps > .52). The nature of the interaction can be seen in Figure 4.1.

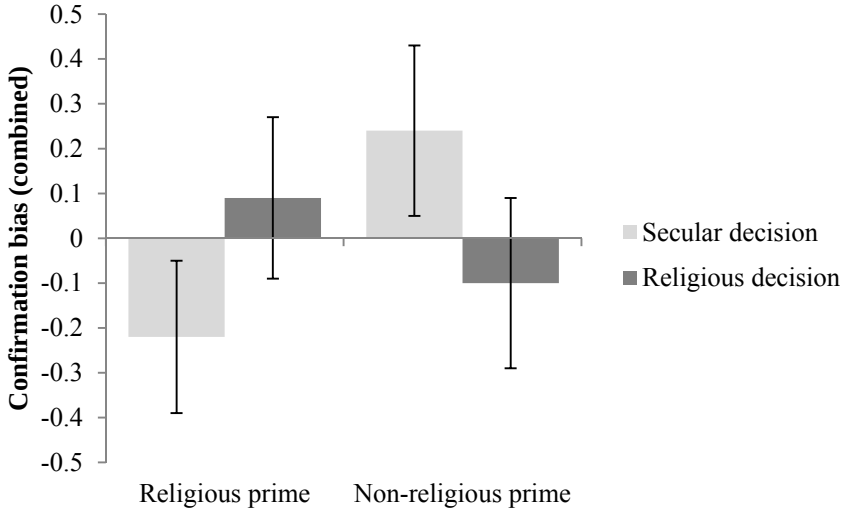

Figure 4.1. Confirmation bias (combined) as a function of experimental condition in Study 11. Error bars represent standard errors.

Simple effects analyses were carried out separately for the secular and religious decision cases. When participants made a secular decision, we found marginally significant, lower levels of confirmatory information processing for participants who were primed with

religious concepts (M = -0.22, SD = 0.85) compared to participants primed with non-religious concepts (M = 0.24, SD = 0.91), $F(1, 46) = 3.38$, $p = .07$, $\eta^2 = .07$. In contrast, we found no differences in confirmatory information processing between the religious prime condition (M = 0.09, SD = 0.88) and the control condition (M = -0.10, SD = 0.91), $F(1, 46) = 0.57$, $p = .45$, in the religious decision case. For an overview of the results, see Table 4.5.

Table 4.5. Means and standard deviations for information search and combined *z*-transformed confirmation bias (search and evaluation) as a function of experimental condition in Study 11.

	Information search					
	Consistent [a]		Inconsistent [a]		Confirmation bias (combined) [b]	
Experimental condition	*M*	*SD*	*M*	*SD*	*M*	*SD*
Religious prime / Secular decision (n = 25)	3.52	2.00	3.04	1.90	-0.22	0.85
Non-religious prime / Secular decision (n = 23)	4.39	0.99	3.00	1.51	0.24	0.91
Religious prime / Religious decision (n = 25)	4.52	1.19	3.12	1.74	0.09	0.88
Non-religious prime / Religious decision (n = 23)	3.78	1.24	2.74	1.57	-0.10	0.91

Notes. [a] Six pieces of information were available in each category. [b] This 'confirmation bias' corresponds to the *z*-transformed combination of the information search bias and information evaluation biases.

Check for interfering effects

We checked for potential interfering effects of gender and age by conducting a 2 (*prime*: religious vs. non-religious) x 2 (*decision case*: secular vs. religious) x 2 (*gender*: female vs. male) mixed model ANCOVA with repeated measures on the second factor and age as a covariate. No significant main effects or interactions occurred for either gender or age (Fs < 2.81, ps > .10).

We also checked whether the order the decision cases were presented in might create an interfering effect. We found a marginally significant main effect of presentation order,

$F(1, 44) = 3.90$, $p = .06$, $\eta^2 = .02$, indicating that, overall, confirmatory information processing was higher when the secular decision case preceded the religious decision case ($M = 0.20$, $SD = 0.79$) compared to when the religious decision case was presented first ($M = -0.17$, $SD = 0.65$). More importantly, presentation order did not significantly interact with the experimental conditions (Fs < 2.40, ps > .12).

4.7.3 Discussion

In summary, Study 11 found that participants who were primed with religion exhibited reduced levels of confirmatory information processing compared to a control group when making a secular decision. In contrast, reminders of religion did not attenuate confirmatory information processing when the decision scenario was itself related to religion. However, this study has a methodical problem regarding the religious decision case. This is because its discussion of religious terrorism may have induced a sense of threat in our participants, which might have affected our results. However, our overall findings can be considered additional evidence for our suggestion that religious primes divert participants' thoughts away from the decision and toward religious ideas when individuals are faced with post-decisional conflicts.

4.8 General discussion

The five present studies show that reminders of religion attenuate confirmatory information processing in secular decision scenarios. We consistently found this pattern of results across four different priming procedures (short essay, rating task, scrambled sentence task, word search puzzle) and three different decision scenarios (Mr. Miller decision case, eBook decision case, investment decision case), which suggests that this effect may be generalized. We also showed that this effect is unlikely to be due to either cognitive dissonance processes (Study 8) or the coactivation of fairness or mortality concepts (Study 9). In Study 10, differences in subjective commitment to the chosen decision alternative mediated the effect of religion on confirmatory information processing: Individuals who were primed with religious concepts indicated less commitment to their decision, which resulted in decreased levels of confirmatory information processing. In Study 11, we found a boundary condition for our basic effect:

Reminders of religion did not attenuate confirmatory information processing in a decision case that was itself related to religion. Notably, levels of personal religiosity did not moderate the effect of religious priming on confirmatory information processing (Studies 8 and 10).

Our findings provide initial evidence that religion might influence day-to-day decision making, as religious primes attenuate confirmatory information processing (see also Baumeister et al., 2010). More specifically, our results suggest that religious primes reduce levels of confirmatory information processing by diverting individuals' thoughts away from the decision and its associated conflict. This is in line with recent research showing that religion guards against the experience of conflict by shifting individual "thought and perception" away from the source of discrepancy (Inzlicht et al., 2009, p. 386). Our findings provide particular support for the notion that reminders of religion divert peoples' thoughts away from conflicts related to the decision: Individuals who were primed with religion exhibited reduced levels of commitment to their decision (i.e., thought less about their decision), which is why they might have become less critical of decision-inconsistent information. However, it should be noted that religious primes could also have affected participants' perceptions of decision-inconsistent information. For example, individuals primed with religion may have perceived decision-inconsistent information as conflicting less with their decision than members of a control group with no religious priming. By perceiving less conflict in this information, individuals may thus actively search for and more positively evaluate it.[11] Further research is needed to examine the processes underlying the effect of religious priming on confirmatory information processing more closely.

The present studies demonstrate that even subtle reminders of religion can affect the subsequent processing of decision-relevant information. This finding is of particular importance when considering the major role played by religious traditions in our cultural context (Hommel & Colzato, 2010) as well as the high prevalence of religious symbols in everyday life. For example, many well-known and popular musicians use religious imaginary and metaphors in their song lyrics (e.g., Bruce Springsteen, Coldplay, Kanye West). Listening to such lyrics may remind people of God and potentially affect subsequent information processing.

[11] We would like to thank Prof. Gesine Dreisbach for this important idea.

In addition, our findings suggest that religious primes affect confirmatory information processing independent of individuals' levels of religiosity. This may initially appear counter-intuitive, as religious concepts should be more readily accessible to individuals who believe in God. However, these findings are in line with recent studies that have reported religious priming effects regardless of participants' pre-existing levels of religiosity (e.g., Randolph-Seng & Nielsen, 2007).[12] With this in mind, it is highly important to further investigate effects of religious primes on psychological processes. Another important limitation is that our research is based only on German samples, which predominantly consisted of Christian participants. It would be of particular interest to explore the effects of religious primes on confirmatory information processing among members of other cultures and religions.

A limitation of our research is that we did not find the basic effect of confirmatory information processing for one of the decision cases (the Mr. Miller decision case in Study 7). This seems to stand in opposition to previous selective exposure research, which has found evidence of biased information processing when employing this scenario. However, Fischer et al. (2005) have noted that this specific case may be problematic: Since participants' final decisions might result in a named individual losing their employment, they might be motivated to make a fair decision, in turn leading to more balanced information processing. However, this limitation does not affect the main finding of the present studies, as various manipulations can cause relative differences in information search and evaluation, irrespective of the level of confirmatory information processing displayed by control groups (e.g., Jonas et al., 2003).

Future research on confirmatory information processing should also address the question of whether it is only religious primes that decrease confirmatory information processing or whether this effect could be extrapolated to the external meaning systems that provide individuals with a sense of stability and control (see also Kay et al., 2008). For example, thinking of a stable government might also buffer the aversive experience of incoming decision-inconsistent information and could thereby lead to balanced information processing.

[12] We used an explicit measure of personal religiosity and measured participants' levels of religiosity at the end of the experiments. Future research should attempt to replicate our findings using implicit measures of religiosity or by measuring participants' levels of religiosity in a preliminary study.

Furthermore, future studies should investigate whether reminders of religion decrease or increase confirmatory information processing when the decisions at hand involve religious values, such as those on contraception (see also Iyer, 2002) or sexual abstinence (see also Paul, Fitzjohn, Eberhart-Phillips, Herbison, & Dickson, 2000). We expect that religious primes would increase confirmatory information processing tendencies in decision scenarios that address religious values, as reminders of religion should intensify the focus on decisions that are directly connected with religious doctrines.

In conclusion, the present investigation is a starting point for exploring the effects of religion on decision making and confirmatory information processing. Our findings suggest that, counter to common perceptions linking religiosity to closed-mindedness, there are certain circumstances under which reminders of religion make individuals more open-minded (cf. Sagioglou & Forstmann, 2013). The finding that religious primes increase individuals' openness to decision-inconsistent information is of particular practical relevance, as several studies have revealed that neglecting decision-inconsistent information leads to poor decision outcomes (Janis, 1982; Kray & Galinsky, 2003). Reminders of religion may thus improve the quality of decisions by decreasing confirmatory biases.

5. General conclusion

5.1 Summary

The main objective of this thesis was to investigate whether randomness affects confirmatory information processing in social and economic decision making. This relationship was explored for three distinct dimensions of randomness, namely (a) physical randomness, (b) social randomness, and (c) metaphysical randomness.

In a first step, Study Series 1 provided evidence for the role of physical randomness in confirmatory information processing (Chapter 2). The results showed that high physical randomness (i.e., contextual disorder) has a de-biasing effect on confirmatory information processing. People who made a decision in a disorderly room were less likely to engage in confirmatory information processing (and were even more likely to engage in disconfirmatory information processing) than individuals who made a decision in an orderly room. It was also found that the relationship between disorder and confirmatory information processing is not due to the mere salience of disorder concepts, but rather to the specific characteristics of contextual disorder. Furthermore, only activating both – disorder concepts and divergent thinking – reduced levels of confirmatory information search. Summarizing, the first study series provided initial evidence that high levels of physical randomness decrease confirmatory information processing.

In a second step, the present research investigated the impact of social randomness on confirmatory information processing (Chapter 3). Four studies consistently found that while high social randomness (i.e., low perceived levels of personal control) increases confirmatory information search, it does not affect confirmatory information evaluation. The mechanism that drives this effect seems to be located in heightened feelings of helplessness: Individuals who perceived themselves as having little control reported increased feelings of helplessness, which in turn strengthened confirmatory information search. Alternative explanations based on feelings of general threat or on the need for cognitive closure were ruled out.

Study Series 2 also showed that the severity of personal consequences for the decision maker moderates the effect of social randomness on confirmatory information search. Though perceived control affected confirmatory information search when decision consequences were low, it had no impact on confirmatory information processing for high-consequence decision problems. Taken together, these findings suggest that high levels of social randomness increase confirmatory information search in situations where decision makers' choices do not elicit the risk of serious personal consequences. These results stand in sharp contrast to the findings of Study Series 1, which showed that high levels of physical randomness decrease confirmatory information processing.

In a final step, Study Series 3 (Chapter 4) investigated the impact of metaphysical randomness on confirmatory information processing. Five studies found that low metaphysical randomness (i.e., religious priming) attenuates confirmatory information processing in secular decision scenarios. In particular, people who were primed with religious concepts exhibited lower levels of confirmatory information processing than participants in a control group. Moreover, the relationship between religious priming and confirmatory information processing was mediated by differences in subjective commitment: Individuals who were primed with religious concepts reported less commitment to their decision, which in turn decreased confirmatory information processing. In addition, it was ruled out that cognitive dissonance or co-activated fairness and mortality concepts could serve as alternative explanations for the observed effect. In sum, the final study series indicated that low metaphysical randomness reduces confirmatory information processing. Notably, the present findings for metaphysical randomness and social randomness point in a similar direction: Both social and metaphysical randomness seem to be positively related to confirmatory information processing.

Collectively, the three study series described in the present thesis converge to a general conclusion: Randomness affects confirmatory information processing, no matter whether it occurs in one's physical, social, or metaphysical environment. However, the effects are not uniform. Whereas physical randomness seems to be negatively related to confirmatory information processing, social and metaphysical randomness are rather positively associated with confirmatory information processing.

5.2 Implications

The present findings for the effects of physical, social, and metaphysical randomness on confirmatory information processing have major theoretical and practical implications. With the specific implications for the distinct dimensions of randomness having been addressed in detail in their respective chapters, this section will focus on the theoretical and practical implications of the present research as a whole.

5.2.1 Theoretical implications

Firstly, the present findings provide valuable theoretical implications for research on confirmatory information processing. Although current theoretical accounts (e.g., cognitive accounts; Fischer et al., 2005; Fischer, Schulz-Hardt, et al., 2008) and recent research (e.g., Fischer et al., 2010; Fischer, Greitemeyer, et al., 2008) have pointed out that researchers should consider both information search *and* evaluation when investigating selectivity in decision making processes, the majority of studies have tended to address either selective exposure *or* biased assimilation (e.g., Fischer, Jonas, et al., 2008; Greitemeyer, Fischer, Frey, & Schulz-Hardt, 2009). Extending this rather narrow research focus, the present study series provided valuable evidence for the effects of randomness on both confirmatory information search and evaluation. In particular, it was shown that physical randomness and metaphysical randomness affect confirmatory information search and evaluation, while social randomness only impacts confirmatory information search. Future research will need to further explore the relevant circumstances under which the effects of confirmatory information search and evaluation occur, be it simultaneously or independent of each other.

Secondly, the present research adds to a limited body of literature examining those potential moderators of confirmatory information processing that are not part of the decision making process *per se* (e.g., Fischer, Kastenmüller, et al., 2011). It remains of critical importance to explore decision-unrelated influences on confirmatory information processing, as decision makers often face various situational influences that may potentially impair decision quality. One such highly-common factor in everyday life is the degree of order in one's environment, or else its randomness. Notably, previous research had not addressed the specific impact of randomness on confirmatory information processing before. Thus, the present research also contributes to closing this particular research gap.

Thirdly, an additional theoretical contribution made by this thesis comes from its comprehensive approach to investigating randomness. In contrast to previous studies of randomness, this research did not simply explore whether a general impression of randomness (or a single dimension of randomness) affects the outcome variable (e.g., Legare & Souza, 2013; Vohs et al., 2013). Instead, three distinct dimensions of randomness (i.e., physical randomness, social randomness, metaphysical randomness) were included, in order to provide a more complete picture of how randomness influences confirmatory information processing.

Importantly, physical, social, and metaphysical randomness were found to affect confirmatory information processing in different ways: High physical randomness decreased confirmatory information processing, whereas high social randomness increased confirmatory information search. Similar to the findings for social randomness, low metaphysical randomness reduced confirmatory information processing. These mixed results suggest that a one-size-fits-all approach is not ideally suited for investigating the potential effects of randomness; that is, the impact of randomness on one outcome variable should not be judged by empirically manipulating a general sense of randomness (or just one single dimension of randomness). Instead, it would be a fruitful endeavor for future research to further investigate effects of randomness by using a more comprehensive approach that builds upon a multidimensional conception of randomness.

Furthermore, the present research not only showed that physical, social, and metaphysical randomness differently affect confirmatory information processing, but also provided valuable insights into the moderators that may strengthen or attenuate the observed effects. Even more importantly, the present research also shed light on the psychological processes that might drive these effects. As far as the impact of physical randomness on confirmatory information processing is concerned, no direct mediation effects were found. However, the results suggest that this effect could be driven by an increased level of cognitive openness toward the unexpected (for a more detailed discussion, see Chapter 2.5). In contrast, the effect of social randomness on confirmatory information search was mediated by increased feelings of helplessness; that is, individuals who perceived low control felt more helpless, and this in turn made them more biased in information search. Regarding metaphysical randomness, differences in subjective commitment to the decision were found to underlie the relationship between religious priming and confirmatory information processing.

In summary, distinct psychological mechanisms seem to drive the effects of physical, social, and metaphysical randomness on confirmatory information processing. The present findings can thus be considered an ideal starting point for investigating just how physical, social, and metaphysical randomness affect confirmatory information processing in personal and economic decision making.

When taking a closer look at the overall picture of results, it is apparent that physical randomness seems to be negatively related to confirmatory information processing, with social and metaphysical randomness being rather more positively associated with it. Why might this be? One crucial difference between physical randomness and social or metaphysical randomness lies in their potential threat to an individual's need to believe in an orderly and predictable world (see Kay et al., 2009). In particular, high levels of physical randomness (e.g., a chaotic room) may not pose a threat to this particular need, as physical disorder is highly localized (e.g., limited to the room) and can be eliminated quite easily (e.g., by cleaning up the room). In contrast, perceptions of high levels of social randomness (e.g., a lack of personal control) or metaphysical randomness (e.g., the absence of a controlling God) are likely to extend to other areas of life and cannot simply be 'turned off'. Thus, an existential threat might emanate from high social or metaphysical randomness.

Against this background, high levels of randomness that do not pose a threat to an individual's need to believe in an orderly and predictable world might be capable of promoting cognitive openness toward the unexpected and could thereby reduce confirmatory information processing (see Study Series 1). In contrast, if high levels of randomness threaten this specific need, decision makers seem to experience increased negative affect, which might be compensated for by increased levels of confirmatory information processing (see Study Series 2). From another perspective, perceiving a high level of order and structure in the world (e.g., provided by a controlling God) might render other coping mechanisms (e.g., confirmatory information processing when experiencing cognitive dissonance following a decision) unnecessary and could thereby reduce confirmatory information processing (see Study Series 3).

In sum, one could argue that the effects of randomness on confirmatory information processing depend on whether high levels of randomness might threaten one's need to believe in an orderly and predictable world. However, as the exact differences and parallels between physical, social, and metaphysical randomness are largely underexplored, future research is needed to further investigate these relationships.

5.2.2 Practical implications

Beyond its theoretical implications, the present research is also of high practical relevance. When making personal and economic decisions, people often have to face highly random (and thus chaotic) circumstances. For example, they make decisions in cluttered conference rooms (i.e., high physical randomness); in times of economic uncertainty (i.e., high social randomness); or when they have doubts about the existence of a controlling God (i.e., high metaphysical randomness). It is thus highly valuable for research to investigate whether randomness affects decision making. The present research contributes to answering this question by demonstrating that physical, social, and metaphysical randomness represent major influences on confirmatory information processing following decisions.

In order to make high quality decisions, it is essential that "the decision maker, to the best of his ability and within his information-processing capabilities […] correctly assimilates and takes account of any new information or expert statement to which he is exposed, even when the information or judgment does not support the course of action he initially prefers" (Janis & Mann, 1977, p. 11). In other words, the tendency to prefer decision-consistent over decision-inconsistent information detrimentally affects decision quality by dissuading the revision of incorrect decisions (Janis, 1982; Kray & Galinsky, 2003). Against this background, the present findings point to the potential risks emanating from the distinct randomness dimensions: Decision quality might be particularly impaired when individuals make decisions in orderly (vs. disorderly) physical environments; perceive low (vs. high) levels of personal control; or perceive low (vs. high) metaphysical order.

From this perspective, it is also possible to specify effective countermeasures that might help avoid confirmatory biases in specific contexts (e.g., the workplace). For example, the finding that a disorderly physical environment was shown to reduce confirmatory information processing (and thus to potentially improve decision quality) might suggest that employers could benefit from relaxing 'clean-desk-policy'-directives. Such directives usually require that employees clear up their workplaces before they depart from them. However, though clean and structured work environments might provide a good starting point for efficiently organizing and executing one's daily work, messy workspaces seem to be more useful when major decisions are at stake. Thus, in order to promote high-quality decision making, employers could create specific working spaces (e.g., conference rooms) where a little chaos is not only permitted, but welcomed.

Employers could also benefit from heeding the finding that randomness perceived in the social environment increases confirmatory information processing and might subsequently compromise decision quality. This could be done by ensuring that employees experience personal control during their daily work, such as via attaching great importance to a reliable and predictable leadership style (e.g., ethically-oriented leadership; Peus, Kerschreiter, Frey, & Traut-Mattausch, 2010); establishing a predictable routine for day-to-day work instead of putting employees under (unnecessary) stress; involving employees in employers' goals and action plans; and avoiding exposing employees to extreme mental or mood changes.

Additionally, the current data propose that decision quality could be further optimized by reminding decision makers of external sources of control. Thus, it seems reasonable for employers to underline the order and structure prevalent within their organizations in public statements or staff appraisals. More specifically, an employer could facilitate high-quality decision making by pointing to their organization's stable economic and financial situation; its high level of protection and job security; or its excellent internal solidarity.

However, if a sense of non-randomness cannot be provided by the employee (e.g., at a time of economic crisis), it seems reasonable for decision makers to remind themselves of other areas in life where they experience personal control or external order, as these perceptions might 'spill over' to other domains (see Kay, Gaucher, et al., 2010; Kay et al., 2008). Similarly, it seems plausible that classic coping strategies such as self-affirmation (i.e., the affirmation of core values) could also serve as a buffer against the aversive experience of high randomness and might thereby counteract confirmatory biases (Steele, 1988; see also Hart et al., 2009). In sum, it would be a fruitful endeavor for future research to further investigate possible countermeasures to the effects of randomness on confirmatory information processing.

5.3 Limitations

Though the present research has provided new insights into the effects of randomness on confirmatory information processing, it has a number of limitations that need to be addressed. With the limitations of the separate study series being discussed in their respective chapters, this section will address the present research's overall limitations.

One such flaw is that the present research was mainly based on student samples. Though students can often have a considerable amount of professional experience (due to vocational training qualifications or side jobs), it would be of particular interest to explore the effects of randomness on confirmatory information processing in professional decision makers. Specifically, future research should focus on field studies with professional decision makers in organizations (e.g., managers) in order to enhance the present results' external validity.

Another limitation concerns the psychological processes that might underlie the effects of physical, social, and metaphysical randomness on confirmatory information processing. With regard to physical randomness, the data presented in Study Series 1 do not answer the question of which specific mechanism drives the effect of contextual disorder on confirmatory information processing. As described in the general discussion of Study Series 1, increased levels of cognitive openness to the unexpected could account for the observed effect, but future research is needed to clarify this relationship.

Additionally, it should be noted that the mediation tests indicating the potential psychological processes underlying the observed effects in Study Series 2 and 3 were based on correlational analyses. For this reason, the causal direction of the mediation effects cannot be unambiguously determined. Thus, future research should further investigate whether the proposed mechanisms actually drive the observed effects.

A final limitation of the present research becomes apparent when comparing the experimental design for investigating physical and social randomness on the one hand and metaphysical randomness on the other. While Study Series 1 and 2 systematically compared high randomness, low randomness, and baseline conditions, Study Series 3 only addressed the differences between low randomness and baseline conditions. This limitation is owed to the fact that Study Series 3 utilized religious priming manipulations that make it difficult to create adequately matched high-randomness conditions. However, in future research it would be useful to determine a priming procedure that allows for such a match. One such approach could be to prime high metaphysical randomness by presenting Darwin's Theory of Evolution in terms of an unpredictable and random process (Rutjens, van der Pligt, et al., 2010).

In sum, while the present research can be considered a first step toward a more complete understanding of how randomness affects personal and economic decision making, additional research is needed to further elucidate the relationship between physical, social, and metaphysical randomness and confirmatory information processing.

5.4 Outlook

The goal of the present thesis was to shed more light on the relationship between randomness and confirmatory information processing following personal and economic decisions. The results of eleven studies suggest that the effects of randomness on confirmatory information processing depend on the environment in which randomness is perceived: In some environments, high randomness seems to be experienced as aversive and is thus likely to increase selectivity, whereas in other environments, high randomness can inspire cognitive openness, subsequently decreasing confirmatory information processing. Thus, returning to the citation quoted in the introduction, the present findings suggest that chaos indeed "brings uneasiness, but […] also allows the opportunity for creativity and growth" (Tom Barrett).

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