In the Heat of the Moment

The Effect of Impulsive and Reflective States on Sexual Risk Decisions

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In the Heat of the Moment:
The Effect of Impulsive and Reflective States on Sexual Risk Decisions

In het Heetst van de Strijd: Het Effect van Impulsieve en Reflectieve Staat op Seksuele Risico Beslissingen

(met een samenvatting in het Nederlands)

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Chapter 1

General Introduction and Overview

In the heat of the moment people give in to temptations despite their long-term goals. People overeat, ruining their diet. People buy expensive shoes, against their goal to save money. People make sexually risky decisions, even though they want to stay healthy. Impulsiveness is an often mentioned factor that contributes to people's inclination to give in to temptations (e.g., Clift, Wilkins, & Davidson, 1993; Donohew et al., 2000; Dudley, Rostosky, Korfhage, & Zimmerman, 2004). However, it is less clear why impulsiveness leads to increased risk taking. This dissertation aims to investigate the underlying processes that may explain why impulsiveness results in risky decisions, despite good intentions. Ultimately, the knowledge acquired with this dissertation could be used to change risky behavior in impulsive states.

In this first chapter, we briefly summarize the literature on risk taking behavior and start with accounts of reasoned action that see people as rational beings who weigh and integrate information and reach a decision on how to behave (e.g., Ajzen, 1991). Then, the interaction between reasoned action and impulsive influences on behavior is discussed, as described in dual-system theories (e.g., Chaiken & Trope, 1999). Next, theoretical accounts and empirical investigations are reviewed that try to provide explanations for the increased risk propensity of people in impulsive states that are the focus of this dissertation. Lastly, an overview is given of the following chapters in this dissertation.

Reasoned action and decision making

Early theories on risk taking behavior focused on reasoned processes. Several theories, which are based on an expectancy value model (Fishbein, 1963), such as the theory of reasoned action (Fishbein & Ajzen, 1975), the theory of planned behavior (Ajzen, 1991), and the health belief model (Janz & Becker, 1984) stated that people are rational beings that use a reasoned process to arrive at a behavioral decision. Based on the expectancy and value of potential (health) threats, and people's ability to accomplish the

behavior necessary to avoid those threats, people form a conscious decision to behave in a certain way. Moreover, these decisions and the resulting goal-directed behaviors are typically seen as rational and intentional acts that require a person's volitional control or willpower to be effective.

And indeed, there is abundant literature showing that willpower is an important ingredient in (health) behavior (e.g., Baumeister & Heatherton, 1996; Baumeister, Heatherton, & Tice, 1994). However, this does not always seem to be true; people do not always think everything through completely. Often, willpower fails. Moreover, a lot of behavior seems to stem from more unconscious processes that involve little or no deliberation. Therefore, in more recent research the emphasis has shifted away from reflective processes towards theories that involve also more impulsive influences on behavior.

The interplay between impulsive and reflective processes

In recent years, theorizing about risk behavior has evolved towards dual-process and dual-system theories (e.g., Devine, 1989; Epstein, 1990; Fazio, 1990; Gilbert, 1991; Greenwald & Banaji, 1995; Metcalfe & Mischel, 1999; Petty & Cacioppo, 1986; Smith & DeCoster, 2000; Strack & Deutsch, 2004; see Chaiken & Trope, 1999, for an extensive overview). Although these theories differ in the domain they can be applied to and their specific definitions, they all assume that people process and are guided by information in two qualitatively different ways. On the one hand, people are guided by information quickly, via the spreading of activation in an associative network. This process is assumed to require little effort. On the other hand, people use a slow, rule-based process that requires a lot of effort.

In this dissertation we focus on the reflective-impulsive model (RIM, Strack & Deutsch, 2004), because this model deals with the influence of information processing on behavior (instead of believes or persuasion for example). Moreover, the reflective-impulsive model has extensive predictions about how the two systems interact and what behavior follows

from either system. Additionally, it is possible to distinguish between situational and personality influences with the reflective-impulsive model. When people process information they tend to use one of the systems more than the other. This general emphasis on one of the two systems results in the classification of having an impulsive (or reflective) personality, *trait* impulsiveness. Moreover, it is possible that situational factors cause the use of one of the systems more than the other. In this case we refer to impulsive (or reflective) *states*. In this dissertation we mostly refer to reflective and impulsive states, however, we do posit that the outcomes of being in an impulsive state can be generalized to outcomes of having an impulsive personality trait.

As a dual-systems theory, the reflective-impulsive model (Strack & Deutsch, 2004) suggests that all information is processed via the impulsive system, which is the system that operates fast and with only little effort. The impulsive system elicits behavior through associative links (i.e. attractive person – sex) and motivational orientations (i.e., approach or avoidance reactions), and is mainly driven by the immediate incentive of information value (i.e., rewarding or not rewarding). When people, for example, meet an attractive sexual partner, this could activate various associations. If these associations are generally positive an approach motivation could arise that activates appropriate behavioral schemas. In this way, behavior can be instigated in a fairly automatic manner, and, if in the case of this example, someone does not have a condom available, this sequence of events could result in risk behavior (i.e., unprotected intercourse).

According to the reflective-impulsive model, when people have the capacity and motivation, information will also be processed via the reflective system (Strack & Deutsch, 2004). The reflective system instigates behavior via syllogistic reasoning. Specifically, knowledge about the value and the probability of potential consequences is weighed and integrated to reach a preference for a behavioral option. If a decision is reached, the reflective system activates the appropriate behavioral schemas. Thus, when someone perceives an attractive sexual partner and is tempted to have unprotected sex,

they could consider the possible future consequences in terms of their possible negative outcomes and act in a less risky manner. The reflective-impulsive model suggests that the behavioral schema that is activated strongest (whether activated by the impulsive or reflective system) will result in actual behavior.

Long-term goals

Based on the reflective-impulsive model, one explanation for the increased risk propensity of people in impulsive states could be that they are less influenced by rational, long-term goals. Our first aim is to test this intuitively appealing explanation, although previous research suggests this might not be why people in impulsive states make riskier decisions as it has already been shown that long-term goals could affect behavior in an effortless manner. According to goal systems theory (Kruglanski et al., 2002), temptations, long-term goals, and the means to achieve ones goals are represented in the same associative network. For instance, an attractive person of the opposite gender could activate the concept of sex, but also health and condoms in the associative network. This means that in impulsive states long-term goals can influence behavior by being activated in the associative network.

More importantly, as temptations and long-term goals are regularly co-activated (e.g., when contemplating what to do in a tempting situation), processing a temptation is posited to automatically activate associated long-term goals (e.g., Kruglanski et al., 2002; Bargh & Ferguson, 2000). Fishbach and Shah (2006) further argue and found that the strength of this co-activation in the associative network is proportional; as a temptation becomes stronger, the co-activation of the long-term goal should also be stronger. Indeed, stronger temptations did elicit more pronounced avoidance responses than weaker temptations, but only in the presence of long-term goals. As temptations are thought to activate long-term goals through the associative network, we propose that relevant and important long-term goals

should also influence decisions in an impulsive state. If long-term goals do indeed also influence behavior in impulsive states the question that remains is why people in impulsive state make riskier decisions.

Attention

A possible alternative explanation for the increased risk propensity of people in impulsive states is that people in reflective and impulsive states differ in their focus of attention. Building on the differentiation between different modes of information processing (Strack & Deutsch, 2004), we posit that in order to strive for more valuable long-term outcomes, people in reflective states need to distribute their attention over the available information. Attention is distributed over all available information to be able to weigh and integrate a wide range of information to reach a preference for a behavioral option. Conversely, the attention of people in impulsive states focuses on the salient information exclusively. As only the most salient information becomes input, it is this salient information and its associations that activate behavioral schema and result in behavior (Strack & Deutsch, 2004).

We posit that this difference in attention between people in impulsive and reflective states is the reason people in impulsive states make riskier decisions. When people focus their attention on salient information, this puts emphasis on temptations because tempting information more often than not is salient. Temptations are often considered salient, because they are emotional, rewarding, and motivational relevant (e.g., Buodo, Sarlo, & Palomba, 2002; Most, Smith, Cooter, Levy, & Zald, 2007; Wright & Adams, 1999). Therefore, a focus on salient information could lead to an emphasis on temptations, and via behavioral schema riskier decisions.

In addition to increased risk taking as a result of a difference in attentional focus between people in reflective and impulsive states, it is also possible that people experience a difference in cognitive focus. Not only is there a focus on tempting, salient information via attentional processes, but

people in impulsive states possibly also view the world more congruent to their current goals. We aim to investigate this possibility in the studies we report in Chapter 4.

Cognitive Focus

Previous research has established that when objects are goal relevant people experience a cognitive focus on these objects, these objects are perceived as larger than when they are not goal relevant (e.g., Bruner & Goodman, 1947; Veltkamp, Aarts, & Custers, 2008). It was argued that this cognitive focus makes these objects stand out in the environment, and therefore enhances goal attainment. Extending these findings, firstly we aim to investigate whether motivated perception is more flexible than just estimating objects as larger in order to promote approach reactions. Goal relevant objects can also be estimated larger for different reasons than to promote approach reactions. If, for example, the hedonic goal of eating is activated, estimating a brownie as bigger would not only mean that brownie stands out more in the environment. It also means that there is more of the brownie, thus more tasty food. However, if the goal to diet is activated, estimating a brownie as smaller instead of larger would be goal congruent. We posit that motivated perception is not explained solely by promoting approach reaction. Furthermore, goal relevant objects are not always estimated as larger. We propose that goal relevant objects can also be estimated as smaller if a smaller size would benefit goal attainment.

Secondly, we aim to investigate whether motivated perception is influenced by the cognitive states people are in. As people in impulsive states are known to be more reward sensitive (Bechara et al., 2000; Dawe et al., 2004; Martin & Potts, 2004; Patton et al., 1995), the question we investigate is whether they are also more vulnerable to motivated perception. In other words, we posit that besides focusing their attention on salient information, people in impulsive states also have a cognitive focus on goal relevant objects, which lets them view the world goal congruently.

Specifically, we would expect that people in impulsive states do show motivated perception, preparing them to attain their goals with little effort or intention. People in reflective states, however, do not show motivated perception, suggesting that the impulse-evoking quality of goal relevant objects decreases, such that subsequent perception of these objects no longer prepares action to obtain the objects unintentionally.

Temperature

The research in this dissertation suggests that reducing risk behavior can be done via three possible mechanisms; the long-term goals, the temptations, or the cognitive states people are in respectively. In Chapter 2 we investigated the option that seems most obvious, but has not been investigated previously; the influence of long-term goals on decisions in reflective and impulsive states. Then in Chapter 3 and Chapter 4 we investigated attentional and cognitive focus on salient, and possibly tempting, stimuli in reflective and impulsive states. Next, it is also important to investigate if we can find a way to change the cognitive state people are in. Our language suggests a possible way of doing this, as it is replete with metaphors that reflect a relation between temperature and behavior. People give in to temptation 'in the heat of the moment', or are 'hot headed', and when people react too impulsively we ask them to 'cool down', 'to take a cold shower' or 'to chill'. These metaphors suggest that temperature might be a factor in impulsive behavior, and could possibly be used to reduce the risk propensity of people in impulsive states by changing their cognitive state.

Metcalfe and Mischel (1999) directly incorporated the temperature metaphor in their dual-system theorizing to explain delay of gratification. The two systems are aptly named the 'hot' and 'cool' system. The cool, cognitive 'know' system and the hot, emotional 'go' system are thought to interact to enable or undermine individuals' attempts at resisting a small immediate reward over a bigger reward after some time. As we also predict,

Metcalfe and Mischel (1999) argue that engaging the hot system makes delaying gratification more difficult, as it is driven by impulses. In other words, their 'hot' system is related to impulsiveness. The cool system can attenuate influences of the hot system, as it is concerned with long-term goals. Although Metcalfe and Mischel (1999) did not mean hot and cold literally when they refer to temperature, intuitively we think they could have, and we aim to establish that temperature influences decisions.

Whereas the direct relation between temperature and impulsiveness has not been investigated previously, there is substantial evidence that changes in temperature affect aggression (e.g., Anderson, 1989). The relation between temperature and aggression is complex, but what is apparent from this research is that higher temperatures might decrease people's ability to inhibit their impulses (Larrick, Timmerman, Carton, & Abrevaya, 2011). Therefore, we expect that temperature can also affect behavior in situations in which people are confronted with temptations. We posit that lower temperatures, as compared to higher temperatures, direct behavior towards less impulsive reactions. Literally cooling down 'the heat of the moment' could change people's cognitive states, and thus reduce risk behavior.

Overview of the Chapters

We conducted twelve studies to address the question why impulsiveness results in risky decisions, despite good intentions. These studies are described in four empirical chapters. First, in the studies reported in Chapter 2, we investigate an important possible underlying reason why people in impulsive states make riskier decisions than people in reflective states. In three studies we show that this is not because of the intuitively appealing notion that people in impulsive states are less influenced by their long-term goals. Specifically, in our studies we show that sexual risk decisions of people in impulsive and reflective states are equally influenced by the importance of their long-term goals. We further show that, when

health goals are important, people in reflective states make riskier decisions as temptations become stronger, while decisions of people in impulsive states are not influenced by temptation strength.

It is reassuring that, in the conflict between temptations and long-term goals, long-term goals do not seem to have an attenuated influence on people in impulsive states. However, people in impulsive states generally still made riskier decisions; therefore in Chapter 3 we investigated another possible reason why impulsiveness leads to riskier decisions further. Specifically, we hypothesized that people in impulsive states focus their attention on the most tempting, salient information, whereas people in reflective states distribute their attention over the available information. We established, using eye-tracking, that people in impulsive states indeed focus their attention on the most salient information, whereas people in reflective states distribute their attention. Additionally, this attentional difference was found to affect sexual attractiveness judgments. People in reflective states, who distribute their attention over all available information, were influenced by the context in which the person in the photograph was depicted when judging sexual attractiveness of a target on a photograph. People in impulsive states were not influenced by the context, in line with our expectations.

In the studies reported in Chapter 4 we explore another potential difference between people in impulsive and reflective states, related to perception. In two studies, we found that people in impulsive states estimate goal-relevant objects in biased ways. Specifically, sex-primed heterosexual men estimated a woman's breasts as larger than men primed with a neutral stimulus; larger cup size indicates sexual maturity. When primed with a sex goal, larger cup size, and thus sexual maturity, is goal congruent. Women showed the reverse effect, and estimated cup size smaller than women primed with a neutral stimulus. Estimating cup size of a competitor as smaller is goal congruent, because for woman another woman is competition, and estimating her cup size as smaller puts themselves in a more positive light (i.e., more sexually mature). That people in impulsive

states are influenced by motivation in their size estimates, whereas people in reflective states are not, suggests that biased size estimation is a spontaneous process that promotes readiness for goal pursuit in people in impulsive states.

Lastly, the studies in Chapter 5 test whether changing a 'simple' environmental factor can possibly change the cognitive state people are in and reduce risk taking. Based on widespread notions in our language, we hypothesized that temperature influences risk taking behavior. We found that imagery, such as 'in the heat of the moment', can be taken literally; people make riskier sexual decisions when temperatures are higher than when temperatures are lower.

Chapter 2

The Impact of Long-term Health Goals on Sexual Risk Decisions in Impulsive and Reflective Cognitive States[1]

[1] Den Daas, C., Häfner, M., & de Wit, J. (revision submitted). The impact of long-term health goals on sexual risk decisions in impulsive and reflective cognitive states.

Abstract

In the heat of the moment people often impulsively take risks. Having unprotected sex, for example, can result in sexually transmitted infections. In three studies we investigate a possible explanation for the increased sexual risk propensity of people in an impulsive state. In contrast to the intuitively appealing notion that they are less influenced by their long-term goals, we hypothesize and show that both people in impulsive and reflective states make less risky sexual decisions when health goals are important. We further show that, when sexual health goals are important, people in a reflective state make riskier sexual decisions as temptations become stronger, while decisions of people in an impulsive state are not influenced by temptation strength. This supports the counterintuitive prediction that people in an impulsive state are better able to cope with strong temptations than people in a reflective state.

In the heat of the moment people often find themselves doing things that may have negative long-term consequences (e.g., Ariely & Loewenstein, 2006). People might, for instance, have unprotected sex and run the risk of a sexually-transmitted infection (STI). Research shows that when impulsive, people tend to make riskier sexual decisions than when not impulsive (Clift, Wilkins, & Davidson, 1993; Donohew et al., 2000; Dudley, Rostosky, Korfhage, & Zimmerman, 2004) and this impulsivity may explain why people take risks in tempting and arousing situations. However, it is not yet entirely clear *why* impulsivity often leads to an increased risk propensity. An intuitively appealing explanation is that people who act impulsively do not sufficiently consider the long-term outcomes of their behavior, as they are mainly focused on immediate rewards (Dawe, Gullo, & Loxton, 2004).

The aim of this study is to assess whether people in an impulsive state indeed do not consider their long-term health goals when making sexual risk decisions in the face of temptations that challenge their long-term health goals. Based on research into the automatic influences of goals on behavior (e.g., Aarts & Dijksterhuis, 2000; Custers & Aarts, 2005, 2010), we hypothesize that people who act impulsively should also be influenced by their long-term goals. As we explain below, long-term goals affect people in an impulsive state through other processes than people in a reflective state, as posited by dual-system theories (e.g., Strack & Deutsch, 2004). Consequently, we hypothesize that a disregard for long-term goals is *not* responsible for the increased risk propensity of people in an impulsive state.

Dual-system theories of behavior

Contemporary dual systems theories (e.g., Epstein, 1990; Metcalfe & Mischel, 1999; Smith & DeCoster, 2000) conceive of behavior as resulting from two interacting cognitive-affective motivational systems that follow different operating principles. The reflective-impulsive model (Strack & Deutsch, 2004), a particularly influential dual systems model, proposes that a reflective system generates behavioral decisions that are based on

values and knowledge of facts, integrated by syllogistic reasoning. A complementing impulsive system is thought to elicit behavior through associative connections in memory and situation- or person-specific motivational orientations. Any behavior is thought to eventually result from the complex interplay between the impulsive and reflective systems, with the relative influence of each of these systems shaped by moderating factors in the person and the situation (e.g., Strack, Werth, & Deutsch, 2006).

In the reflective system, people's long-term goals are thought to act as conscious guards against temptations. When people hold a long-term goal, they supposedly consider both the goal and the temptation to subsequently form a behavioral intention (e.g., Azjen, 1991). For instance, when two people who are about to have a one-night stand find out they have no condoms, they might think: 'I am really in the mood, but do not want to risk contracting HIV or another STI. I will use a condom or I will not have intercourse.' Rationally, behavior resulting from the reflective system should be concurrent with people's long-term goals (Fishbach, Friedman, & Kruglanski, 2003; Freitas, Liberman, & Higgins, 2002; Trope & Fishbach, 2000), as long-term positive outcomes should be more important than the short-term positive effects associated with temptations, especially given the often negative long-term consequences accompanying giving in to temptations. Thus, people with a strong sexual health goal would decide not to have unprotected sex. Moreover, more important long-term goals exert more influence, result in stronger intentions, and thus lead to less risky decisions.

Long-term goals in the impulsive system

In the impulsive system, behavior is initiated through the associative network in memory. People are thought to encounter a situation, experience an approach or avoidance motivation, and act in accordance with the behavioral schemas that become activated (Strack & Deutsch, 2004). This pathway to behavior is thought to leave little room for any influence of long-

term goals. For example, when facing a tempting possibility for a one-night stand while no condoms are available, people in an impulsive state are thought to simply have unprotected sex, without contemplating the implications for their health in the long run. We propose, however, that long-term goals should also exert an influence on behavior in the impulsive system.

For goals to influence behavior in an impulsive state, they would have to be represented in the associative networks that shape behavior in the impulsive system (Strack & Deutsch, 2004), which is precisely what goal systems theory proposes (Kruglanski et al., 2002). Moreover, according to goal systems theory, temptations, long-term goals, and the means to achieve both these ends are represented in the same associative network. More importantly, as these concepts are regularly co-activated (e.g., when contemplating what to do in a tempting situation), processing a temptation is posited to automatically activate associated long-term goals (e.g., Kruglanski et al., 2002; Bargh & Ferguson, 2000). Fishbach and Shah (2006) further argue that the strength of this co-activation in the associative network is proportional; as a temptation becomes stronger, the co-activation of the long-term goal should also be stronger. Indeed, their research has shown that stronger temptations elicit more pronounced avoidance responses than weaker temptations, but only in the presence of long-term goals. As temptations are thought to activate long-term goals through the associative network, we propose that relevant long-term goals should also influence behavior in an impulsive state. We further expect that this is only true for important long-term goals, which are more likely to have been regularly activated in association with a temptation.

That long-term goals can guide behavior through the impulsive system is well illustrated in research and theorizing regarding the influence of habits on behavior. Habits are considered a prime example of automatic goal-directed behavior, which results from associative connections between goals and actions. When people frequently perform the same action to achieve a goal, and when this action generally leads to goal achievement in a

satisfactory manner, the action, over time, becomes mentally linked to the goal. Activation of the goal then spreads automatically to the action associated with this goal (Ouelette & Wood, 1998). This spreading of activation subsequently results in the corresponding behavior when the goal is activated. Although research traditions regarding both goal systems theory and habits suggest that long-term goals should also guard and guide behavior in an impulsive state, this has not yet been investigated directly. The present research was designed to fill this void.

The Present Research

In a pre-test and three experimental studies, we test the influence of long-term sexual health goals on sexual risk decisions in impulsive and reflective states. The aim of the pre-test is to establish that cognitive states can affect sexual risk decisions independent of sexual arousal. Sexual arousal and an impulsive state can both contribute to increased sexual risk taking (Abrams & Wilson, 1983; Ariely & Loewenstein, 2006; Macdonald, MacDonald, Zanna, & Fong, 2000; Rivers, Reyna, & Mills, 2008), and as arousal can increase impulsiveness, this pre-test was intended to rule out sexual arousal as an explanation of the effect of cognitive state.

In the subsequent three experimental studies, we test our main hypothesis that a disregard for long-term goals is *not* responsible for the increased risk propensity of people in an impulsive state. To test this hypothesis, we semantically (Experiment 2.1) and procedurally (Experiments 2.2 and 2.3) prime reflective or impulsive cognitive states, and then assess how long-term goals influence sexual risk decisions. We hypothesize that in both impulsive and reflective cognitive states more important long-term sexual health goals have a stronger risk minimizing effect on decisions than less important long-term sexual health goals. Experiment 2.2 differs from Experiment 2.1 in two important ways. First, we use a novel manipulation of cognitive state, so that we can induce cognitive states more implicitly. Additionally, we measure sexual health goals at the

end of the experiment to exclude the possibility that measuring sexual health goals activates them, whereas health goals might typically not become activated in an impulsive state.

In Experiment 2.3 we extend Experiments 2.1 and 2.2 by including a manipulation of temptation strength. We hypothesize that cognitive states affect people's ability to resist temptations of varying strengths, depending also on the importance of their sexual health goals. In line with research on impulsivity (Clift et al., 1993; Donohew et al., 2000; Dudley et al., 2004), we hypothesize that people in a reflective state are more capable of coping with temptations overall than people in an impulsive state. However, people in an impulsive state do not always make riskier sexual decisions than people in a reflective state. Specifically, we hypothesize that, when health goals are relatively important, as temptations become stronger, people in a reflective state become *less* capable to resist these temptations. Conceptually, stronger temptations are generally more desirable, which should make it more difficult to resist them (cf. Chen & Bargh, 1999; Lang, Bradley, & Cuthbert, 1998).Empirically, this expectation is in line with the findings of Ditto et al. (2006), who showed that stronger temptations (i.e., temptations that result in more visceral experiences) result in riskier decisions. In their study, participants who saw a video of a sexual situation made riskier sexual decisions than participants who read the scenario of the same situation (Ditto et al., 2006).

In contrast, we expect that people in an impulsive state are equally able to cope with moderate and strong temptations. Temptations have been found to co-activate long-term goals, and as this co-activation is contingent on the strength of the association between the temptation and long-term goal, it is posited to be proportional to the strength of the temptation (Fishbach & Shah, 2006). Thus, stronger temptations should result in a stronger co-activation of long-term goals than more moderate temptations. This stronger co-activation of long-term goals should, in turn, result in more resistance to stronger temptations that should hence not result in more risky decisions. Additionally, we expect that when their sexual health goals are relatively

unimportant, there is no reason for people to resist the temptation, as there is no conflict with long-term goals. Thus, when long-term sexual health goals are relatively unimportant, people in reflective and impulsive states are expected to be equally likely to give in to stronger and moderate temptations.

Methods

Participants

A total of 63 (30 men; Pre-test), 63 (18 men; Experiment 2.1), 46 (23 men; Experiment 2.2), and 74 (27 men; Experiment 2.3) heterosexual Dutch students participated. Participants were compensated with a chocolate bar (Pre-test), 6 Euro's or course credits (Experiments 2.1-2.3). In the pre-test and Experiments 2.1 and 2.2, participants were randomly assigned to one of two cognitive state conditions (reflective vs. impulsive). In Experiment 2.3, participants were randomly assigned to one of the four conditions of a 2 (Cognitive state) x 2 (Temptation strength: strong vs. moderate) between-participants design.

Procedure

In the pre-test, participants first read the scenario of a sexual situation, after which they completed measures of the dependent variable and the manipulation checks of arousal and cognitive state. In Experiment 2.1, participants completed a health goal questionnaire, read the scenario of a sexual situation, and then completed measures of the dependent variable and the manipulation check of cognitive state, as in the pre-test. In Experiment 2.2 cognitive state was manipulated implicitly and participants filled out the health goal questionnaire at the end of the study. Experiment 2.3 followed the procedures of Experiment 2.2, with the addition of a manipulation of temptation strength.

Materials

Sexual scenario. Participants read a gender-specific version of a scenario describing a sexual interaction appropriate for heterosexual participants (see also, MacDonald, Zanna, & Fong, 1996; MacDonald et al., 2000; Ditto, Pizarro, Epstein, Jacobson, & MacDonald, 2006). In the scenario, participants run into an attractive acquaintance of the opposite sex (Rebecca/Frank) and spend an evening talking with her/him. At the end of the evening both the participant and their acquaintance want to have sex (i.e. intercourse), but unfortunately condoms are not available. In the scenario the female always takes birth control pills, to rule out the risk of pregnancy. Nevertheless, deciding to have intercourse without a condom would entail a risk of sexually transmitted infections.

Manipulation Checks, Sexual Risk Decisions, and Sexual Health Goals. We included two manipulation checks, one for sexual arousal (Pre-test) and one for cognitive state (Pre-test and Experiment 2.1). Sexual arousal was assessed with one item: 'This situation arouses me' (1=false, 7=true; in this context, the Dutch term used for 'arousal' unequivocally means 'sexual arousal'). The manipulation check of cognitive state also consisted of one item: 'Did you answer the questions reflectively and analytically or impulsively and intuitively?' (1=reflective and analytical, 7=impulsive and intuitive; these terms were previously used in the manipulation of cognitive states).

In the Pre-test and Experiments 2.1-2.3 we assessed the dependent variable, participants' sexual risk decision, with one item: 'If I were in this situation I would have intercourse with Rebecca/Frank' (1=unlikely, 7=likely). Furthermore, in Experiments 2.1-2.3, we included a health goal questionnaire consisting of six items regarding the importance of participants' long-term sexual health goals (1=completely false, 7=completely true).

Cognitive States. In the pre-test and in Experiment 2.1 we manipulated cognitive state with a procedure previously used by Maas and

Van den Bos (2009). Specifically, participants read an instruction that asked them to either think carefully and consider the pros and cons of their decision (reflective condition) or react intuitively and go with their gut feeling (impulsive condition). It was further explained that either their answer was right when they thought about it extensively (reflective condition) or that the first answer that came to mind was the correct response (impulsive condition).

In Experiments 2.2 and 2.3 participants ostensibly completed a personality test by indicating whether personality-related words applied to them (yes-no). The manipulation of cognitive state was achieved through varying instructions regarding the test. The instruction used to induce an impulsive state read that the test only effectively measured personality when answers were given as fast as possible, and without thinking; when participants failed to respond within 1000 ms they received feedback to respond faster. A reflective state was induced by instructing participants that the test was only effective when their answers were given after considerable deliberation; when they reacted within 2000 ms they received feedback to think more extensively.

Temptation Strength. In Experiment 2.3, we told participants that they would participate in an unrelated experiment on person perception, which took place prior to the presentation of the sexual scenario. In this ostensibly unrelated study, we showed, for a person of the opposite sex, the level of descriptiveness of twenty characteristics (e.g., 'interesting', 'aggressive'), on a scale ranging from 0 to 100. Temptation strength was manipulated by varying the descriptiveness of the person's attractiveness. In the moderate temptation condition, the descriptiveness of attractiveness was 67 out of 100; while in the strong temptation condition descriptiveness of attractiveness was 97 out of 100. Attractiveness was always shown as the first characteristic, after which the other characteristics were shown one by one. Fourteen of these other characteristics were positive and presented as moderate to highly descriptive (values above 60). Five characteristics were negative and their descriptiveness was indicated to be moderate to low

(values below 40). Other than for attractiveness, the descriptiveness of the characteristics was kept constant, resulting in an overall positive description. An overview of all characteristics and how descriptive these were of the person was shown last, with characteristics listed alphabetically (alphabetically, attractiveness was also the first listed characteristic in Dutch). In line with the cover story, some questions then followed about the described person; the scenario and the dependent variable, participants' sexual risk decisions, were embedded in these questions. To check the manipulation of temptation strength, participants were asked how attractive the described person was (1=very attractive, 7=very unattractive).

Statistical Analyses. In the pre-test and Experiments 2.1-2.3, we analyzed the data using a General Linear Model (GLM). The dependent variable was participants' sexual risk decision. Cognitive state, Gender and Temptation strength (Experiment 2.3) were categorical between-participants independent variables, and sexual health goals was a continuous between-participants independent variable (not included in the pre-test). Significant interaction effects were further analyzed with simple comparisons of values 1 SD above and below the mean (cf. Aiken & West, 1991).

Results

Pre-test

The aim of the pre-test was to establish that our cognitive state manipulation was not confounded and did not influence sexual arousal ratings. As expected, a t-test revealed that participants in reflective and impulsive states did not differ in their experienced sexual arousal, $t(61) = 1.47$, $p = .15$. This underlines that differences found between the cognitive state conditions in this pre-test and subsequent experiments cannot be attributed to differences in the extent to which participants were sexual aroused. There was, however, a significant main effect of gender on sexual

arousal; men (M = 4.30, SD = 1.69) indicated being more aroused than women (M = 3.50, SD = 1.60), $t(61) = 2.77$, $p < .05$.

The manipulation check of cognitive state further showed that this manipulation was successful; participants in the impulsive state condition (M = 4.70, SD = 1.72) indicated that they had answered the questions more impulsively than participants in the reflective state condition (M = 3.63, SD = 1.67), $t(61) = 2.48$, $p = 0.02$. Nevertheless, in both cognitive states some participants indicated not to have followed instructions, with 20 participants indicating to have done the opposite of the instructions they received. These participants were excluded from further analyses, and data of the remaining 43 participants was used for the main analysis.

A GLM with participants' sexual risk decision as the dependent variable and cognitive state and gender as independent variables revealed two main effects. Men made significantly riskier sexual decisions than women, $F(1, 39) = 26.95$, $p < .05$, $\eta_p^2 = .41$, and, also as expected, participants in an impulsive state made riskier sexual decisions than participants in a reflective state, $F(1, 39) = 4.79$, $p = 0.04$, $\eta_p^2 = .11$ (see Table 1 for Means and Standard Deviations). Importantly, this difference in sexual risk decisions between cognitive states cannot be explained by differences in sexual arousal, as this did not differ between cognitive state conditions (see above). The gender difference we found in sexual risk decisions is in line with previous research, showing that men typically make riskier sexual decisions than women (cf. Byrnes, Miller & Schafer, 1999). Previous research has also consistently shown that men report more sexual arousal than women across situations and in response to a variety of sexual stimuli (cf. Murnen & Stockton, 1997). As men rated the scenario as more sexually arousing then women, the gender difference in sexual risk decisions can possibly be explained by differences in sexual arousal.

We also conducted a GLM in which we added compliance with the instructions (yes-no) as a factor in the analysis. This showed a significant interaction effect between compliance and cognitive state on sexual risk decision, $F(1, 55) = 25.53$, $p < .05$, $\eta_p^2 = .32$. Subsequent simple

Table 2.1. Means and Standard Deviations (Standard Errors for Sexual Health Goals) of Sexual Risk Decisions in all Experiments, as a Function of Cognitive State, Gender, (Non-)Compliance with the Instructions, and Sexual Health Goals (1 SD above and below the Mean).

		Cognitive State				Gender				Sexual Health Goals			
		Impulsive		Reflective		Men		Women		Important		Unimportant	
Pre-test	Compliance	3.54[a]	(2.12)	2.32[a]	(1.67)	4.35[b]	(1.84)	1.83[b]	(1.30)	-	-	-	-
	Non-compliance	1.89[c]	(0.78)	5.18[c]	(1.40)					-	-	-	-
Exp 2.1	Compliance	3.36[d]	(2.26)	2.68[d]	(1.95)	4.86[e]	(2.19)	2.78[e]	(1.95)	3.09[f]	(0.46)	4.66[f]	(0.46)
	Non-compliance	2.22[g]	(0.97)	5.14[g]	(0.90)								
Exp 2.2		3.81[f]	(2.10)	2.65[f]	(1.76)	3.91[h]	(2.11)	2.70[h]	(1.77)	2.43[i]	(0.36)	4.21[i]	(0.40)
Exp 2.3		3.13	(2.21)	3.69	(2.15)	4.85[j]	(2.01)	2.62[j]	(1.86)	2.71[k]	(0.39)	4.56[k]	(0.43)

Notes

[a,b,c,d,e,f,g,i,j,] and [k] significant at levels of $p < .05$

[h] significant at levels of $p < .07$

comparisons revealed that participants who did not comply with instructions (the 20 participants we excluded before) showed the reverse effect compared to participants who did comply with the instructions. That is, when they had not complied with the instructions, participants in an 'impulsive state' made *less* risky decisions than participants in a 'reflective state', $F(1, 55) = 20.15$, $p < .05$, $\eta_p^2 = .27$. This illustrates that people who reported doing the opposite from the instructions they received, also showed the matching, opposite effect on sexual risk decisions.

Results Experiment 2.1

The manipulation check showed that our manipulation of cognitive state was successful; participants in the impulsive condition answered the questions more impulsively ($M = 2.76$, $SD = 1.67$) than participants in the reflective condition ($M = 4.50$, $SD = 1.63$), $t(61) = 4.11$, $p < 0.05$. Nevertheless, 16 participants indicated they had not complied with instructions. They were removed from further analyses, and the main analysis was performed over the data of the remaining 47 participants. Participants in reflective ($M = 5.94$, $SD = 0.66$) and impulsive states ($M = 5.73$, $SD = 0.90$) did not differ in their ratings of the importance of sexual health goals, $t(45) = 0.89$, $p = .38$.

Sexual risk decisions were analyzed using a 2 (Cognitive State) x 2 (Gender) GLM, with sexual health goals included as a continuous variable. This showed a main effect of gender, $F(1, 46) = 10.78$, $p < .05$, $\eta_p^2 = .20$, such that men made riskier sexual decisions than women. As expected, the main effect of cognitive state was also significant, $F(1, 46) = 4.91$, $p = .03$, $\eta_p^2 = .11$. Again, participants in an impulsive state made riskier sexual decisions than participants in a reflective state. As expected, participants' sexual health goals also significantly influenced their sexual risk decisions, $F(1, 46) = 8.56$, $p < .05$, $\eta_p^2 = .17$, irrespective of cognitive state. When participants' goals were relatively unimportant (1 SD below the mean) they made riskier sexual decisions than when their sexual health goals were

relatively important (1 SD above the mean). None of the interactions reached statistical significance.

When we added compliance with instructions as a between-participant variable and repeated the GLM analysis, the interaction between compliance and cognitive state was significant, $F(1, 54) = 9.57$, $p < .05$, $\eta_p^2 = .15$. In contrast to participants who had complied with instructions, non-complying participants in an 'impulsive state' made less risky sexual decisions than non-complying participants in a 'reflective state', $F(1, 54) = 4.08$, $p < .05$, $\eta_p^2 = .05$. This again illustrates that effects on sexual risk decisions match participants' response to instructions to manipulate their cognitive state.

Results Experiment 2.2

In this experiment, sexual health goals were assessed after the measurement of the dependent variable. As in Experiment 2.1, participants in reflective and impulsive states did not differ in their ratings of the importance of their sexual health goals ($M = 5.28$, $SD = 0.81$ and $M = 5.45$, $SD = 0.99$, respectively), $t(44) = 0.61$, *ns*.

Sexual risk decisions were then analyzed using a 2 (Cognitive State) x 2 (Gender) GLM, with importance of sexual health goals included as a continuous variable. There was again, a marginally significant main effect of gender, $F(1, 41) = 3.47$, $p = .07$, $\eta_p^2 = .08$, such that men tended to make riskier sexual decisions than women. As expected, the main effect of cognitive state was also significant, $F(1, 41) = 4.55$, $p=.04$, $\eta_p^2 = .10$. Again, participants in an impulsive state made riskier sexual decisions than participants in a reflective state. In line with our predictions, sexual health goals were also significantly associated with sexual risk decisions, $F(1, 41) = 10.11$, $p < .05$, $\eta_p^2 = .20$. When participants' goals were relatively unimportant, they again made riskier sexual decisions than when their goals were relatively important. None of the interactions reached statistical

significance, including the interaction between cognitive state and sexual health goals ($F < 1$).

Results Experiment 2.3

As in the previous experiments, we found that participants in reflective and impulsive states valued their sexual health goals equally (M = 5.42, SD = 0.82 and M = 5.38, SD = 1.00, respectively), $t(72) = 0.15$, *ns*, as did participants in the moderate and strong temptation conditions (M = 5.51, SD = 0.95 and M = 5.28, SD = 0.85, respectively), $t(72) = 1.07$, *ns*. As expected, attractiveness of the person described was rated lower by participants in the moderate temptation condition (M = 4.49, SD = 0.96) than by participants in the strong temptation condition (M = 5.22, SD = 1.11), $t(72) = 3.03$, $p < .05$, $r = .34$. Participants in impulsive and reflective states did not differ in their ratings of attractiveness (M = 4.95, SD = 0.93 and M = 4.75, SD = 1.25, respectively, $F < 1$). The interaction between cognitive state and temptation strength on attractiveness ratings also did not reach significance ($F < 1$), illustrating that our manipulation of temptation strength equally affected participants in reflective and impulsive states.

Sexual risk decisions were analyzed using a 2 (Gender) x 2 (Cognitive State) x 2 (Temptation Strength) GLM, with sexual health goals included as a continuous variable. This analysis revealed three main effects. The main effect for gender showed that men again made riskier decisions than women, $F(1, 58) = 13.95$, $p < .05$, $\eta_p^2 = .19$. The main effect for sexual health goals again showed that, when sexual health goals were relatively important, participants again made less risky decisions than when health goals were relatively unimportant, $F(1, 58) = 7.31$, $p < .05$, $\eta_p^2 = .11$. The main effect of temptation strength was marginally significant, $F(1, 58) = 3.26$, $p < .08$, $\eta_p^2 = .05$, and showed that in response to a strong temptation (M = 4.06, SE = 0.33), participants made riskier decisions than in response to a moderate temptation (M = 3.24, SE = 0.31).

These main effects we qualified by the expected three-way interaction between cognitive state, sexual health goals and temptation strength, $F(1, 58) = 4.73$, $p < .05$, $\eta_p^2 = .08$ (see Figure 2.1). We subsequently analyzed the interaction between cognitive state and temptation strength separately for people whose sexual health goals were relatively important or relatively unimportant (+1 SD and -1 SD from the mean). The interaction between cognitive state and temptation strength was not significant when participants' sexual health goals were relatively unimportant, $F(1, 58) = 1.05$, *ns*. Also, no other effects reached significance when participants' sexual health goals were relatively unimportant.

When health goals were relatively important, a significant interaction between cognitive state and temptation strength was observed, $F(1, 58) = 7.19$, $p = .01$, $\eta_p^2 = .11$. To further examine this interaction, we conducted simple comparisons of the effects of temptation strength according to cognitive state (see Aiken & West, 1991). These showed that, when sexual health goals were relatively important, participants in a reflective state made riskier sexual decisions in response to a strong temptation than in response to a moderate temptation, $F(1, 58) = 6.07$, $p < .05$, $\eta_p^2 = .10$. When sexual health goals were relatively important, temptation strength did not affect the sexual risk decisions of participants in an impulsive state, $F < 1$. Furthermore, when temptations were stronger, people in an impulsive state tended to make less risky decisions than people in a reflective state, $F(1, 58) = 3.79$, $p < .06$, $\eta_p^2 = .06$. The only other effect that reached statistical significance when participants' sexual health goals were relatively important, was the main effect of gender, $F(1, 58) = 8.44$, $p < .05$, $\eta_p^2 = .13$; men again made riskier sexual decisions than women.

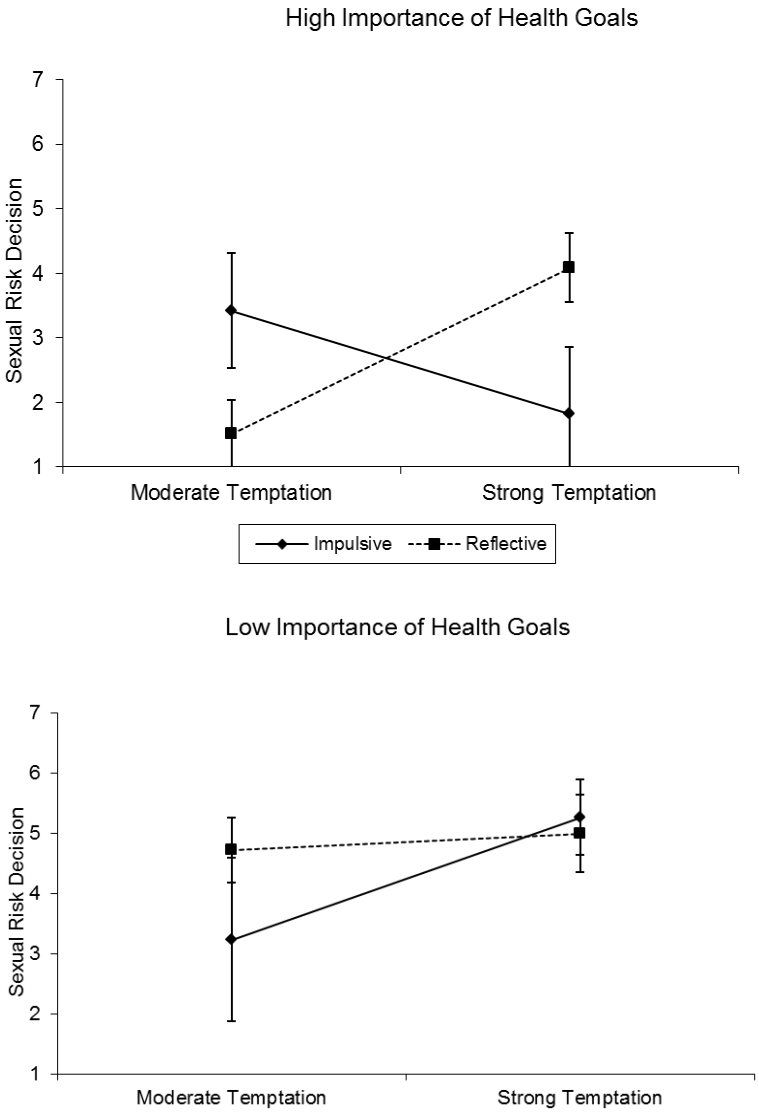

Figure 2.1. Sexual risk decisions as a function of cognitive state and temptation strength, for participants for whom their sexual health goals are more or less important (*High* and *low* values for the importance of health goals represent plus or minus one standard deviation from the mean). Error bars depict standard errors of the means.

Discussion

The main purpose of the presented experiments was to examine the role of long-term health goals on sexual risk decisions made in reflective and impulsive cognitive states. Results of the pre-test and the subsequent series of three experiments provided consistent evidence that is in line with our central prediction that people in an impulsive state are influenced by their long-term sexual health goals, as are people in a reflective state. Specifically, Experiments 2.1 and 2.2 showed that, although people in an impulsive state made riskier sexual decisions than people in a reflective state, this difference could not be accounted for by a decreased influence of the importance of their health goals on their sexual risk decisions. Both people in impulsive and reflective states were significantly influenced by the importance of their sexual health goals, and, irrespective of their cognitive state, people who valued their sexual health more were less inclined to have unprotected sex when the situation arose. Experiment 2.3 further extended these findings, demonstrating that people in reflective and impulsive states react differently to temptations of diverging strengths. We found support for the prediction that people in a reflective state make riskier decisions as temptations become stronger. This could be because the temptation becomes too strong to resist or because people consider the immediate pleasure to be worth the risks. In contrast, we found support for the expectation that, in an impulsive state, people cope just as effectively with weaker and stronger temptations.

An impulsive state is often seen as equivalent to other types of states that lead to increases in risk taking, such as ego depletion or a state of sexual arousal (e.g., Ariely & Loewenstein, 2006; Baumeister, Bratslavsky, Muraven, & Tice, 1998). We manipulated cognitive state in a way that did not tap into these 'hot' states, and also used an unobtrusive manipulation. We developed this novel manipulation of cognitive state to address the problem that, although the manipulation used in Experiment 2.1 was explicit, a substantial number of participants did not follow the instructions. While people who indicated that they did the opposite of the instruction they

received showed sexual risk decisions that matched the cognitive state they displayed. That some participants did not follow instructions is an important limitation. Violations of instructions are less likely to affect the implicit manipulation we developed and used in Experiments 2.2 and 2.3. Moreover, using this novel manipulation enabled us to replicate the findings of Experiment 2.1, thus validating that, when people comply with instructions, both manipulations induce reflective and impulsive cognitive states, as intended.

The presented research has important, novel implications regarding the role of impulsive influences in the prevention of sexual risk behavior. Previously, Hofmann, Friese and Wiers (2008), have suggested that interventions to promote people's healthy behaviors may be most effective when these (also) address impulsive influences on behavior. Hofmann and colleagues (2008) in particular argue that people in an impulsive state might be more influenced by their implicit attitudes than by their reasoned attitudes, beliefs and control standards. In contrast, we consistently show that long-term sexual health goals, which are typically seen as belonging to the realm of reasoned attitudes, beliefs and control standards, influence people also in an impulsive state. As we have shown in Experiment 2.3, people in an impulsive state were even guarded against stronger temptations, as long as they considered their sexual health to be important. Together these findings suggest that, to effectively influence behavior in impulsive states, interventions do not have to focus exclusively or additionally on impulsive influences. Moreover, implicit attitudes and affective responses might be even more difficult or cumbersome to change than more reasoned influences (cf. Petty, Tormala, Brinõl, & Jarvis, 2006; Rudman, 2004; Wilson, Lindsey, & Schooler, 2000).

We recognize that the present research did not address what precisely can explain the observed difference between decisions made in reflective and impulsive states. A possible explanation for the increase in sexual risk decisions made in an impulsive state could be that people in this state focus their attention more on the immediately gratifying features of the

situation, giving these more weight in their decision. In a separate set of experiments we have indeed found significant differences in attentional focus between people in impulsive and reflective states (Den Daas, Häfner, & de Wit, in press). According to attentional myopia theory (Mann & Ward, 2004), people under high cognitive load only pay attention to the most salient features of the environment. We propose that people in impulsive states may show a similar bias and focus their attention on the most salient features of the situation.

Also, we have not explicitly examined the process(es) potentially underlying the effects of temptation strength, which leaves open the possibility of alternative explanations. Notably, when a temptation becomes stronger, people in a reflective state possibly make riskier decisions than people in an impulsive state because they underestimate the dangers of the temptation, for example because of a feeling of invulnerability (e.g., Dew & Henley, 1999). However, we found no differences in the attractiveness ratings of people in different cognitive state, which renders it less plausible that the temptation was interpreted differently. Nevertheless, future research is needed to explore possible underlying processes.

A further possible limitation is our use of hypothetical scenarios to assess sexual risk decisions. It has been shown that people are not good at anticipating how they will behave in visceral states (e.g., Ariely & Loewenstein, 2006; Nordgren, van Harreveld, & van der Pligt, 2009). However, this should result in less risky sexual decisions, as people typically overestimate their capacity for impulse control. Hence, whereas the likelihood of sexual risk decisions in our experiments may have been underestimated, our manipulation of cognitive states still resulted in meaningful differences. Also, using a behavioral measure of sexual risk would be problematic from an ethical perspective, as people in impulsive states are expected to behave riskier.

Conclusions

People often find themselves in situations in which they make sexual risk decisions in the 'heat of the moment'. In such situations, they would benefit most from their long-term goals to protect their sexual health. The present research did not find support for the intuitively appealing account that people in an impulsive state make riskier decisions because of an attenuated influence of their long-term goals. The current research, in contrast, showed that long-term sexual health goals influence sexual risk decisions equally in reflective and impulsive states. Giving in to the urge of a temptation can have major consequences, even if it is only once, as in sexual risk-taking. Therefore, it is reassuring that in the conflict between temptations and long-term goals, the influence of long-term goals does not diminish for people in impulsive states. Long-term goals, in both reflective and impulsive states, do not seem to be a long shot.

Chapter 3

Out of Sight, Out of Mind:
Cognitive States Alter the Focus of Attention[23]

[2] Den Daas, C., Häfner, M., & de Wit, J. (in press). Out of sight, out of mind: Cognitive states alter the focus of attention. *Experimental Psychology*. doi:10.1027/1618-3169/a000201

[3] We would like to thank Haico Wensink for his assistance in collecting data for Experiment 3.1.

Abstract

People in an impulsive state are influenced mainly by the immediate incentive value of appetitive stimuli, whereas people in a reflective state usually also consider the (sometimes negative) long-term consequences of such stimuli. In order to consider all information, we hypothesize that, people in reflective states distribute their attention over all available information, whereas people in impulsive states focus their attention on the most salient information. We measured cognitive states using eye-blink rate (Experiment 1) or induced them with a procedural priming manipulation (Experiments 2 and 3). In eye-tracking Experiments 1 and 2, we established that people in an impulsive state indeed focus their attention on the salient information, whereas people in a reflective state distribute their attention. Moreover, we show that this attentional difference extends to evaluative judgments (Experiment 3), which could potentially contribute to people's increased propensity to risk in impulsive states.

Impulsiveness is considered an important factor in risk-taking behavior. It has been shown, for instance, that people who are more impulsive are more likely to overeat or to engage in risky sexual behavior (Clift, Wilkins & Davidson, 1993; Cooper, Agocha, & Sheldon, 2000; Donohew et al., 2000; Guerrieri et al., 2007; Hoyle, Fejfar, & Miller, 2000; Dudley, Rostosky, Korfhage, & Zimmerman, 2004). While these findings suggest that impulsiveness makes people more prone to behave in risky ways, it is less clear *why* exactly this is the case.

Dual-system models, such as the reflective-impulsive model (Strack & Deutsch, 2004), suggest that the increased propensity for risk-taking of people in impulsive states is related to their mode of information processing. Whereas people in an impulsive state usually process and ultimately are driven by the immediate incentive value of incoming information (through stimulus-valence-behavior associations), people in a reflective state are able to abstract from the immediate input and bridge temporal gaps in order to process long-term consequences. Hence, people in a reflective state are able to oversee immediate rewards and take long-term consequences into account.

Building on the differentiation between modes of information processing, we posit that also attention is spread differentially in reflective and impulsive states: In order to strive successfully for valued long-term outcomes, people in a reflective state must attend to more than the immediate incentive information. They have to distribute their attention over all available information. Conversely, we hypothesize that people in an impulsive state focus mainly on salient information. The aim of the studies reported here was to put these hypotheses to an experimental test. Specifically, we set out to investigate whether impulsive versus reflective cognitive states affect to what information people pay attention.

Attention in Impulsive States

The reflective-impulsive model (Strack & Deutsch, 2004) proposes that behavior is determined jointly by a reflective and an impulsive system. In the impulsive system, behavior is directly driven by perceptual input through mere associations. As only the most salient information becomes input, it is this salient information and its associations that activate behavioral schemata, and, ultimately result in behavior (Strack & Deutsch, 2004). Stated differently, the behavior of people in an impulsive state is most likely influenced by the information that initially attracts attention. Other information is unlikely to enter the system as it would require intention and effort, both of which people are usually lacking in an impulsive state (Strack & Deutsch, 2004).

What do people in impulsive states focus their attention on, or, in other words, what information is salient? We define saliency as information that stands out somehow. Generally, information that stands out is information that is considered emotional (Schimmack, 2005), or motivationally relevant (Bruner, 1957; Bruner & Postman, 1949; den Daas, Häfner, de Wit, 2013). Information can also stand out because of its perceptual features (e.g., contrast and luminance) or because of its predominant presence (Mann & Ward, 2004).

Previous research has shown that stimuli that are linked to motives of survival and reproduction are salient by establishing an attentional bias for threatening stimuli (e.g., snakes or spiders, Öhman, Flykt, & Esteves, 2001), food stimuli (e.g., Papies, Stroebe, & Aarts, 2008), beautiful people (e.g., Maner et al., 2003), and tempting sexual stimuli (Buodo, Sarlo, & Palomba, 2002; Most, Smith, Cooter, Levy, & Zald, 2007; Wright & Adams, 1999). Note however, that although these stimuli are connected to motives of survival and reproduction, letting these stimuli direct behavior (through behavioral associations) more often than not may result in risky decisions (e.g., eating attractive but unhealthy food, sexual risk decisions without consideration of the long-term consequences).

Attention in Reflective States

People in a reflective state can move beyond the information given, at least if they have the capacity and/or motivation to do so. Their behavior reflects syllogistic reasoning (Strack & Deutsch, 2004). Specifically, in a reflective state, the reflective-impulsive model suggests that knowledge about the value and probability of the potential consequences is weighed and integrated to reach a preference for a behavioral option. If a decision is made, the reflective system activates appropriate behavioral schema through a mechanism of intending (Strack & Deutsch, 2004). As information about different behavioral options is weighed and integrated (Strack & Deutsch, 2004), we posit that people in a reflective state often prefer to consider a wider range of information than only the most salient. Moreover, we propose that people in a reflective state extend their attention beyond the most salient stimuli.

Notably, the quality of the salient stimuli does not change in reflective states compared to impulsive states. Stimuli that are emotional, rewarding, and relevant still attract attention. However, in reflective states people are able to direct their attention to other non-salient stimuli as well. Attending to all available information by disengaging from the salient stimuli provides people in reflective states with more information and distraction from the salient stimuli (Mischel & Ebbesen, 1970; Peake, Hebl, & Mischel, 2002), which provides them the opportunity to reach a more balanced decision.

Impulsive and Reflective States and Traits

First, we want to clarify the difference between impulsive states and traits. Therefore, we again refer to the reflective-impulsive model (Strack & Deutsch, 2004): When people process information people usually have a general emphasis on one of the two systems, resulting in the classification of having an impulsive (or reflective) personality, *trait* impulsiveness.

Moreover, it is possible that situational factors put the emphasis on one of the systems; in that case we refer to impulsive (or reflective) *states*.

In order to investigate whether attention is distributed as a function of the cognitive state, we have to manipulate or measure reflective and impulsive states. Although the theoretical distinction between them is relatively straightforward, it remains a challenge to separate the two states experimentally. On the one hand, many studies have measured impulsiveness from explicit questionnaires (e.g., Clift et al., 1993; Donohew et al., 2000; Dudley et al., 2004) or made use of conceptual priming techniques (e.g., Guerrieri et al., 2007), both of which are abstract predictors of impulsiveness. On the other hand, several studies used fairly specific measurements and/or manipulations, such as a stop-signal task (e.g., Guerrieri et al., 2007; Guerrieri, Nederkoorn, Schrooten, Martijn, & Jansen, 2009) or a measure of delay of gratification (e.g., Metcalfe & Mischel, 1999). These measurements are quite specific in what they measure and do not cover impulsiveness in its whole array.

We therefore used a novel, unobtrusive measure of impulsive and reflective states, namely the eye-blink rate (EBR). EBR is an innate tendency that is associated with striatal dopaminergic functioning (e.g., Karson, 1983). Striatal dopaminergic functioning has been linked to a preference for immediate over delayed rewards (Hariri, et al., 2006; McClure, Laibson, Loewenstein, & Cohen, 2004). This preference for immediate rewards has in turn been linked to impulsiveness (e.g., Martin & Potts, 2004). Research also indicates that people with high spontaneous EBR are less capable of inhibiting their impulses (Colzato, Van den Wildenberg, Van Wouwe, Pannebakker, & Hommel, 2009). In contrast, people with low EBR have better inhibitory control, which has also been related to impulsiveness (e.g., Dawe, Gullo, & Loxton, 2004). More directly, high EBR has previously been linked to higher scores on impulsiveness (Huang, Stanford, & Barratt, 1994). Taken together, these studies support the prediction that people with a high spontaneous EBR can be considered more impulsive, whereas people with a low EBR can be considered more reflective.

The Present Research

In three experiments, we investigated whether cognitive states alter the focus of people's attention. In Experiments 3.1 and 3.2, we investigated attention to photographs by using eye-tracking. Eye-tracking has been successfully used to measure attentional focus in past research (for a review see Rayner, 1998) and records where visual attention is aimed. Specifically, this measure assesses selective orienting to information on one part of, for example, a photograph, at the expense of other parts of the same photograph. If there is a difference in attentional focus between people in impulsive and reflective states, this difference can be revealed by the eye-tracker.

We expected that people in an impulsive state would look longer and more often at salient, tempting information than at less salient information, whereas people in a reflective state would divide their attention over all the available information. In Experiment 3.3, we investigated whether this difference in focus of attention extends to evaluative judgments. We expected that people in an impulsive state would base their sexual attractiveness judgments on salient information only, whereas people in a reflective state would also incorporate other available information.

Experiment 3.1

In this experiment, we used EBR as a measure of impulsive and reflective cognitive states to test the idea that people in an impulsive state (high EBR) focus more on salient information then people in a reflective states (low EBR). We chose erotic stimuli that are typically salient, in that they refer to an opportunity for reproduction. Even though such pictures might not contain a direct behavioral link, they should still be quite salient in a way similar to how pictures of spiders are salient albeit they do not represent a direct threat (Öhman et al., 2001). Furthermore, research has shown that both men and women pay more attention to bodies in erotic pictures than in non-erotic pictures (Lykins, Meana, & Kambe, 2006). In

Lykins and colleagues' study, heterosexual men and women viewed erotic and non-erotic pictures of an individual of the opposite sex. In our study, we showed photographs of naked (erotic) and clothed (less erotic) individuals side-by-side to investigate whether people in an impulsive state focus mainly on salient information (naked targets) and people in a reflective state have a different viewing pattern.

We expected that naked female targets, and similarly male targets, are salient for both men and women, although for different underlying reasons. Notably, recent eye-tracking studies have shown that heterosexual men spend a substantial time looking at the body of a depicted woman when viewing both erotic and non-erotic stimuli (Lykins, Meana, & Kambe, 2006; Lykins, Meana, & Strauss, 2008; Rupp & Wallen, 2007). Women are also attuned to attractive women (Maner et al., 2003), perhaps because they represent potential competitors to their reproductive goal (cf. Gutierres, Kenrick, & Partch, 1999). The attentional salience of these sexual competitors could help women to determine their own attractiveness relative to other women and also help them to guard against direct relationship threats posed by other women. We expected that people in an impulsive state would focus on the salient photograph depicting a nude individual, whereas people in a reflective state would divide their attention over both photographs.

Method

Participants. A total of 53 heterosexual[4] undergraduate students (18 men, M_{age} = 21.32 years; *SD* = 2.52) participated in this experiment in exchange for course credits or 2 Euro. This experiment had a 2 (type of photograph, naked or clothed) x 2 (gender of the target, within-subject variable) x 2 (gender of the participants, between-subject variable) design,

[4] We excluded 2 participants, because they were not heterosexual. In Experiment 3.2 we also excluded 2 participants and in Experiment 3.3 we excluded 8 participants.

with EBR as the continuous variable and fixation count and dwell-time on photographs as dependent variables.

Procedure. We first measured participants' EBR with an eye-tracker (Tobii, type X120). For this measurement, participants were asked to look at a fixation point for 5 minutes. Research has shown that this duration is optimal, as a shorter observation period is likely to be compromised by natural fluctuations in eye blinks (Doughty, 2001). All recordings took place between 10:00 and 17:00 h, as EBR is most stable during this time of the day (Barbato et al., 2000). In addition, temperature and lighting were held constant (Doughty, 2001). An eye blink was defined as missing data for 100–500 ms. The number of eye blinks divided by the total length of recorded time served as the EBR score. In line with other studies of EBR in healthy individuals (e.g., Doughy, 2001), the mean EBR/min in our sample was 12.67 (*SD* = 6.65).

After this measurement, participants were shown photographs. Specifically, they were shown 10 pairs of photographs of people obtained from the internet, the first five pairs consisting of women and the next five pairs of men. We chose to show the photographs of females first, because photographs of males induce strong (reluctant) reactions especially in male participants. In order to reduce effects of gender-threat in men, which is not as pronounced in women, we believe the benefits of presenting the photographs of men last outweigh the benefits of random presentation. Each pair consisted of two photographs of the same person, one in which they were naked and in the other in which they were scarcely clothed. We changed the position of the naked photograph (left or right). The photographs shown as a pair were similar in size, position and body posture. Each pair was preceded by a fixation cross in the middle of the screen that appeared for 1 s (approximately 0.96° x 0.96° of visual angle at a viewing distance of 60 cm). The pairs were depicted for 5 s on a 24-inch monitor with a resolution of 1920 x 1200 pixels and a repeat rate of 60 Hz. The height of photographs was between 20 and 24 centimeters (approximately

18.93° and 22.62°), the width of all pictures was between 10 and 15 centimeters (9.53° and 14.25°), depending on body posture.

We analyzed the focus of attention by means of dwell time (the duration of the fixation in a given area), and fixation count (the number of fixations on a given area). We are aware that there are other measures of attention, but we have not included these because in Experiment 2, we compare two regions we are specifically interested in, first fixations sometimes occur in regions not of interest in the current study (e.g., head or arm of the target on the photograph). Therefore, we decided to analyze the data using dwell time and fixation count (e.g., not first fixation and first run dwell time).

Only the results of the first second of measurement were analyzed. This strategy was chosen on the basis of the findings of Dixson, Grimshaw, Linklater and Dixson (2009) that showed a rapid drop in both dwell time and the number of fixations after the third second, and found that attentional effects are typically observed within 1 s after stimulus onset. For the data analyses we used a lag time of 200 ms to allow enough time for the eye to move from its initial fixation point in the center of the screen. We calibrated the eye-tracker for each participant before each experimental session.

Results

Two participants were excluded from the data analyses because the time during which their EBR was recorded deviated substantially from the intended 5 min (i.e. 1.87 min and 3.15 min). Another participant was excluded because he needed eye correction (glasses or lenses) but did not wear them. The analyses were therefore conducted for the remaining 50 participants.

Dwell Time. We did a general linear model (GLM) analysis with gender of the target and type of photograph (naked versus clothed) as within-subject variables, gender of participant as between-subject variable, EBR as continuous variable and dwell time on each of the two photographs as

dependent variables. As expected, we found a significant interaction effect between type of photograph and EBR, $F(1, 47) = 9.07$, $p < .01$, $\eta_p^2 = .16$. Simple comparisons (Aiken and West, 1991; see Figure 3.1) revealed that people with a high EBR (+1 SD) dwelled significantly longer on the photographs with naked targets than on those with clothed targets, $F(1, 47) = 4.84$, $p = .03$, $\eta_p^2 = .09$. People with a low EBR (-1 SD) showed the opposite effect, $F(1, 47) = 3.98$, $p < .06$, $\eta_p^2 = .08$. No other effects were significant.

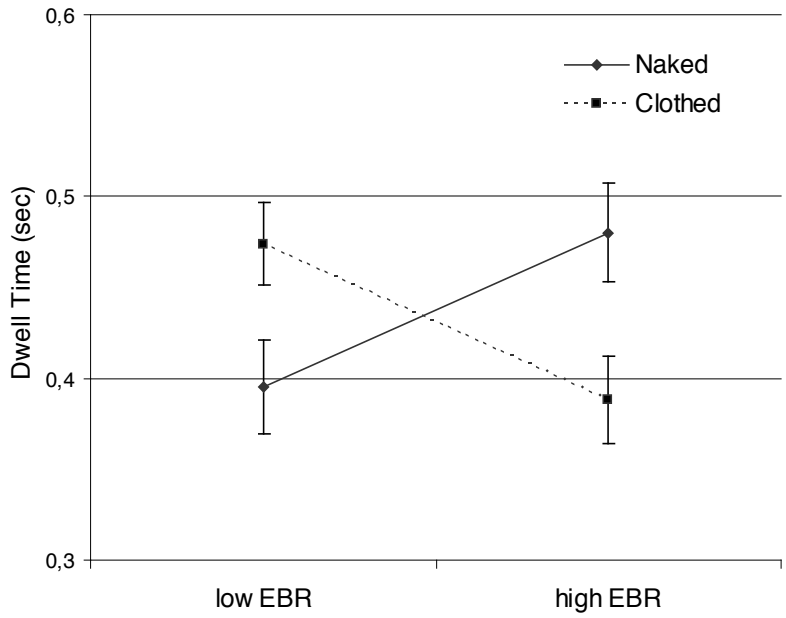

Figure 3.1. Total lengths of time people with high (+1 SD) and low (-1 SD) eye-blink rate (EBR) spent paying attention to photographs of naked or clothed individuals. Error bars depict standard errors of the means.

Fixation Count. A GLM was conducted, with type of photograph and gender of the target as within-subject variables, gender of participants as between-subject variable, EBR as continuous variable and fixation count for each of the two photographs (naked and clothed targets) as dependent variable. We found a main effect of EBR, $F(1, 47) = 5.16$, $p = .03$, $\eta_p^2 = .10$, such that people with a high EBR had a significantly higher fixation count ($M = 1.85$, $SD = 0.09$) than people with low EBR scores ($M = 1.59$, $SD = 0.08$).

More importantly, and as expected, we found a significant interaction effect between type of photograph and EBR, $F(1, 47) = 5.55$, $p = .02$, $\eta_p^2 = .11$. Simple comparisons (see Figure 3.2) revealed that people with a high EBR fixated significantly more often on the photographs with naked targets than on those with clothed targets, $F(1, 47) = 6.73$, $p = .01$, $\eta_p^2 = .13$. The effect of type of photograph did not reach statistical significance in people with a low EBR, $F < 1$, whose fixation count was similar across both types of the photograph. Lastly, we found a main effect of gender, $F(1, 47) = 6.59$, $p = .01$, $\eta_p^2 = .12$, such that men ($M = 1.79$, $SD = 0.10$) had a significantly higher fixation count than women ($M = 1.65$, $SD = 0.07$). No other effects were significant.

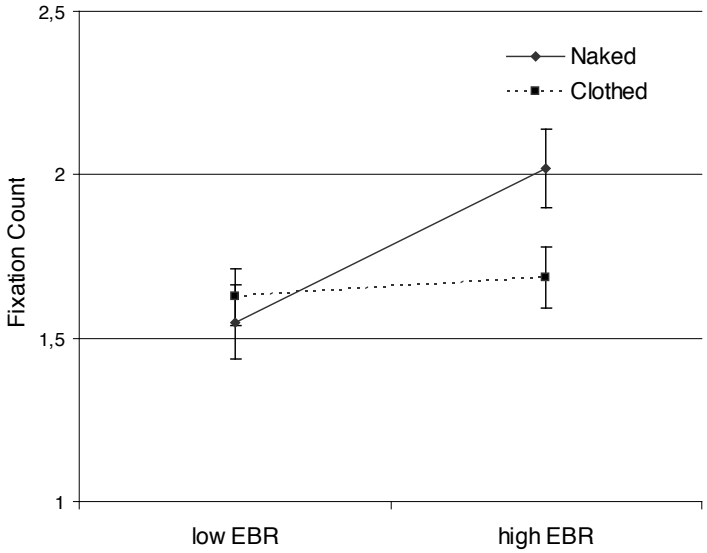

Figure 3.2. Total number of times people with high and low eye-blink rate (EBR) fixated on photographs depicting naked or clothed individuals. Error bars depict standard errors of the means.

Discussion

In line with our expectations, we found that people with a high EBR, that is, people who are more impulsive, had longer dwell times and higher fixation counts on the photographs with naked targets than on the photographs with clothed targets. People with a low EBR, who are considered to be more reflective, had equal fixation counts on the photographs with naked and clothed targets. This suggests that people in reflective states spread their attention over the available information.

The results for dwell times in people with low EBR showed a different pattern. People in reflective states did not divide their attention over both photographs but had longer dwell times on the photographs with clothed targets than on those with naked targets. Possibly, reflective participants were more influenced by social norms and normative concerns

and thus preferred the photographs with clothed targets. The absence of an effect in fixation count could be explained by a floor effect, whereby people with a low EBR have fewer fixations, making it difficult to find differences between the two photographs. Although EBR and fixation count are not the same, they are related, potentially weakening our conclusions with regard to fixation count. Importantly, however, our results pertaining to dwell time, which is not strongly related to EBR, confirm our hypothesis. Nevertheless, we will choose a different manipulation of cognitive states in our second experiment in order to control for this problem.

Unexpectedly, men had a higher fixation count than women. This effect could not be explained by a gender difference in EBR, $t(47) = 1.01$, $p > .30$, but possibly reflects a difference in preference for erotic stimuli. Men generally prefer more explicit stimuli, whereas women prefer more subtle references to affection, emotions, and storyline (see Leitenberg & Henning, 1995). Perhaps our photographs (both the naked and the clothed) were more in line with male-preferred stimuli. We found no other differences in attention between male and female participants. The absence of gender differences could be due to our small sample of men, or to a genuine absence of gender effects, we discuss these possibilities more extensively in the General Discussion. Also, we found no differences regarding the gender of the targets, analyzing the data for just opposite-sex targets yielded the same result. Arguably, both naked male and female targets are salient, although likely for other underlying reasons.

Experiment 3.2

Notwithstanding these possible limitations, use of EBR appears to be an exciting new way of unobtrusively measuring cognitive states. Nevertheless, we wanted to replicate the pattern of results with a different manipulation we have used before (Den Daas, Häfner, & de Wit, 2012). Therefore, in Experiment 3.2 we manipulated cognitive states using a

procedural priming manipulation[5]. Another limitation we tackled in Experiment 3.2 was that people in photographs are generally experienced as salient; therefore, a stronger test of our hypothesis would be to compare attentional focus on salient information with non-salient, contextual information. Additionally, we wanted to clarify the attentional pattern of people in reflective states. Unintentionally, we created a choice situation in Experiment 3.1 (between one of two targets). In Experiment 3.2, we therefore presented participants with only one person (target) in and context on a photograph. We compared attention to the salient area of the target on the photograph to the background area, removing the choice between two targets.

In Experiment 3.2, we again showed people erotic photographs. Research on the areas of the female body that people attend to has shown that women's breasts are a particular focus of attention, whether the targets are shown fully clothed (Hewig, Trippe, Hecht, Straube, & Miltner, 2008), wearing less clothing (Suschinsky, Elias, & Krupp, 2007), or naked (Dixson, Grimshaw, Linklater, & Dixson, 2009). Breasts are important appetitive and biologically relevant stimuli for heterosexual men, because they are a cue to adult sexual maturity (Marlowe, 1998). Most research has focused on reactions of men to female targets, we however also included female participants and the reactions of both genders to targets. We followed the same line of reasoning as in Experiment 3.1 for men and female targets and expected that the areas that cue sexual maturity (in both male and female targets) are salient for both men and women, albeit for different underlying reasons.

In Experiment 3.2, we again used eye-tracking, this time to measure attention to the breast and also to the genital areas (Suschinsky et al., 2007)

[5] In this study we have manipulated cognitive states in two ways. The procedural priming manipulation, and the other method was very explicit, participants had to imagine themselves in a situation where they were impulsive or reflective. These methods showed the same results, thus providing converging validity.

of the bodies of male and female targets photographed in their underwear. We predicted that people in impulsive states would focus more on the breasts and genital areas, whereas people in reflective states would distribute their attention over the available information and also attend to the background. To test this expectation, cognitive states were induced in an ostensibly unrelated study through a procedural priming manipulation. Specifically, participants were asked to answer questions in a way that mimics the way people would respond in a either an impulsive or a reflective state. That is, participants were asked to respond as fast as possible without reflection or to take their time and respond only after careful deliberation.

Method

Participants. A total of 31 heterosexual undergraduate students (8 men, M_{age} = 21.03 years; *SD* = 2.32) participated in this experiment in exchange for course credits or 2 Euros. Participants were randomly assigned to one of two cognitive state conditions (impulsive or reflective). The data for one participant was excluded from the analyses because of a technical failure in calibrating the eye-tracker.

Procedure.

Manipulation of Cognitive State. To manipulate cognitive states, participants completed a test that was ostensibly about the perceived functionality of objects. The test required participants to indicate whether pictures of neutral objects (taken from The Amsterdam Library of Object Images; Geusebroek, Burghouts, & Schmeulders, 2005) were 'functional' (yes-no). We kept what we meant by 'functional' intentionally vague and told participants that it is arguable whether something is functional or not. The instruction used to induce an impulsive state was: 'This test will work only when you answer as fast as possible and do not think before you react'. When participants failed to respond within 1000 ms, they received feedback to respond faster. Reflective state was induced by informing participants that

the test 'worked' only when their answers were given after deliberation. When they reacted within 2000 ms, they received feedback to think more extensively. Subsequently, we calibrated the eye-tracker and started the eye-track portion of this experiment. The time between the manipulation and the eye-tracking was kept as short as possible (approximately 3 minutes, the time it took to calibrate and start the experiment).

Eye-Tracking. Participants viewed eight photographs, four of men and four of women, all in their underwear (the targets). For the eye-tracking trials, each photograph was presented individually in the middle of the computer screen (24-inch monitor, resolution of 1920 x 1200 pixels, repeat rate 60 Hz). The photographs were approximately 10 x 13 cm (9.53° x 12.37°).

We divided the photographs into two regions of main interest for subsequent analysis of the eye-tracking results. The regions were defined as (1) sexual information, including the breasts (chest for male targets), from the top of the clavicle to the posterior border of each breast, and the genital area, from the top of the underwear to the bottom of the underwear; and (2) contextual information, referring to the background of the photograph. The background was the room the target stood in, thus excluding fixations on the body that are not the sexual information. For each of these regions, dwell time and mean fixation count were used in the analyses for the first second of exposure.

Results

Dwell Times. A GLM with gender of the targets as within-subject variable, cognitive state and gender of participants as between-subject variables and dwell times (total time spent looking at the areas of interest) on each of the two regions as dependent variables revealed a significant main effect of region, $F(1, 26) = 5.60$, $p = .03$, $\eta_p^2 = .18$, which was qualified by a significant interaction between cognitive states and region, $F(1, 26) = 6.33$, $p = .02$, $\eta_p^2 = .20$. Simple comparisons revealed that participants in an impulsive

state dwelled on sexual information longer than on contextual information (see Figure 3.3), $F(1, 26) = 11.91$, $p < .05$, $\eta_p^2 = .31$. This difference between regions was not significant for people in a reflective state, $F(1, 26) = .01$, *ns*, who dwelled equally long on sexual and contextual information.

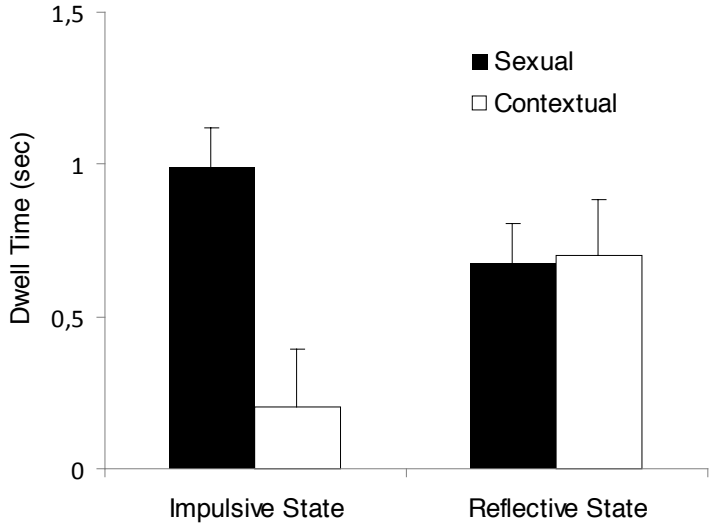

Figure 3.3. Total length of time people in impulsive and reflective states spent paying attention to the sexual and contextual regions of photographs. Error bars depict standard errors of the means.

The interaction between gender of the targets and region on dwell time was also significant, $F(1, 26) = 8.40$, $p < .05$, $\eta_p^2 = .24$. Simple comparisons showed that participants dwelled longer on the sexual region of female targets ($M = 1.10$, $SE = .13$) than on that of male targets ($M = 0.57$, $SE = .09$), $F(1, 26) = 15.94$, $p < .05$, $\eta_p^2 = .38$. There was no difference in dwell time between the contextual regions of photographs of female ($M = 0.36$, $SE = .12$) and male targets ($M = 0.55$, $SE = .20$), $F(1, 26) = 0.92$, *ns*.

Fixation Count. A GLM was conducted with gender of the targets as within-subject variable, cognitive states and gender of participant as between-subject variables and fixation counts for each of the two regions as dependent variables. This revealed a significant main effect of region, $F(1, 26) = 25.15$, $p < .01$, $\eta_p^2 = .49$, which was qualified by a significant interaction between cognitive states and region, $F(1, 26) = 6.46$, $p = .02$, $\eta_p^2 = .20$. Simple comparisons showed that participants in an impulsive state fixated on the sexual region more often than on contextual information (see Figure 3.4), $F(1, 26) = 30.50$, $p < .01$, $\eta_p^2 = .54$. This difference between regions was not significant for people in reflective states, $F(1, 26) = 2.87$, *ns*.

We also found a main effect of gender of the targets, $F(1, 26) = 10.66$, $p < .01$, $\eta_p^2 = .29$, which was qualified by an interaction between gender of the targets and region, $F(1, 26) = 4.32$, $p = .05$, $\eta_p^2 = .14$. Simple comparisons showed that participants fixated more often on the sexual region of female targets ($M = 3.48$, $SE = .36$) than on the sexual region of male targets ($M = 2.13$, $SE = .28$), $F(1, 26) = 9.33$, $p = .01$, $\eta_p^2 = .26$. There was no difference between the number of fixations in the contextual region of photographs of female ($M = 1.27$, $SE = .26$) and male targets ($M = 1.01$, $SE = .31$), $F(1, 26) = 1.07$, *ns*.

Discussion

The results of Experiment 3.2 confirm that people in impulsive and reflective states, as measured with EBR, have different attentional foci. More specifically, people in impulsive states focus more on sexual information, whereas people in reflective states divide their attention between sexual and contextual information. We found no difference in attention between male and female participants, all of whom focused more on the sexual area of female than male targets. Again, analyzing only the opposite-sex data yielded similar results.

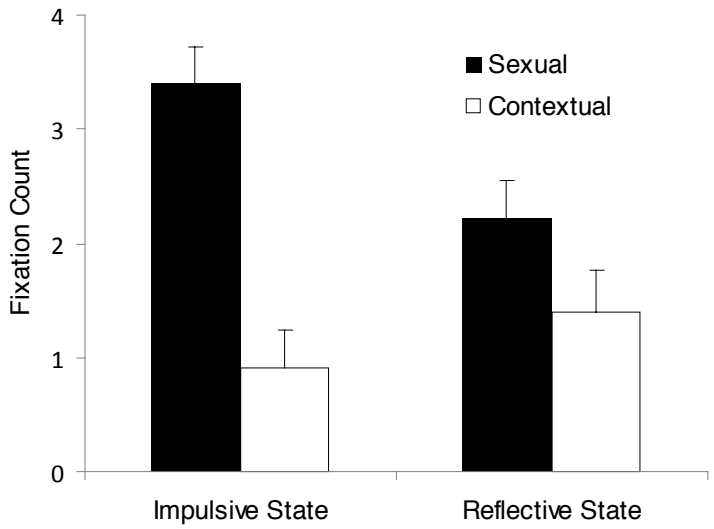

Figure 3.4. Total number of times people in impulsive and reflective states fixated on the sexual and contextual regions of photographs. Error bars depict standard errors of the means.

Although we established that being in a reflective rather than an impulsive state results in differences in the focus of attention, we did not yet examine whether this difference in attentional focus also results in any evaluative differences. It seems that if people have a different attentional focus this would also result in different outcomes. However, it is important to test this assumption and investigate whether this pattern could also result in the increased risk propensity of people in impulsive states.

Experiment 3.3

In Experiment 3.3 we investigated whether paying attention to different information influences sexual attractiveness judgments. In Experiments 3.1 and 3.2, people in impulsive states were found to pay less

attention to less salient, contextual information than to salient, sexual information. This suggests that the judgments of people in impulsive states should be less influenced by contextual information. People in reflective states, however, distribute their attention over more of the available information and are expected to integrate contextual information into their judgments.

Judgments about people's sexual attractiveness should be mainly derived from their attractiveness. As people in impulsive states focus their attention on the most salient aspects of a stimulus, on the person depicted in a photograph, we expect that people in an impulsive state will indeed derive their attractiveness ratings mainly from the attractiveness of the person. However, as people in a reflective state distribute their attention over more of the available information, we expect that their sexual attractiveness judgments will also be influenced by contextual information. Research on contextual influences on evaluative judgments has shown, for instance, that both mood and the weather influence judgments of life satisfaction (Schwarz, Strack, Kommer, & Wagner, 1987; Schwarz & Clore, 1983). Context can also activate certain norms and stereotypes. In line with this research we therefore expected that paying attention to context would influence judgments (Higgins, 1996). A bedroom, by association, activates the concept of sex, and depicting a person in a bedroom will therefore increase sexual attractiveness. In contrast, a library is typically not linked with sex and depicting a person in a library is therefore expected to decrease sexual attractiveness judgments. Of course a library could signal traits such as intelligence and thus possibly making a person in a library more attractive. However, we investigate sexual attractiveness not general attractiveness.

Contextual, backgrounds can affect evaluative judgments only when people are paying attention to it. Therefore, we expect that the context effect will be apparent only for people in a reflective state, who are expected to distribute their attention over the available information. People in an impulsive state are not expected to attend to the contextual, background

information and will hence base their judgments solely on the attractiveness of the target in the photographs.

Method

Participants. A total of 99 heterosexual undergraduate students (36 men, M_{age} = 21.42; *SD* = 3.40) participated in this experiment in exchange for course credits or 6 Euro. Participants were randomly assigned to one of two cognitive state conditions, impulsive or reflective.

Procedure. Cognitive states were manipulated with a slightly amended version of the method used in Experiment 3.2. Participants now completed an ostensible personality test instead of a functionality test, indicating whether certain words applied to them (yes-no). In all other respects, the instructions were the same as in Experiment 3.2.

Subsequently, participants were presented with eight photographs, with a different person (target) depicted on each, four male targets and four female targets, of whom two were attractive and two unattractive. A pilot study (*N* = 35, 10 men, M_{age} = 21.21, *SD* = 3.27) confirmed that the targets were perceived as attractive (*M* = 4.20, *SD* = 0.96, on a 7-point scale) or unattractive (*M* = 1.54, *SD* = 0.66). The background of the photographs was either a bedroom or a library. There were four different bedroom and library backgrounds. All stimulus materials were obtained from the internet. Participants judged how sexually attractive they found the targets in the photographs, giving their responses on a 7-point scale (1=not very sexually attractive, 7=very sexually attractive).

Results

Main analyses. A GLM was conducted with attractiveness of the targets, type of background, and gender of the targets as within-subject variables, cognitive state and gender of participants as between-subject variables and sexual attractiveness judgments as dependent measures. This analysis revealed a main effect for attractiveness of the target, $F(1, 95) = 175.36$, $p < .01$, $\eta_p^2 = .65$. Not surprisingly, attractive targets were rated as more sexually attractive than unattractive targets. There also was a main effect of type of background, $F(1, 95) = 17.75$, $p < .01$, $\eta_p^2 = .16$, which was qualified by the expected two-way interaction between cognitive state and type of background, $F(1, 95) = 4.45$, $p < .04$, $\eta_p^2 = .05$. As expected, simple comparisons revealed that participants in a reflective state were influenced by type of background, $F(1, 95) = 17.61$, $p < .01$, $\eta_p^2 = .16$ (see Figure 3.5). Participants' sexual attractiveness ratings increased when the target was depicted in a bedroom and decreased when the target was depicted in a library. Participants in impulsive states were not significantly influenced by type of background, $F(1, 95) = 2.56$, $p = .11$, $\eta_p^2 = .03$, although the pattern of the means is in the same direction. There also was a significant interaction between type of background and the attractiveness of the target, $F(1, 95) = 7.33$, $p = .01$, $\eta_p^2 = .16$. The influence of type of background on sexual attractiveness ratings was more pronounced for attractive targets.

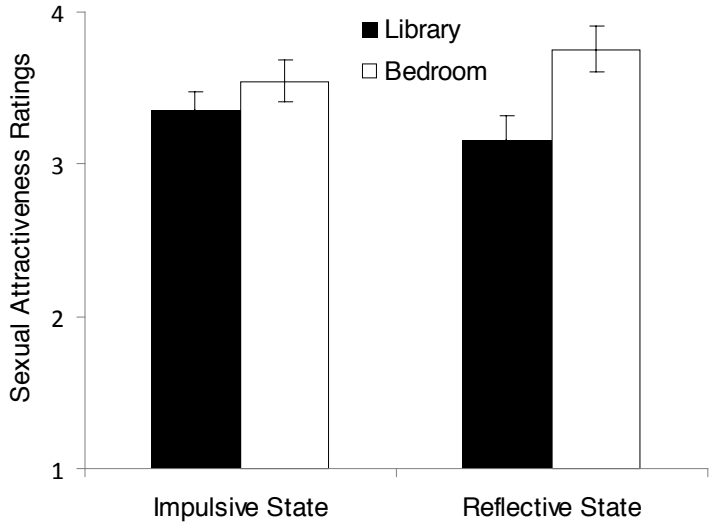

Figure 3.5. Sexual attractiveness ratings made by people in an impulsive and a reflective state as a function of the background of photographs. Error bars depict standard errors of the means.

Gender effects. We also found several main and interaction effects of gender of the targets and participants. These effects were qualified by a three-way interaction between gender of the targets, attractiveness of the targets and gender of the participants, $F(1, 95) = 20.28$, $p < .01$, $\eta_p^2 = .18$. Notably, photographs of attractive male targets were judged to be less sexually attractive than photographs of attractive female targets. This effect was explained mainly by the low sexual attractiveness ratings that male participants gave, especially in response to photographs of attractive male targets. There also was a significant interaction effect between gender of the participants and type of background, $F(1, 95) = 11.42$, $p < .01$, $\eta_p^2 = .11$. Female participants were significantly influenced by background, whereas male participants were not.

General Discussion

The results of three experiments provide substantial evidence to support our central prediction that cognitive states alter the focus of attention. In Experiment 3.1, we found that EBR is an excellent new way of measuring impulsive and reflective states unobtrusively. Using this novel technique, we were able to show that impulsive people, as indicated by high EBR, focused on the more salient of two photographs, whereas reflective people appeared to distribute their attention over both photographs and even looked longer at the less salient photograph. These results were in line with what we expected and with the results in Experiment 3.2.

In Experiment 3.2, we replicated this finding using a different, established method of manipulating cognitive states (Den Daas, Häfner, & de Wit, 2013). We found similar results as in Experiment 3.1, strengthening our confidence that we can measure impulsiveness with both our procedural priming manipulation and the EBR measure. Moreover, we showed that people in a reflective state divided their attention over both the sexual and the contextual information in the photographs, whereas people in impulsive states focused mainly on the sexual information and paid less attention to the contextual information.

Experiment 3.3 extends these findings and showed that differences in attentional focus affect sexual attractiveness ratings. When judging sexual attractiveness, people in a reflective state were influenced by the context in which a person was depicted, whereas people in an impulsive state were not. Although we did not measure visual attention in this study, the pattern of result is perfectly in line with Experiments 3.1 and 3.2, in that people in an impulsive state do not incorporate contextual information in their judgments. Notably, in this experiment people in impulsive states seem to make more pure judgments, as context does not provide information about sexual attractiveness. However, in most situations context is not irrelevant for decision making.

Taken together these findings convincingly illustrate that people in impulsive and reflective states differ not only in the ways they process information but also in their focus of attention, which influences their judgments. The present studies thus provide an important basis for further research of the behavioral consequences of attentional processes in real life, which could guide the development of prevention programs to reduce risk behavior, especially for people in impulsive states who need it most. Our results in particular shed light on the attention processes that potentially underlie differences in risk behavior in impulsive and reflective cognitive states.

Along the same line as our idea that people in impulsive states focus their attention on salient information, attentional myopia theory (Mann & Ward, 2004) proposes that people are disproportionately influenced by the most salient information when cognitive capacity is limited. Mann and Ward's (2004) research concerns eating behavior in chronic dieters. They manipulated the salience of information, either their diet was made more salient to them than the available food or the available food was made more salient to them than indicators of their diet. Salient information influenced behavior only when people's cognitive capacity was limited. We believe that, even though the cognitive capacity of people in an impulsive state is not necessarily limited, the attentional processes are comparable to those of people in states of attentional myopia. Limiting cognitive capacity can be one of the situational factors that induce functioning via the impulsive system, and thus an impulsive state.

Generally, impulsive people are known for their increased risk propensity; they are not very good at resisting temptations (Clift et al., 1993; Cooper et al., 2000; Den Daas et al., 2013; Donohew et al., 2000; Guerrieri et al., 2007; Hoyle et al., 2000; Dudley et al., 2004). We think this is because temptations are generally salient, because they are emotional, rewarding and relevant, as many temptations are linked to one of two social motives: survival and reproduction (Neuberg, Kenrick, Maner, & Schaller, 2004). The assumption that focused attention on temptations would lead to risky

behavior is in line with research showing for instance that increasing the attentional bias towards alcohol cues increased alcohol craving and intake (Field et al., 2007; Field & Eastwood, 2005). Inhibiting stimuli have a lower immediate incentive value; therefore, they will not be most salient in the majority of situations.

Temptations often conflict with long-term goals (Fishbach & Shah, 2006), which signals that more reflection is needed before deciding. When reflecting on the consequences of giving in to a temptation, the possible conflict with long-term goals will increase the likelihood that people in a reflective state will pay attention to other available information as well, because a good decision must be made. In our studies we investigated appetitive stimuli, that can be tempting, but they cannot be classified as temptation in the classical sense, because there was no conflict with an opposing goal in our experiments. Future research could investigate attention to temptations and also include a measure of risk decisions in combination with cognitive states.

It is important to consider potential limitations of the study. In Experiment 3.3, we associated attentional focus with differences in attractiveness ratings, but we did not measure real-life risk behavior. Not only would it be difficult to obtain reliable measures of real-life sexual risk-taking, it would also be unethical to then manipulate cognitive states, as this could lead to riskier behavior. Pertaining gender differences, in both Experiment 3.1 and Experiment 3.2, there was a gender imbalance in respondents, and it remains unclear whether the lack of effects of gender of the participants was due to the limited number of male participants (and thus a lack of statistical power) or the actual absence of a gender effect. Alternatively, anecdotal data from Experiment 3.2 suggest that some of the female participants liked the underwear of the female targets. Therefore, the lack of a gender difference might be explained by the increased attention female participants paid to the underwear of the female targets.

To investigate gender differences more explicitly, we recruited more men in Experiment 3.3. We did find some gender differences, but these were

all explained by the fact that the men did not consider other men to be attractive, combined with an increased attentional focus of women on the background of the photographs. Both of these findings are in line with previous research (Lykins et al., 2006). The objective of our study was not, however, to assess differences in the attentional patterns of men and women but rather to investigate the attentional patterns of people in reflective and impulsive states. In contrast to the gender effects, the results for cognitive states and attention are clear and unequivocal. Future research could further investigate gender differences in attention, in particular to sexual stimuli, also taking cognitive states into account.

Notably, we investigated not only attention to people of the opposite-sex, but also attention to people of the same-sex. Our results show that cognitive state generally affects attention to both types of targets in the same way. We believe that naked target of the opposite-sex are salient because they are rewarding, relevant, and emotional. People of the same-sex are also salient, but we think this is because they are emotional and relevant (as possible competitor), albeit not particularly rewarding.

In conclusion, this series of experiments extends previous research by showing that cognitive states not only influence the way in which information is processed but also alter the focus of attention. We used a new measure of cognitive states and validated it with an established means of manipulating cognitive states. The information that people in an impulsive state pay attention to is more limited than the information people in reflective states pay attention to. For people in impulsive states out of sight means out of mind.

Chapter 4

Sizing Opportunity:
Biases in Estimates of Goal-Relevant Objects Depend on Goal Congruence[6]

[6]Den Daas, C., Häfner, M., & de Wit, J. (2013). Sizing Opportunity: Biases in Estimates of Goal-Relevant Objects Depend on Goal Congruence. *Social Psychological and Personality Science, 4,* 361 - 367. doi:10.1177/1948550612456046.

Abstract

An abundance of research has investigated the effects of motivational states on size estimates, with initially a strong focus on the functionality of size overestimations. We suggest and found, however, that goal-relevant objects can be over- and underestimated, depending on which size is goal congruent. Specifically, we found that people with a throwing goal estimated (verbally and via visual matching) the size of a basketball as smaller than people without a throwing goal; hoop size estimates showed the reverse effect (Experiments 4.1 and 4.2). In Experiment 4.3, sex-primed men estimated a woman's breasts as larger than neutral-primed men; women showed the reverse effect. Finally, Experiment 4.4 replicated this finding for people in impulsive but not reflective cognitive states, suggesting that biased size estimation is a spontaneous process that promotes readiness for goal pursuit. We conclude that bigger is not always better; people size the world as it best suits them.

Imagine a basketball match. You hold the basketball in your hands with a second left to score the deciding point. Wouldn't it be great if the basketball got smaller or the hoop larger to make it easier for you to score? Unfortunately, our minds cannot shrink or enlarge objects (yet), but our minds can fool us into perceiving objects more favorably with respect to the goals we pursue. Stated differently, our perceptions are responsive to top-down influences, such as motivations.

An abundance of research has investigated the effects of motivational states on size perception, with initially a strong focus on size overestimations (see, for example, Bruner & Goodman, 1947; Veltkamp, Aarts, & Custers, 2008). Such overestimation effects have been explained by positing that anything of value, regardless of valence, captures visual *attention* and is therefore perceived as larger than it really is (Bruner, 1957; Bruner & Postman, 1948). Extending this now classic idea, we, along with others, suggest that people perceive valued objects in ways congruent to their goals. That implies that objects are *not* always overestimated in size. Sometimes – like in the initial basketball example – objects fit better with our goals if they are perceived as smaller. In line with the assumption that anything of value is perceived in ways congruent with active goals, we report evidence from four studies showing that the size of one and the same object can be over- or underestimated, depending on which goal is active, and that one and the same goal can lead to size over- or underestimation, depending on the object's relation to the goal.

Motivated size estimation

In their classic study, Bruner and Goodman (1947) asked children to estimate the size of monetary coins and valueless discs. They found that coins were judged larger in size than the discs, and that this effect was larger for more valuable coins. Other studies on the association between value and size estimates yielded similar results (see for example Bruner & Postman, 1949). However, these early studies on biased size estimates did not go

unchallenged (Eiser & Stroebe, 1972; Tajfel, 1957, 1959). Firstly, it is unclear whether it is really motivation that plays a role in the larger size estimates; this could only be indirectly inferred by assuming that people are more motivated to obtain more valuable coins. Secondly, in the studies of Bruner and Goodman (1947) people estimated a *series* of objects. Therefore, size estimates could have been biased by comparisons of the objects. Also, an increase in size of the objects was generally related to an increase in value of the objects, and value could have been used as a cue for size.

More recent studies have addressed most of these critiques and also show that size estimates are influenced by motivational states. For example, when people are motivated they estimate the size of objects instrumental to that goal as larger (e.g., a glass of water when people are thirsty or a shovel when a gardening goal has been activated, Veltkamp et al., 2008). When people are motivated to perform, as in sports, the size of instrumental objects is also estimated as larger (e.g., baseballs and golf holes; Witt, Linkenauger, Bakdash, & Proffitt, 2008; Witt & Proffitt, 2005). Furthermore, people estimate hill slants as steeper when they lack energy or the capability to climb the hills (Bhalla & Proffitt, 1999; Creem & Proffitt, 1998; Proffitt, Creem, & Zosh, 2001; Proffitt, Stefanucci, Banton, & Epstein, 2003; Schnall, Zadra, & Proffitt, 2010). There is also evidence for size underestimation, showing, for instance, that people tend to estimate the distance to desirable objects as smaller compared to the distance to undesirable objects (Balcetis & Dunning, 2010). Further research shows that the possibility to reach an object with a tool decreases the perceived distance to the object (Witt, Proffitt, & Epstein, 2005).

Taken together, this research thus illustrates not only that motivational states influence size estimates, but also that biased size estimation is a flexible phenomenon in that size can be over- or underestimated. This suggests that people do not just accentuate goal-related objects, as is the classical assumption, but that people perceive valued objects in ways that are congruent with their active goals. However, to date this flexibility, or multidirectionality, of motivated size estimation has not

been shown in one and the same domain. The present research was therefore designed to further investigate this flexibility, by directly linking size biases with respect to a single object to different goals, or, vice versa, the size estimates of several objects in relation to a single goal.

The present research

In the current manuscript we report four experiments that tested the hypothesis that the size of goal-relevant objects is estimated in goal-congruent ways. In Experiments 4.1 and 4.2, we aim to show that goals can affect size estimates of objects in either direction. Specifically, we hypothesize that certain goals will lead to larger size estimates, whereas others will lead to smaller estimates. Therefore, we varied the goals people had when they estimated the size of objects, namely to throw a basketball through a hoop or to pose for a photograph holding a basketball. We suggest that when people have a throwing goal, the size of the basketball is estimated in relation to the hoop, as people do not only want to throw the ball, but they want to throw the ball *through* the hoop. This suggests that estimating the basketball as smaller fits this goal better than perceiving it as bigger. In a same vein, people will estimate the hoop as bigger, as the basketball needs to go through it.

Experiments 4.3 and 4.4 aimed to extend these findings in two important ways. Firstly, we wanted to show that the direction of the bias in size estimates of objects is not a characteristic of the objects per se, but a function of the goals that are active. In Experiment 4.3 we investigated motivated size estimates by varying the meaning of the object in relation to the activated goal. We expect to show that, depending on the goal people hold and the meaning the object has in relation to that goal, the size of the same object will be estimated as larger or smaller.

Secondly, we aimed to gain more insight into the processes underlying biased size perception. More specifically, we aimed to investigate to what degree reflective cognition about size is required for biased

estimates: Do biased size estimates literally reflect wishful *thinking,* or do they rather mirror spontaneous, impulsive adjustments in the service of action preparation? To address this question, we conceptually replicated Experiment 4.3, but added a manipulation of impulsive and reflective cognitive states. This manipulation induces people to think about what they are doing (reflective state) or induces a state of acting without thinking (impulsive state; see also Strack & Deutsch, 2004). We posit that the biased size estimates of people in reflective states imply that they intend to picture the world in the most positive goal-fitting way. Through this process they possibly cognitively boost their motivation to accomplish their goals. However, when people in impulsive states show the bias in size estimation, this would add to the notion that the bias is a truly spontaneous phenomenon, ultimately in the service of goal accomplishment.

Experiment 4.1

Method

Participants and design. Seventy-two undergraduate students (16 men; M_{age}= 20.24, *SD* = 2.07) participated for course credit. Participants were randomly assigned to the conditions of our 2 (Object: basketball versus hoop)[7] x 2 (Goal: throwing goal versus no-throwing goal) between-subjects design.

Procedure and materials. Goal activation was manipulated through written instructions. Half of the participants read that they were ready to throw a basketball through a hoop. The other half read that they were ready to have their photograph taken with a basketball. Subsequently, participants

[7] Of course, the basketball and the hoop are related in size, the hoop is necessarily bigger than the basketball, and to exclude comparison processes (Tajfel, 1957, 1959) people were asked to either estimate the basketball or the hoop.

typed in their numerical estimate of the size (in cm) of a basketball or hoop (a reference-line of 1 centimeter was provided).

Results and Discussion

A 2 (Object: basketball versus hoop) x 2 (Goal: throwing goal versus no-throwing goal) ANOVA was conducted with object and goal as between-subject factors and size estimates as dependent variable. Because basketball and hoop size are not comparable (the hoop is by definition larger), size estimates were z-transformed before analysis. For ease of interpretation, we report the unstandardized estimates.

The predicted interaction between object and goal reached significance, $F(1, 68) = 7.73$, $p < .01$, $\eta_p^2 = .12$. Simple comparisons revealed that, when participants estimated basketball size, participants with a throwing goal estimated the basketball ($M = 27.64$, $SD = 1.59$) as smaller than participants without a throwing goal ($M = 31.39$, $SD = 1.55$), $F(1, 68) = 4.91$, $p < .05$, $\eta_p^2 = .07$. When participants estimated hoop size, participants with a throwing goal estimated the hoop ($M = 42.50$, $SD = 1.86$) as larger than participants without a throwing goal ($M = 33.18$, $SD = 2.24$), $F(1, 68) = 4.84$, $p < .05$, $\eta_p^2 = .07$. None of the other effects reached statistical significance.

Interestingly, even though we compared the estimates between groups that differed in the goal they held and not with objective measures of basketball and hoop size, our data seem to suggest that people in the throwing-goal condition provided more accurate estimates than people in the control condition (the NBA norm for the diameter of a basketball is approximately 25 centimeters and for a hoop this is approximately 45 centimeters). However, given that neither a ball nor a hoop were physically present and basketball is not a really popular sport in the Netherlands, we tend to interpret this finding as a coincidence.

More importantly, however, a viable alternative interpretation of our results could be that asking for *numerical* estimates might have triggered the

effects rather than that they reflect a real motivational/perceptual bias. To address this alternative explanation, we designed a conceptual replication of the Experiment 4.1, using a visual, non-verbal measure of basketball and hoop size (see also, Proffitt et al., 2006).

Experiment 4.2

Method

Participants and design. Eighty-four undergraduate university (30 men; M_{age} = 21.31, SD = 2.61) participated for course credit. Participants were randomly assigned to the conditions of our 2 (Object: basketball versus hoop) x 2 (Goal: throwing goal versus no-throwing goal) between-subjects design.

Procedure and materials. The procedure was kept similar to Study 1, except that instead of asking for a numerical size estimate we collected visual (graphic) size estimates. Specifically, using a standard data projector (4:3; 178 x 138.5 centimeters), we presented participants with a projected image of a basketball or a hoop and instructed them to adjust the size of the image using the wheel of a mouse attached to the computer steering the projection; the size of the projected image could vary between approximately 1 and 120 cm). Participants were instructed to adjust image size until they thought it fit the actual size of a basketball or a hoop, respectively. The experimenter recorded the diameter of the projected image at the end of the session.

Results and Discussion

A 2 (Object: basketball versus hoop) x 2 (Goal: throwing goal versus no-throwing goal) ANOVA was conducted with object and goal as between-subject factors and size estimates as dependent variable. Again, we analyzed the standardized estimates and report the unstandardized estimates. As predicted, this analysis revealed a significant interaction between object and

goal, $F(1, 80) = 7.11$, $p<.05$, $\eta_p^2 = .08$. Simple comparisons revealed that, when participants estimated basketball size, participants with a throwing goal estimated the size of the basketball ($M = 30.78$, $SD = 2.35$) as smaller than participants without a throwing goal ($M = 36.02$, $SD = 2.35$), $F(1, 80) = 4.32$, $p < .05$, $\eta_p^2 = .05$. When estimating hoop size, participants with a throwing goal tended to estimate the size of the hoop ($M = 58.97$, $SD = 3.03$) as larger than participants without a throwing goal ($M = 49.93$, $SD = 2.69$), $F(1, 80) = 3.05$, $p < .09$, $\eta_p^2 = .04$. No other effects reached statistical significance.

Looking at absolute size estimates, these results again seem to suggest that people with a throwing goal provide more accurate size estimates than people without throwing goal. Closer inspection of the means reveals, however, that this only holds for the estimated size of the basketball. For the hoop, people without throwing goal are more accurate in their size estimates. In combination with the finding that, again, the difference between the two size estimates is much larger in the throwing goal condition than in the control condition, we are confident that the pattern of results reflects motivated, goal-congruent estimation rather than a difference in judgment accuracy.

Although results of the Experiments 4.1 and 4.2 are fully in line with our expectations that having a goal leads to over- or underestimation of the size of objects as a function of goal congruence, we have not yet demonstrated that the size of one and the same object (i.e. a means to a goal) can be over or underestimated as a function of the active goal; Experiment 4.3 addresses this issue.

Experiment 4.3

Experiments 4.1 and 4.2 show that the size of objects can be estimated as larger or smaller, depending on what is congruent to the goal at stake. In Experiment 4.3 we aim to extend these findings by showing that the size of one and the same object can be estimated as larger or smaller,

depending on what goal is active. To test this hypothesis we presented participants with a photograph of either a heterosexual couple in their underwear (i.e. a sex prime, for men and women) or a flower (i.e. a neutral prime). Subsequently, in an ostensibly unrelated experiment, participants estimated the height and breast size of a woman shown in another photograph.

We propose that following activation of a sex goal by a sex prime, women become goal relevant for both heterosexual men and women. For men primed with a sex goal a woman is a possible sexual partner, while for sex-primed women another woman is a possible rival (Maner, Gailliot, Rouby, & Miller, 2007). Furthermore, it has previously been shown that both men and women interpret large breast as signs of sexual attractiveness (Furnham, Dias, & McClelland, 1998). Therefore, and reflecting gender differences between heterosexual men and women in the goal congruence of the size of a(nother) woman's breast and the primed sex goal, we expect that men who are primed with a sex goal will estimate the women's breast size as larger, compared to the neutral prime condition, while women who are primed with a sex goal will estimate breast size as smaller compared to the neutral prime condition.

Estimating breast size as larger when a sex goal is active, corresponds to the 'bigger is better' heuristic (Silvera, Josephs, & Giesler, 2002). Height however does not have a similar relationship with sexual attractiveness; taller women are not seen as more sexually attractive. Possibly because social conventions suggest that men need to be at least as tall as or, preferably, taller than their female partners, men typically prefer women who are shorter than themselves (Hensley, 1994). Additionally, biological research has shown that taller women become fertile later in life. As men orientate towards cues of fertility, and because a woman being taller is not a cue of increased fertility (Nettle, 2002), men do not base their judgments of sexual attractiveness on a woman's height. If motivated size estimation occurs only to accentuate objects, then there should be an effect of priming sex on height estimates. We expect, however that height

estimates will not be affected by a sex prime, as the height of a woman is not critical to sexual attractiveness and hence is not relevant for the primed goal.

Method

Participants and design. One hundred twenty-seven undergraduate university students (52 male, M_{age}= 21.6, *SD* = 4.10) participated; they received €6,- in compensation. Participants were randomly assigned to one of two goal conditions (sex versus neutral).

Procedure and materials. A sex goal was activated in half of the participants by showing a picture of a kissing heterosexual couple in their underwear. The other half of the participants were primed with a neutral stimulus (a flower). Participants were instructed that this picture was part of a design for a new advertising campaign for a water brand. Six bogus questions were asked to support this cover story. Subsequently, in an ostensibly unrelated experiment, participants were shown a picture of a woman and were asked to estimate her height (in centimeters) and her breast size, (on a 9 point scale, cup AA to G). None of the participants reported suspicions about the manipulation in a verbal debriefing at the end of the experiment.

Results and Discussion

A 2 (Goal: sex versus neutral) x 2 (Gender: male versus female) mixed design ANOVA was conducted with height and cup size estimates of a woman shown in a different picture as dependent measures. Because height and breast size were not measured on identical scales, we analyzed the standardized variables. For ease of interpretation, we report the unstandardized estimates. The ANOVA revealed a significant three-way interaction between goal, gender and the two size estimates, $F(1,123) = 7.98$, $p < .05$, $\eta_p^2 = .06$. To investigate this interaction further, we assessed the interactions between goal and gender separately for height and cup size.

The interaction between goal and gender was not significant for the height estimate, $F < 1$. However, there was a significant interaction between goal and gender on the estimates of cup size, $F(1,123) = 4.98$, $p = .03$, $\eta_p^2 = .04$. Simple comparisons showed that men primed with a sex goal estimated cup size as larger than men who were not primed with a sex goal, $F(1,123) = 4.46$, $p = .04$, $\eta_p^2 = .04$ (see Figure 4.1). Women primed with a sex goal estimated cup size as smaller (marginally significant) than women who were not primed with a sex goal, $F(1,123) = 2.77$, $p = .09$, $\eta_p^2 = .02$. No other effects reached statistical significance.

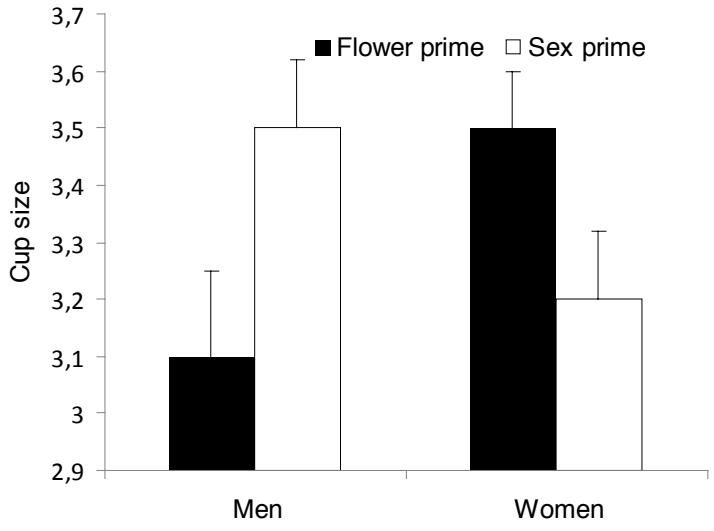

Figure 4.1. Estimated breast size as a function of gender and goal.

These findings offer further support for our hypothesis, and show that the size of goal-relevant objects is only estimated as larger when larger estimates are goal congruent; when it is goal congruent to estimate the size of an object as smaller, then people do so. Moreover, the direction of the bias in the estimated size of the same object can go either way, depending on the meaning of the object in relation to the goal that is activated. The absence of

biases in the height estimates confirms that accentuation is not the sole purpose of the biases in size estimates.

Experiment 4.4

The previous experiments corroborate the idea that people estimate objects in a way that is congruent with their goals. A question that remains is what the origin of this bias is. Do people construct their estimations through reflective cognition? Is it thus 'wishful thinking' what we were observing in our previous experiments? Or were we rather observing instances of spontaneous perceptual adaptation to active goals with little or no reflection involved? In order to clarify this question, we compare size estimations between conditions in which people are asked to think extensively and conditions in which people react impulsively. Specifically, we conceptually replicated Experiment 4.3, and added a manipulation to induce impulsive or reflective cognitive states. With this manipulation we hope to gain more insight into the process underlying motivated size estimation.

Method

Participants. Ninety undergraduate university students (41 male, M_{age}=19.96, *SD* = 2.38) participated; they received €6,- in compensation. Participants were randomly assigned to the conditions of our 2 (Cognitive State: reflective versus impulsive) x 2 (Goal: sex versus neutral) between-subjects design.

Procedure and materials. First, we manipulated cognitive state with a procedure modeled after Lockwood and Kunda (1997). Participants read a bogus newspaper article describing the positive effects of acting after reflection or acting impulsively. Participants' task was to guess in which Dutch newspaper the article was published. Otherwise the procedure was similar to that of Experiment 4.3. We only assessed breast size estimates,

with a measure that was slightly adjusted; participants now rated breast size on a 9-point scale (1=small, 9=large).

Results and Discussion

We conducted a 2 (Cognitive State: reflective versus impulsive) x 2 (Goal: sex versus neutral) x 2 (Gender of partcipants: Male versus Female) ANOVA with breast size estimations as dependent variable. This analysis revealed two main effects, of cognitive state, $F(1, 82) = 16.62$, $p < .05$, $\eta_p^2 = .17$, and gender, $F(1, 82) = 4.74$, $p = .03$, $\eta_p^2 = .06$, and a two-way interaction between goal and gender, $F(1, 82) = 4.43$, $p = .04$, $\eta_p^2 = .05$. These effects were qualified by the expected significant three-way interaction between cognitive state, goal and gender, $F(1, 82) = 9.01$, $p<.05$, $\eta_p^2 = .10$. To investigate this interaction further, we assessed the interaction between goal and gender separately for people in reflective and impulsive states.

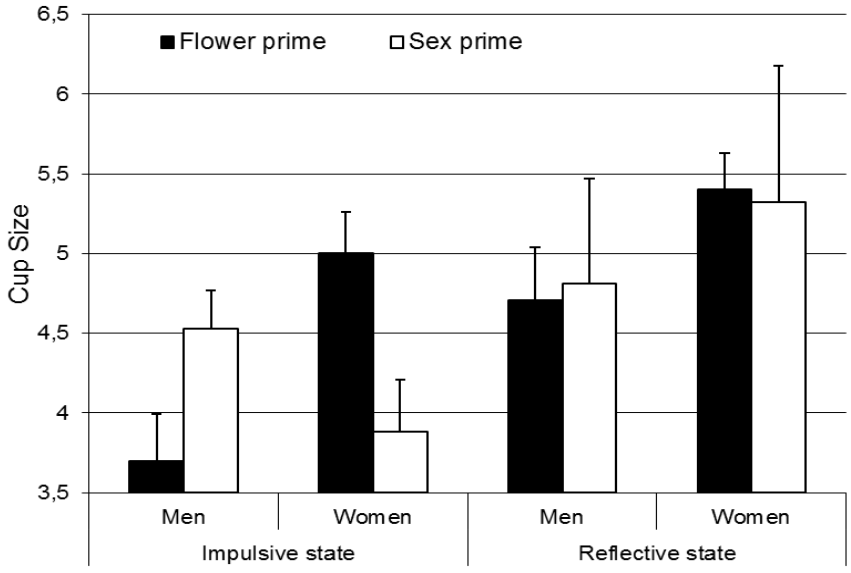

Figure 4.2. Estimated breast size as a function of gender and goal among participants in impulsive and reflective states.

For participants in an impulsive state (N = 46), the interaction between goal and gender on breast size estimates was significant, $F(1, 42) = 11.91$, $p < .05$, $\eta_p^2 = .22$. Simple comparisons showed that, in an impulsive state, men primed with a sex goal estimated breast size as larger than men who were not primed with a sex goal, $F(1,42) = 4.77$, $p = .04$, $\eta_p^2 = .10$ (see Figure 4.2). In an impulsive state, women primed with a sex goal estimated breast size as smaller than women who were not primed with a sex goal, $F(1, 42) = 7.17$, $p < .05$, $\eta_p^2 = .15$. The interaction between goal and gender was not significant for participants in a reflective state, $F < 1$. The only effect for participants in a reflective state (N = 44) was a marginally significant main effect of gender; women tended to estimated breast size as larger compared to men, $F(1,40) = 4.05$, $p < .06$, $\eta_p^2 = .09$.

General Discussion

In four experiments we investigated whether the size of goal-relevant objects is estimated in goal-congruent ways. In line with our expectations, Experiments 4.1 and 4.2 showed that people, who have a goal that is facilitated by a smaller goal-relevant object, estimate the size of that object as smaller than people who have a goal that is not facilitated by a smaller object. The opposite was found for goals that are facilitated by larger goal-relevant objects. Experiment 4.3 extended these findings by showing that the direction of the bias in size estimation is not a characteristic of the goal-related objects per se, but instead is affected by the meaning of the object in relation to the goal people pursue. In support of our hypothesis, the results of Experiment 4.3 show that size estimations depend on what size is goal congruent. This suggests that size estimations are adjusted in a way most favorable for goal pursuit.

Our findings extend previous research on biased size estimation by showing that the well-known larger size estimations are only part of the story. Certainly, when people's goals are to find or approach an object, estimating its size as larger is goal congruent. However, our research shows

that, depending on the goal that is active, size estimations can also be biased in the direction of smaller estimates. Moreover, looking at size estimations as reflecting the extent to which objects are congruent or incongruent with people's motivation allows us to integrate research on the effects of people's goals on size, distance, and hill-slant estimations. Together studies in these domains suggest that people 'see what they want to see'; they construct their world in a way that is congruent with their goals (Balcetis & Dunning, 2006).

Experiment 4.4 further suggests that biases in size estimation occur spontaneously and with little reflection in impulsive cognitive states. When asked to make a deliberate estimate, biases in size estimation disappear. This suggests that typically biased size estimates reflect impulsive decision-making, with minimal deliberation. We hence conclude that goals spontaneously promote goal-related action. We show that biased size estimation is not necessarily a result of wishful *thinking*, but spontaneously arises. We perceive the world in goal-congruent ways, which spontaneously prepares us for action.

We note that the current findings cannot ultimately answer the question of whether biased size estimation is a perceptual or a post-perceptual process. Our findings of Experiment 4.4 seem to be more easily reconcilable with a perceptual process than a post-perceptual (and therefore most likely reflective) process. However, further research will have to go into greater detail.

Another important question that remains is whether it is really beneficial for goal attainment to estimate objects in biased ways, even if the biases are goal congruent. It is conceivable that, for example, when people estimate the size of a basketball as smaller compared to its actual physical size this could lead them to aim less precisely and miss the hoop. Another possibility is, however, that performance is not negatively influenced by biased size estimation, because physical reactions to the environment are not influenced by biases in size (Bhalla & Profitt, 1999). For example, the angle of people's feet relative to the hill is not influenced by their biased

estimation of the slant of that hill; aiming might not be influenced by ball and hoop size either. Alternatively, it is also possible that biases in estimates give people the confidence necessary to instigate behavior and to perform well. So far, research has only shown that better performance is correlated with biased estimates (Witt & Profitt, 2005)[8]. Future research should further investigate the relation between biases in size and performance. Specifically, the influence of biased size estimation on performance could be investigated, keeping the two ways in which performance could be influenced (confidence or aiming) in mind.

In summary, our four experimental studies show that size estimations depend on the active goal, the meaning of the object in relation to the active goal. Our perceptual system is flexibly responsive to top-down processes, such as motivations. When a larger size is goal congruent we estimate an object as larger, but when smaller is goal congruent we estimate an object as smaller. Hence, accentuation of goal-relevant objects is only part of the story. Bigger is not always better; people size opportunities as it best suits them.

[8] Performance is usually measured first before perception (for a review see Witt, 2011). So performance influences perception. Witt (2011), however, leaves open the theoretical possibility that perception also influences performance. We believe that perception could influence performance, but this needs to be investigated empirically. We discuss the possible effect of biased estimates on performance assuming there is a relation between perception and performance.

Chapter 5

In the Heat of the Moment:

High Temperatures Promote Impulsiveness[9][10]

[9] Den Daas, C., Häfner, M., & de Wit, J. (submitted). In the Heat of the Moment: High Temperatures Promote Impulsiveness

[10] We would like to thank Tom Sman for his contribution in collecting the data.

Abstract

'In the heat of the moment', 'having warm feelings for someone', and 'keeping a cool head' are common sayings that – though partly contradictory – suggest a direct effect of temperature on behavior. The aim of the presented studies is to reconcile these metaphors by showing that higher temperatures, compared to lower temperatures, generally result in more impulsiveness. In two studies we tested the effect of temperature on sexual risk decisions and found support for the predicted relation. We manipulated temperature by giving participants a hot or cold drink (Experiment 5.1) or by manipulating room temperature (Experiment 5.2). Higher temperatures, compared to lower temperatures, resulted in more impulsive sexual decisions, when confronted with a temptation. It thus seems that higher temperatures tip the decision-making scale towards temptations. People make more impulsive decisions 'in the heat of the moment' and 'cooling down' could literally help in the defense against temptations.

Our language is replete with metaphors that reflect a relation between temperature and behavior. People give in to temptation 'in the heat of the moment', or are 'hotheaded', and when people react too impulsively we ask them to 'cool down', 'to take a cold shower' or 'to chill', but we also give people the 'cold-shoulder', or have 'warm feelings' for someone. Despite that such associations between concrete experiences and abstract psychological concepts (Asch, 1958) are strongly rooted in our language (e.g., Foroni & Semin, 2009), the effect of temperature on behavior seems to be paradoxical. On the one hand, research suggests that higher temperatures are associated with positive effects on affiliation and liking (IJzerman & Semin, 2009, 2010; IJzerman et al., 2012; Williams & Bargh, 2008; Zhong & Leonardelli, 2008). On the other hand, higher temperatures are associated with more impulsive behavior and aggression (Anderson, 1989; Anderson, Anderson, Dorr, DeNeve, & Flanagan, 2000; Cohn & Rotton, 1997; Larrick, Timmerman, Carton, & Abrevaya, 2011; Rotton & Cohn, 2004). We aimed to reconcile these seemingly contradictory findings by proposing a possible underlying mechanism. Specifically, we posit that temperature affects decisions and behaviors because it affects impulsiveness.

Temperature, Temptation, and Risk Decisions

Most prominently, Metcalfe and Mischel (1999) directly incorporated the temperature metaphor in their dual-system theory to explain delay of gratification. The two systems are aptly named the 'hot' and 'cool' system. The cool, cognitive 'know' system and the hot, emotional 'go' system are thought to interact to enable or undermine individuals' attempts at resisting a small immediate reward over a bigger reward after some time. In line with our expectations, Metcalfe and Mischel (1999) argue that engaging the hot system makes delaying gratification more difficult. In other words, their 'hot' system is related to impulsiveness. Although hot and cold in this context do not refer to temperature literally, intuitively we think they could.

Whereas the direct relation between temperature and impulsiveness has not been investigated previously, there is substantial evidence that changes in temperature affect aggression (Anderson, 1989). Higher temperatures are associated with greater aggression in both controlled experiments (Anderson et al., 2000) and field-studies (Anderson, 1989; Cohn & Rotton, 1997; Rotton & Cohn, 2004). Moreover, research has shown that higher temperatures possibly decrease inhibition, causing baseball players to retaliate more, but only after provocations when there is an impulse to aggress (Larrick et al., 2011). Notably, decreased inhibition is one of the factors of impulsiveness (e.g., Dawe & Loxton, 2004).

Temperature has also been systematically linked to trust (Williams & Bargh, 2008), and the experience of physical warmth leads to the experience of interpersonal warmth (i.e., trust). Additionally, higher temperatures are associated with greater social proximity (IJzerman & Semin, 2009, 2010), and being socially excluded is related to the experience of lower temperatures (IJzerman et al., 2012; Zhong & Leonardelli, 2008).

What could possibly explain these diverse consequences of changes in temperature? A closer look suggests that there may be a unifying mechanism. In situation where people have to choose between two potential behavioral alternatives, people prefer the one which is immediately rewarding over the other which is more related to long-term concerns. As these two behavioral alternatives are conflicting, people can behave in line with one or the other behavioral alternative. Take sexual risk decisions, trust, and aggression for instance. These situations involve a possibility of experiencing negative consequences when people behave in line with the immediate rewarding alternative. When people decide to, for example, trust someone who is actually not trustworthy, this can have negative consequences (e.g., feelings get hurt or an investment is lost). Similarly, when people act aggressively, their target could decide to retaliate. Also, when people take a sexual risk this could result in a sexually transmitted infection. Choosing the behavioral option that is immediately gratifying is

something that impulsive people often do. We suggest that higher temperatures promote impulsiveness.

The aim of the present paper is to establish that temperature influences impulsive decisions. We expect that temperature affects behavior in situations in which people are confronted with conflicting behavioral options. We posit that in these situations, higher temperatures, as compared to lower temperatures, direct behavior towards the temptation. If there is no temptation, and thus no impulse, temperature should not influence behavior.

Present Research

We report two experiments examining the effect of temperature on sexual risk decisions. Different temperature conditions were created by providing participants with a warm or cold drink (Experiment 5.1; Williams & Bargh, 1998) or by differently heating research spaces (Experiment 5.2). We hypothesize that higher temperatures result in riskier sexual decisions as compared to lower temperatures, but only when the situation is sexually tempting. We assessed sexual risk decisions by presenting participants with a scenario and asking them to indicate how likely it was that they would have unprotected sex with a person of the opposite sex they saw in a photograph, in the situation described in the scenario. We assessed whether the situation was tempting by having participants rate the attractiveness of the person in the photograph (Experiment 5.1) or manipulated how tempting the person in the photograph was by presenting a photograph of either an attractive or unattractive person (Experiment 5.2). We expect that when the person in the photograph was attractive (measured or manipulated) temperature affects sexual risk decisions. When the person in the photograph is unattractive, temperature is not expected to affect sexual risk decisions.

Experiment 5.1

Method

Participants and design. Participants were approached in the university cafeteria. A total of 68 students (34 men; M_{age}= 20.55, *SD* = 3.20) participated. Participants were randomly assigned to the higher or lower temperature conditions. Participants received no other compensation than a hot or a cold drink.

Procedure and materials. Participants were asked whether they wanted to fill out a brief questionnaire in exchange for a drink, which we handed to them before they filled out the questionnaire. This drink was either warm or cold and was handed to the participants after they consented. Participants then rated a photograph of someone of the opposite gender (9 items; e.g., attractiveness; 1= very unattractive, 7= very attractive).

Participants subsequently read a scenario describing a sexual interaction appropriate for heterosexual participants (see also MacDonald, Zanna, & Fong, 1996; MacDonald et al., 2000; Ditto, Pizarro, Epstein, Jacobson, & MacDonald, 2006). In the scenario participants run into the person in the photograph and spend an evening talking. At the end of the evening they both want to have sex but unfortunately condoms are not available. In the scenario the female always takes birth control pills, to rule out the risk of pregnancy. Nevertheless, deciding to have sex without a condom would entail a risk of sexually transmitted infections. We then assessed the dependent variable, participants' sexual risk decision, with one item: 'If I were in this situation I would have sex with the person in the photograph' (1=unlikely, 7=likely).

Results and Discussion

We excluded five participants because they were homosexual, and the scenario did not fit their preference. The analyses were done over the remaining 63 participants. Temperature condition did not affect the

attractiveness ratings, $t(61) = .79$, $p = .43$ ($M_{cold} = 4.42$, $SD = 1.06$ and $M_{warm} = 4.20$, $SD = 1.19$).

Sexual risk decisions were analyzed using a 2 (Temperature) x 2 (Gender) General Linear Model (GLM), with attractiveness ratings as a continuous variable (see Aiken & West, 1991). This showed a main effect of gender, $F(1, 55) = 11.11$, $p < .05$, $\eta_p^2 = .17$. Men ($M = 3.62$, $SD = .32$) made significantly riskier sexual decisions than women ($M = 2.11$, $SD = .32$). As expected, the only other significant effect was the interaction between the attractiveness rating and temperature condition, $F(1, 55) = 5.23$, $p < .05$, $\eta_p^2 = .09$. When the person in the photograph was rated as attractive (1 SD above the mean) participants in the higher temperature condition ($M = 4.08$, $SD = .51$) made riskier decisions than participants in the lower temperature condition ($M = 2.50$, $SD = .51$), $F(1, 55) = 5.48$, $p < .05$, $\eta_p^2 = .09$. Temperature had no effect when the person in the photograph was rated as unattractive (1 SD below the mean), $F(1, 55) = 0.94$, $p = .34$, $\eta_p^2 = .02$ ($M_{cold} = 2.80$, $SD = .47$ and $M_{warm} = 2.17$, $SD = .45$). No other effects reached statistical significance.

Even though we did not find an effect of the temperature manipulation on the attractiveness ratings of the person in the photograph (or any of the other ratings), it could be argued that people in the high temperature condition did view the person on the photograph differently. Previous research has found that high temperatures affect attractiveness negatively (Griffitt, 1970; Griffitt & Veitch, 1971). In contrast to our results, this should lead to less risky decisions in the higher temperature condition. In contrast, and in line with our findings, other research has shown that higher temperatures result in more positive judgments of people (Williams & Bargh, 1998). To rule out effects of attractiveness as an alternative explanation of our results, in Experiment 5.2 we manipulated attractiveness of the person in the photograph. We, again, hypothesize that participants in the higher temperature condition make riskier sexual decisions than people in the lower temperature condition, but only when they are presented with a photograph of an attractive and thus sexually tempting person.

Also, giving participants a drink before the experiment could have created a social interaction with the experimenter that may have influenced sexual risk decisions. We consider this unlikely, because all participants were in the same situation, but to rule out any influence of the interaction with the experimenter we manipulated room temperature in Experiment 5.2.

Experiment 5.2

Method

Participants and design. A total of 58 students (29 men; M_{age}= 21.62, *SD* = 3.18) participated. Participants were randomly assigned to one of the four conditions in a 2 (Temperature: high versus low) x 2 (Attractiveness: attractive versus unattractive) between-subjects design. Participants were compensated with 2 Euros or course credits.

Procedure and materials. The study was conducted in a lab space. Participants rated a photograph of someone of the opposite gender as in Experiment 5.1, were presented with the same scenario and filled out the same dependent measure. However, this time we manipulated whether the photograph participants saw was of someone attractive or unattractive (this was established in a pilot study).

Furthermore, we manipulated temperature by adjusting the temperature in the space where participants did the experiment. All participants removed their jacket, as is standard lab protocol. Then, also as usual, they were escorted to the research space, which either had a higher temperature (we aimed for 27°C; *M* = 27.73 °C, *SD* = 1.32) or a lower temperature (we aimed for 18°C; *M* = 18.50 °C, *SD* = 0.81), $t(60) = 33.31$, $p < .01$.

Research suggests that the relation between temperature and arousal is linear; as temperature increases subjective arousal decreases. Other research suggests that the relation between temperature and arousal is represented as an inverted U-shape, which means that both higher and lower temperatures result in less arousal (for an overview see, Anderson,

Anderson, & Deuser, 1996; Anderson et al., 2000). As research has shown that the manipulation of room temperature affects perceived arousal, we have measured arousal to be able to control for this effect.

Results and discussion

We excluded 3 participants, one because he was much older than the rest of the participants, and two participants because their Cook's distance deviated more than three standard deviations. The analyses were done over the remaining 55 participants. Temperature condition, as in Experiment 5.1, did not affect the attractiveness ratings, $F(1, 51) = 0.36$, $p = .55$, $\eta_p^2 = .01$, and also did not interact with attractiveness condition on the attractiveness ratings, $F(1, 51) = 0.71$, $p = .41$, $\eta_p^2 = .01$.

Sexual risk decisions were analyzed using a 2 (Temperature) x 2 (Attractiveness) x 2 (Gender) GLM analysis, with arousal as covariate[11]. This, as in Experiment 5.1, revealed a main effect of gender, $F(1, 46) = 4.04$, $p = .05$, $\eta_p^2 = .08$; men ($M = 3.07$, $SD = .24$) made significantly riskier sexual decisions than women ($M = 2.36$, $SD = .23$). As expected, the only other significant effect was the interaction between the attractiveness and temperature conditions, $F(1, 46) = 5.33$, $p = .02$, $\eta_p^2 = .10$. When the person in the photograph was attractive, participants in the higher temperature condition ($M = 3.34$, $SD = .31$) made riskier decisions than participants in the lower temperature condition ($M = 2.29$, $SD = .34$), $F(1, 46) = 5.66$, $p =$

[11] When we conduct a GLM without arousal as covariate, there are no statistically significant effects of temperature (all Fs < 1). Arousal is important as covariate because higher temperatures affect arousal. The main effect of gender remains, $F(1, 47) = 22.26$, $p < .01$, $\eta_p^2 = .32$. Additionally, there is a significant main effect of attractiveness, $F(1, 47) = 12.10$, $p < .01$, $\eta_p^2 = .21$, participants made riskier sexual decision when the person on the photograph was attractive. When we control for arousal in Experiment 5.1 the results of temperature remain significant.

.02, η_p^2 = .11. Temperature had no effect when the person in the photograph was unattractive, $F(1, 46) = 0.80$, $p = .38$, $\eta_p^2 = .02$ ($M_{cold} = 2.80$, $SD = .30$ and $M_{warm} = 2.42$, $SD = .33$). No other effects reached statistical significance.

As expected, manipulating temperature differently from Experiment 5.1 again result in more impulsive decisions. However, when manipulating room temperature it is important to consider people's arousal levels. We discuss this further in the General Discussion.

General Discussion

In line with our expectations, we have shown that temperature affects risk decisions. Specifically, in two experiments we showed that higher temperatures, as compared to lower temperatures, result in riskier sexual decisions, but only when the situation is (perceived as) tempting. When the situation is not tempting, temperature does not affect sexual risk decisions. This suggests that higher temperatures, regardless of how these were induced, indeed result in more impulsiveness. Our results extend previous research on the effect of temperature on behavior by suggesting an underlying mechanism. To our knowledge, the present studies are the first to attempt to reconcile the different literatures on the effect of temperature on behavior. The finding that men make riskier decisions than women, independent of the other conditions, is in line with previous research on sexual decision making (e.g., Byrnes, Miller & Schafer, 1999; den Daas, Häfner, de Wit, 2013a).

An alternative explanation of our findings could be that we tapped into the effect of temperature on another form of trust, social proximity, or social inclusion. In other words, higher temperatures result in enhanced social relations. However, this reasoning would have led to the expectation that people make riskier sexual decision under higher temperatures, independent of attractiveness. Currently, we are extending our research on the association between temperature and impulsiveness, and also find an

effect of temperature on impulsiveness in the domain of eating behavior, which cannot be explained by enhanced social relations (den Daas, Häfner, de Wit, 2013b).

A question that remains unanswered is what the underlying processes are, why does temperature influence impulsiveness? Explanations offered in the literature on aggression provide some suggestions in this regard. Theories considered three possible mechanisms: arousal, cognition, and affect (Anderson & Bushman, 2002). Regarding physical arousal, high temperatures have been shown to increase heart rate and galvanic skin response (e.g., Hardy, 1961). Hence, higher temperatures could energize behavior towards any stimulus. In line with the arousal explanation, we observed that subjective arousal affected our findings when we manipulated temperature by adjusting the room temperature. In the manipulation using the hot and cold drinks, as one might expect, arousal did not seem to be of influence. This manipulation is quite subtle and local, and therefore arousal should and was not affected. It thus seems that arousal plays are role in the effect of temperature on behavior, but it cannot explain our results.

A second explanation for the relation between temperature and impulsiveness could be that high temperatures cause people to cognitively interpret the meaning of the experienced temperature depending on the cues that are present in their situation (e.g., 'I am angry' or 'I am sexually aroused'). This interpretation in turn results in behavior consistent with the interpretation. When there is a cue, which causes people to interpret the situation in a certain way, this results in the behavior that is in line with the cue. However, we think this explanation is unlikely because then temperature would influence behavior in more diverse ways; people could behave in line with any cue that is available. Why do high temperatures lead to the interpretation of anger is some situation, and sexual arousal in other situations?

Finally, affect could explain the effects of temperature on behavior. In the aggression research, high temperatures are often regarded as uncomfortable, which could explain the negative consequences. However,

this influence of affect is difficult to align with the effects of temperature on risk taking and social relations. It remains to be seen if the manipulations of high temperatures in the social relation studies are uncomfortable enough to induce negative affect. Moreover, negative affect would lead to decreased attractiveness ratings (Griffitt, 1970, Griffitt & Veitch, 1971), and we would thus expect less - not more - risk taking.

An important implication of this research is that a background factor as temperature might have important consequences on behavior. Temperature could affect all kinds of behavior, such as how much you eat during the holidays. Or looking at a different perspective, supermarkets that turn down the heat to keep products fresh; based on the present research, they are likely to lose revenue because people behave less impulsively and thus are able to refrain from buying tempting products.

In conclusion, higher temperatures seem to induce impulsiveness, and thus decrease people's ability to resist temptations. Temperature is an important but subtle factor influencing our decisions. The metaphors in our language seem to refer to an actual phenomenon, namely impulsiveness. People make riskier decisions in the heat of the moment and cooling down could literally help in the defense against temptations.

Chapter 6

General Discussion

The aim of this dissertation was to investigate why people in impulsive states make riskier decisions than people in reflective states. Well, if there is one definite conclusion to be drawn from all the studies I conducted to investigate this question, then it would be that the answer is not as simple as lay theories would suggest: Even though we have shown in Chapter 2 that when people value their long-term goal to stay healthy, they make less risky decisions than those who do not value their long-term health goals, overall, people in impulsive states still made riskier decisions than people in reflective states. Thus, it seems that people in impulsive states do not make riskier decisions because of a reduced influence of their long-term goals, but why then? In the subsequent series of experiments we investigated other possible explanations for the increased risk propensity of people in impulsive states.

Specifically, in Chapter 3 we investigated the role attention could possibly play in risk decisions. Building on dual-system theories, we posited that the focus of attention of people in impulsive and reflective states differs. The reflective-impulsive model (Strack & Deutsch, 2004) assumes that people in reflective states weigh and integrate information on the value and probability of potential outcomes to reach a behavioral preference. In line with this idea we posited that to be able to do this, people in reflective states need to divide their attention over all available information. We proposed that people in impulsive states, on the other hand, focus their attention on salient information. This salient information activates associations, motivational orientations, and ultimately behavioral schema. Our findings support this assumption. Using eye-tracking, we showed that people in impulsive states focus their attention on the salient photograph in a pair of photographs, salient features of one photograph, and make evaluations based on salient information. People in reflective states distributed their attention over all available information, and base their evaluations on all available information. In addition to a difference in attentional focus we suggest that there also might be a difference in cognitive focus. Possibly, people in

impulsive states do not only focus their attention on salient information, but also view objects in goal congruent ways.

Indeed, in the studies reported in Chapter 4 we have shown that people in impulsive states estimate the size of objects in ways congruent to their goals, whereas people in reflective states do not show this bias in their size estimates. In one of the studies (Experiment 4.4), we induced an impulsive or reflective cognitive state and also whether people had a sex goal or not. Our idea was that priming people with a sex goal could change their perception of women's breasts. Subsequently, we asked people to estimate the cup size of a woman in a photograph. When people in impulsive states have a sex goal, they perceive a woman's cup size in a biased way. Specifically, men perceive the woman's cup size to be bigger, women, on the other hand, perceived the woman's cup size to be smaller. Thus, not only do men in impulsive states focus on salient features, features that are goal congruent can become more salient through the perceived size. Women in impulsive states also focus on salient features, and features that are goal incongruent actually become smaller. Hence, not only do people in impulsive states focus their attention on salient information, information that is relevant to their goals is viewed *differently*. This combination could make it harder for people in impulsive states to resist temptation.

In the final empirical chapter, Chapter 5, we have looked into a way to reduce impulsive risk behavior. Strengthening long-term goals does not seem to be the answer, as we have shown in Chapter 2, and temptations are inherently positive, often salient and difficult to make less tempting. Therefore, we posited that a possible way to change behavior is to change the state people are in, as people in reflective states usually make less risky decisions. Metaphorically, we want to 'cool people down' who are 'in the heat of the moment'. Interestingly, previous research suggests that we could do this literally (e.g., Larrick et al., 2011). Therefore, we posited to change the cognitive state people are in by changing the ambient temperature. In two studies we indeed found that higher temperatures resulted in riskier decisions

compared to lower temperatures. Turning down the heat may be a way to change behavior.

In the subsequent paragraphs we will first discuss the procedures we used to manipulate and assess cognitive states. We will comment on the strengths and weaknesses of the manipulations. Subsequently, we will discuss our findings with regard to gender differences. In our studies we found various different influences on gender, some in line with the literature and others more surprising. Then we will discuss in what way our findings may be used to change people's behavior and some possible future directions. Finally, we will close with a general conclusion.

Cognitive States

Although the theoretical distinction between impulsive and reflective states (or traits) is quite straightforward, it remains a challenge to separate the two states experimentally, as is also reflected in the variety of strategies we have used throughout our empirical chapters. Up to now, it has been difficult to find one ideal means of measuring or manipulating cognitive states, as most techniques have problems. On the one hand, many studies have measured impulsiveness using explicit questionnaires (e.g. Clift et al., 1993; Donohew et al., 2000; Dudley et al., 2004) or made use of conceptual priming techniques (e.g. Guerrieri et al., 2007), both of which are abstract indicators of impulsivity. On the other hand, several studies used fairly specific measurements and/or manipulations, for instance, a stop-signal task (e.g. Guerrieri et al., 2007; Guerrieri, Nederkoorn, Schrooten, Martijn, & Jansen, 2009), or measures of delay of gratification (e.g. Metcalfe & Mischel, 1999). These measurements are too specific in what they measure and do not cover impulsiveness in its entirety.

One of the first challenges in these series of studies was to find a manipulation or measure of cognitive states that was not affected by concerns of being too abstract or too specific. In a first attempt to find a method to manipulate cognitive states we used an explicit manipulation

(Chapter 2, Experiment 1). Specifically, we instructed participants to either react impulsively or react after careful deliberation (see also, Maas & Van den Bos, 2009). This manipulation seemed to cover impulsivity in its entirety without being too abstract. A disadvantage of this technique, however, is that a large proportion of participants did not comply with the explicit instructions, as they indicated in a manipulation check. Fortunately, participants who indicated that they did not comply with the instructions also showed the opposite behavioral pattern (e.g., the behavioral pattern that fitted with the indicated cognitive state). Nevertheless, the fact that a large proportion of the participants did not comply with the instruction is a major weakness of this technique.

In a second attempt we used a procedural priming manipulation to induce impulsive and reflective states (Chapter 2, Experiments 2 and 3; Chapter 3, Experiments 2 and 3). The strength of this technique is that it is implicit; it is typically presented to participants as a separate task. After finishing this task participants start an ostensibly unrelated task. Also, there is no mention of impulsivity. Participants are merely instructed to perform a task either fast and without thinking or slowly after careful consideration. It is assumed that this induced mind-state subsequently spills over in to the next focal task. A weakness of this task is its relation to time. Asking people to do something fast could influence the actual time they take doing the tasks, instead of the way they perform the task (i.e., without thinking). People who are impulsive do not necessarily lack time; they lack motivation or capacity. However, having no time to think and thus acting immediately does mimic the outcomes usually associated with not thinking and thus performing tasks impulsively.

Thirdly, we have used a manipulation modeled after Lockwood and Kunda (1997), in which participants read a bogus newspaper report describing the positive effects of acting after reflection or acting impulsively (Chapter 4, Experiment 4); participants' task was to guess in which Dutch newspaper the article was published. A weakness of this procedure is that it remains unclear what participants interpretation of impulsiveness is; maybe

some participants have a different definition of impulsivity than others. Hence, this manipulation could trigger different kinds of behavior in different participants.

Finally, and most promising, we assessed impulsiveness using eye-blink rate (EBR; Chapter 3, Experiment 3.1), an exciting new method to assess impulsivity. EBR is an innate tendency that is associated with striatal dopaminergic functioning (e.g., Karson, 1983), which has been linked to a preference for immediate over delayed rewards (Hariri, et al., 2006; McClure, Laibson, Loewenstein, & Cohen, 2004). This preference for immediate rewards has in turn been linked to impulsiveness (e.g. Martin & Potts, 2004). Research also indicates that people with high spontaneous EBR are less capable of inhibiting their impulses (Colzato, van den Wildenberg, van Wouwe, Pannebakker, & Hommel, 2009). In contrast, people with low EBR have better inhibitory control, which has been related to reduced impulsiveness (e.g. Dawe, Gullo, & Loxton, 2004). More directly, high EBR has previously been linked to higher scores on impulsiveness (Huang, Stanford, & Barratt, 1994). Taken together, previous research supports the assumption that people with a high spontaneous EBR can be considered more impulsive, whereas people with a low EBR can be considered more reflective.

So even though it is difficult to experimentally separate impulsive and reflective states we have attempted to do this in several different ways. Most of the methods have both strengths and weaknesses and whether we used an ideal method remains to be seen. In our studies mostly we used two methods to manipulate or measure cognitive states. Conducting studies using multiple methods with similar results provides converging validity for the manipulation of cognitive states. We have found these converging results using the explicit manipulation and the procedural priming manipulation, and also using the procedural priming manipulation and the EBR measure.

Gender Effects

In the research reported in this dissertation the primary goal was certainly not to investigate gender effects. Nevertheless, we did find several gender differences. First, we found that men make riskier decisions than women (Chapters 2 and 5), which is in line with previous research showing that men are typically more inclined to have unprotected sex than women (cf. Byrnes, Miller & Schafer, 1999). Previous research has also consistently shown that men report more sexual arousal than women, across situations and in response to a variety of sexual stimuli (cf. Murnen & Stockton, 1997). Men generally rate scenarios as more sexually arousing then women, the gender difference in sexual risk decisions can possibly be explained by differences in sexual arousal. Importantly however, both arousal and gender did not interact with our manipulations of cognitive states, meaning that the effects we found of cognitive state are not confounded by gender or arousal.

Second, and more surprisingly, we did not find any gender effects in the experiments on attentional focus. The lack of gender difference in these studies could be explained because of the gender imbalance in respondents, and it remains unclear whether the lack of effect of gender of the participants on attentional focus was due to the limited number of male participants (and thus a lack of statistical power) or a genuine absence of a gender effect. Alternatively, anecdotal data suggest that some of the female participants in our studies liked the underwear of the female targets. Therefore, the lack of a gender difference in attentional focus might be explained by the increased attention female participants paid to the female targets, making their attentional pattern similar to that of men.

To address the gender imbalance we recruited more men in Experiment 3.3, in which we investigated the effect of the found attentional difference on sexual attractiveness ratings. Now, we did find some gender differences, these gender differences could all be explained by the fact that men did not consider other men sexually attractive, combined with an increased attentional focus of women on the background of the photographs. These

findings are in line with previous research (Lykins et al., 2008) showing that men attend to opposite sex targets mostly, whereas women divide their attention over both opposite and same sex targets.

Most research on attention to sexual stimuli focusses on heterosexual male participants' reactions to female targets (e.g., Dixson, Grimshaw, Linklater, & Dixson, 2009; Dixson, Grimshaw, Linklater, & Dixson, 2010). In our research we have chosen to investigate reactions of men, as well as, women towards male and female targets. For instance, we investigated not only attention to people of the opposite-sex, but also attention to people of the same-sex. Results show that cognitive state generally affects attention to both types of targets in the same way. People in impulsive states focus their attention on the salient of two photographs, regardless of whether the photographs depict men or women. We believe that photographs of naked targets of the opposite-sex are salient because they are rewarding, relevant, and emotional. Targets of the same-sex are also salient, but we think this is because they are emotional and relevant (as possible competitor), albeit not particularly rewarding. Investigating gender differences in attentional focus should take into account that even though the focus of attention shows the same pattern this might be because of different underlying reasons.

In short, we have found some gender effects that are in line with the literature on gender differences. In other experiments we have not found any gender differences. The objective in most of our studies was not, however, to assess differences between men and women but rather to investigate the influence of cognitive states on decisions, attention, and perception. Importantly, in contrast to the gender effects, the results for cognitive states in our studies are clear and unequivocal. This means that the conclusions we derived from our experiments apply equally to both men and women. That men in our experiment usually make riskier decisions cannot be explained by different effects of cognitive states on decisions. Future research could further investigate gender differences taking cognitive states into account.

Changing behavior

What can we do with the information we obtained in the empirical chapters? Ultimately, we wanted to increase understanding about why impulsiveness leads to riskier decisions to be able to change unhealthy behavior. Our results show that education does help. Assuming that knowing the risks involved in certain behavior strengthens people's long-term goals, and via these goals affects risk decisions in both reflective and impulsive states; forming and strengthening long-term goals is a way to reduce risk behavior. However, despite the positive effect of long-term goals, people in impulsive states still made riskier decisions. Focusing on strengthening long-term goals is not the answer to reducing the risk propensity of people in impulsive states compared to people in reflective states.

Another possibility to reduce risk behavior is that the attentional quality of long-term goals could be changed. As people in impulsive states focus their attention on salient information, the obvious answer is that healthy information could be made more salient. One key difference between temptations and long-term goals is that long-term goals, such as health goals, are more abstract (Fujita & Sasato, 2011). Long-term goals are farther away in time, and there are many ways in which to accomplish a long-term goal. In other words, long-term goals are less salient than temptations. Thus, changing exactly this attentional quality of long-term goals might be an extremely difficult task and most likely not the answer to reduce risk behavior.

Additionally, we have shown that people in impulsive states perceive goal-relevant objects in goal-congruent ways. We believe that objects related to long-term goals are less likely to be perceived in goal-congruent ways compared to short-term goals (i.e., temptations); as there is a more direct relation between objects associated with temptations, than with objects related to long-term goals. Take for example being or staying healthy as long-term goal. A multitude of objects such as condoms, apples, running shoes can all be related to this same goal. Making the long-term goal more

specific will not necessarily help; take for instance a sexual health goal. Now condoms are still relevant objects, however condoms usually are not out in the open, thus they cannot be perceived as more salient. Another way to reach the long-term sexual health goal is to not have sex without a condom, but this behavior is not related to a specific object. Hence, viewing the world in goal-congruent ways is less likely to help people to attain their long-term goals in impulsive states.

Maybe then the focus should not be on changing the attentional quality of the long-term goals, but instead, we should change the attentional quality of temptations. In order to reduce risk behavior tempting information could be made less salient. Temptations, however, are associated with immediate gratification and tempting objects are intrinsically positive. Therefore, we believe that these tempting stimuli by definition are salient. It is difficult to change the features of all tempting objects to make them less salient than healthy option. Hence, changing the (salient) quality of temptations does not seem to be a solution against risk taking behavior in impulsive states.

Changing the attentional qualities of temptations seems to be a difficult task, and strengthening people's long-term goals is not the entire answer to reducing risk behavior in people in impulsive states, another solution might be to change the cognitive state people are in. Drawing upon metaphors on risk-taking behavior, we posited that temperature might be a good candidate to change the cognitive states people are in. People are said to make risky decisions in the heat of the moment, moreover when people need to take a minute to think they have to cool down or take a cold shower. This suggested to us that turning down the heat literally could make people less impulsive. Indeed, we found that lower temperatures resulted in less risky decisions compared to higher temperatures.

Ultimately, we could change behavior most effectively by changing people's attentional or cognitive focus. If people are able to divert their attention away from temptations and view the world in ways congruent to their long-term goals instead of temptation behaving in line with these long-

term goals would become more likely. Hypothetically, attenuating the focus on temptations or increasing the focus on long-term goals is quite difficult. One possible way of accomplishing a change in focus is by changing the temperature. As people are very bad at predicting their own behavior in tempting situations (such as after going out) in advance (Ariely & Loewenstein, 2006), implementing this counter measure might still be a challenge. Possibly, people should turn down the heat every time they are in tempting situations. Or maybe there should be a maximum temperature in establishments where people are often tempted to make risky decisions (i.e., clubs)? We admit there is a long way to go before this method might be used successfully, turning down the heat is easily done; just push a button or turn a dial, but who is responsible? What temperature is optimal? Does this work in combination with alcohol?

Future directions

Our results show that people's sexual risk decisions, attention, and perception are influenced by their cognitive state. This information provides interesting insights into the processes that cause risky decisions especially when people are in an impulsive state. However, we have not yet provided direct evidence that these processes also influence actual real-life risk-taking behavior. Take the risk decisions people made in relation to the scenario we provided in Chapter 2 and Chapter 5, people tried to anticipate how they would react in that actual situation. However, it has been shown that people are bad at anticipating how they will behave under the influence of certain visceral states (e.g., Ariely & Loewenstein, 2006; Nordgren, van Harreveld, & van der Pligt, 2009). Overestimating self-control should actually result in riskier sexual decisions in real-life, as people typically overestimate their capacity for impulse control. Hence, the likelihood of making sexual risk decisions in our experiments may have been underestimated.

We have chosen in our experiments to investigate risk decisions in reaction to a scenario instead of real-life behavior, because using a

behavioral measure of sexual risk would be problematic from an ethical perspective, as people in impulsive states are expected to behave riskier. Future research could directly link the different cognitive states to risk behavior, although maybe in a domain different from sexual risk decisions. We believe that making riskier decisions could also be translated to riskier behavior. Moreover, focusing on temptations and viewing the world goal congruently would also drive behavior. We already have data concerning the effect of temperature on behavior, in the domain of over-eating. Specifically, we have found that higher temperatures cause people to eat more M&M's in a taste-test setting (Den Daas, Häfner, & de Wit, 2013).

Besides connecting our result to real-life behavior there are also some interesting theoretical directions. Notably, the difference in the distribution of attention, that people in impulsive states focus their attention on salient information and people in reflective states distribute their attention over the available information, overlaps substantially with the distinction between global and local information processing (Friedman & Förster, 2010; Förster, 2009; Förster & Dannenberg, 2010). Global versus local information processing reflects the difference between attending to the bigger picture and focusing on details. That is, focusing on the 'forest' or the 'trees' (Förster & Higgins, 2005; Navon, 1977). The assumption that impulsivity may be associated with more local information processing is also supported by research on the association between temperature and information processing and by our research on temperature (Chapter 5). Firstly, higher temperatures lead to more concrete language use and local information processing (IJzerman & Semin, 2009). Secondly, our research shows that higher temperatures lead to riskier decisions (Chapter 5). Taken together, we posit that a key aspect of impulsivity is that people process information locally.

This new theoretical insight is important, because this possibility offers new ways of investigating impulsivity and reducing risk behavior. Processing information locally is likely to result in an emphasis on concrete and specific features of a situation. These features are usually associated with immediate rewards, such as, temptations (Fishbach, Friedman, &

Kruglanski, 2003; Mischel & Gilligan, 1964). Long-term goals, on the other hand, are usually more abstract and global. A focus on local information, at the expense of global information, could thus result in riskier behavior. Knowing what drives impulsive risk-taking can instigate novel interventions that increase people's ability to resist temptations.

This link we propose between impulsiveness and global-local information processing also connects to research on implementation intentions. An often researched way to change impulsive behavior is through the formation of implementation intentions (Papies, Aarts, & de Vries, 2009). Implementation intentions are if-then plans that specify when, where, and how people will enact goal-directed behavior (e.g. 'If I am tempted to eat chocolate, then I will eat an apple instead'; Gollwitzer, 1993, 1996, 1999; Gollwitzer & Brandstätter, 1997; Gollwitzer & Schaal, 1998; Gollwitzer & Sheeran, 2006; Milne, Orbell, & Sheeran, 2002; Sheeran & Orbell, 1999, 2000). From an information processing point of view, what stands out is that implementation intentions are typically formulated 'locally' (Gollwitzer, 1999; De Vet, Oenema, & Brug, 2011), that is, specifically and concretely (e.g. 'then I will eat an apple' versus 'then I will eat something healthy'). Moreover, implementation intentions are possibly most effective this way, because long-term goals are phrased more locally, increasing the fit with the situation (impulsiveness).

Conclusion

In this dissertation we have investigated why impulsiveness tends to contribute to people's increased risk propensity. On the basis of this dissertation we can conclude that the intuitive explanation that people in impulsive states are less influenced by their long-term goals cannot explain the increased risk propensity of people in impulsive states. People in impulsive states are not influenced by their long-term goals less. Moreover, if people are confronted with strong temptation people in impulsive states make *less* risky decisions. Thus, in the fight against temptation strengthening

ones long-term goals can be a way to change risk behavior. Nevertheless, despite their long-term goals people in impulsive states still make riskier decisions than people in reflective states. Strengthening long-term goals is not the solution to reducing risk behavior.

An explanation for the increased risk propensity of people in impulsive states that is plausible on the basis of our findings is the difference in attentional focus between people in impulsive and reflective states. People in impulsive states focus their attention on salient information, whereas people in reflective states distribute their attention over all available information. As tempting information is often salient, attending mainly to this information increases the likelihood that people in impulsive states are influenced by this information and make riskier decisions as a consequence. Another possible explanation for the increased risk propensity of people in impulsive states is that they perceive goal relevant objects goal congruently. Both attention and perception of certain information influence decisions people make.

Finally, we aimed to finish this dissertation on a positive note. We found that temperature influences impulsive decisions. Higher temperatures result in more impulsive decisions. In the heat of the moment people focus their attention on salient information and perception is biased, but turning down the heat could reduce people's risky decisions in impulsive states.

Nederlandse Samenvatting

Waarom doen mensen dingen die op de lange termijn niet goed of zelfs slecht voor ze zijn? Sterker nog, waarom doen mensen dingen die niet goed voor ze zijn met de intentie dat juist niet te doen? Er zijn heel veel voorbeelden te vinden van het toegeven aan verleiding ten koste van een langetermijndoel. Mensen eten bijvoorbeeld ongezond, terwijl ze willen afvallen , mensen (vrouwen) kopen dure schoenen, terwijl ze zouden moeten sparen en mensen hebben onveilige seks met het risico op een geslachtsziekte.

Impulsiviteit wordt vaak genoemd in relatie tot risicogedrag (Clift, Wilkins, & Davidson, 1993; Donohew et al., 2000; Dudley, Rostosky, Korfhage, & Zimmerman, 2004), maar tot nu toe blijft het onduidelijk waarom impulsiviteit leidt tot meer risicovolle beslissingen. In dit proefschrift wordt onderzocht waarom impulsiviteit tot meer risicovolle beslissingen leidt. Met andere woorden, wat zijn de onderliggende processen die ten grondslag liggen aan de toename in risicogedrag bij impulsieve mensen. Hierbij kijken we naar het nemen risicobeslissingen in een seksuele context.

Wat is impulsiviteit?

De lekendefinitie van impulsiviteit stelt dat mensen iets doen zonder na denken (bv. Van Dalen). Meer wetenschappelijk wordt impulsiviteit in verband gebracht met twee factoren (Dawe & Loxton, 2004); een verminderd vermogen om gedrag te onderdrukken (Veling & Aarts, 2009) en een verhoogde gevoeligheid voor beloningen (Bechara, Tranel, & Damasio, 2000; Dawe, Gullo, & Loxton, 2004; Martin & Potts, 2004; Patton, Stanford, & Barratt, 1995). Mensen die niet impulsief, maar reflectief zijn beredeneren juist wel hun gedrag (Webb & Sheeran, 2005). De tweedeling tussen impulsief en reflectief wordt uitvoerig beschreven in zogenaamde ‘dual-process’ en ‘dual-system’ theorieën (bv. Chaiken & Trope, 1999; Epstein, 1990; Metcalfe & Mischel, 1999; Smith & DeCoster, 2000; Strack

& Deutsch, 2004). Deze theorieën stellen dat gedrag bepaald kan worden door één of beide van twee mogelijke processen of systemen.

Het 'Reflective-Impulsive Model' (Strack & Deutsch, 2004), een zeer invloedrijke theorie binnen de literatuur stelt dat informatie altijd verwerkt wordt door het impulsieve systeem. In dit systeem activeert bepaalde input associaties in een associatief netwerk in het geheugen, waarin ook gedragsschema's geactiveerd kunnen worden. Wanneer een bepaald gedragsschema sterk genoeg geactiveerd is zal dit resulteren in gedrag. Neem bijvoorbeeld een aantrekkelijk persoon. Deze kan associaties met seks activeren en dit kan vervolgens tot gedrag leiden. Wij veronderstellen dat een mogelijke reden waarom mensen die informatie via het impulsieve systeem verwerken meer risicovol gedrag vertonen zou kunnen zijn dat in het associatief netwerk gezondheidsdoelen en gerelateerde objecten (zoals condooms) niet worden geactiveerd en daarom niet leiden tot activatie van de bijbehorende gedragsschema's.

Strack en Deutsch (2004) stellen dat, naast verwerking via het impulsieve systeem, mensen informatie ook kunnen verwerken via het reflectieve systeem. In het reflectieve systeem worden langetermijndoelen verondersteld te werken als beschermers tegen verleidingen. Als mensen een langetermijndoel hebben, dan worden zij verondersteld zowel het langetermijndoel als de verleiding in acht te nemen en aan de hand daarvan een intentie voor gedrag te vormen (bv. Azjen, 1991). Wanneer mensen die een one-night stand willen hebben geen condooms bij zich hebben, zouden zij kunnen denken: 'Ik heb wel zin, maar ik wil niet het risico lopen op een seksueel overdraagbare aandoening. Ik zal een condoom gebruiken en anders geen onveilige seks hebben.' Rationeel gezien zouden beslissingen die via het reflectieve systeem genomen worden overeen moeten komen met de langetermijndoelen van mensen (Fishbach, Friedman, & Kruglanski, 2003; Freitas, Liberman, & Higgins, 2002; Trope & Fishbach, 2000). Positieve uitkomsten op de lange termijn zouden belangrijker moeten zijn dan de positieve uitkomsten van de verleiding op de korte termijn, vooral omdat toegeven aan verleidingen negatieve effecten kan hebben op de lange

termijn. Mensen die het langetermijndoel om gezond te blijven hebben zouden dus uiteindelijk moeten beslissen om geen onveilige seks te hebben.

Het impulsieve en reflectieve systeem werken parallel. Dit betekent dat mensen zowel via het impulsieve systeem als via het reflectieve systeem tot gedrag kunnen komen. Sommige mensen zullen over het algemeen vaker door het ene dan door het ander systeem geleid worden, wat een verschil in persoonlijkheidskenmerken zou kunnen weerspiegelen, impulsieve of reflectieve mensen. Bepaalde situaties kunnen ook leiden tot een nadruk op het ene of andere systeem. Factoren als 'arousal', afleiding en 'cognitive load' leiden bijvoorbeeld tot verwerking via het impulsieve systeem (Hofmann, Friese, & Wiers, 2008). Wanneer mensen in een bepaalde situatie informatie voornamelijk via één van de twee systemen verwerken, zijn zij in een impulsieve of reflectieve staat.

Verminderde invloed van langetermijndoelen

Het is mogelijk dat mensen die informatie voornamelijk verwerken via het impulsieve systeem minder door hun langetermijndoelen worden beïnvloed en daarom meer risicovolle beslissingen nemen. In de experimenten gerapporteerd in Hoofdstuk 2 hebben we deze intuïtief voor de hand liggende aanname getoetst. Wij veronderstellen echter dat het niet plausibel is dat langetermijndoelen geen plaats hebben in het associatieve netwerk in het geheugen. Volgens de 'goal-systems' theorie (Kruglanski et al., 2002), bijvoorbeeld zijn zowel verleidingen als langetermijndoelen en de middelen die mensen gebruiken om deze doelen te bereiken gerelateerd in hetzelfde associatieve netwerk. Belangrijker nog, naargelang deze concepten vaker samen worden geactiveerd, bijvoorbeeld wanneer mensen overwegen wat te doen in een verleidelijke situatie, zal het verwerken van een verleiding automatisch ook de geassocieerde langetermijndoelen en de middelen om de langetermijndoelen te behalen activeren (e.g., Kruglanski et al., 2002; Bargh & Ferguson, 2000).

Wij verwachten dan ook dat mensen in een impulsieve staat wel degelijk door hun langetermijndoelen worden beïnvloed. Een goed voorbeeld van hoe mensen in impulsieve staat ook door de langetermijndoelen beïnvloed kunnen worden is door de automatische werking van langetermijndoelen, zoals bij gewoontes (Aarts & Dijksterhuis, 2000; Custers & Aarts, 2005, 2010). Gewoontes komen voort uit associaties tussen doelen en acties. Wanneer mensen vaak hetzelfde gedrag uitvoeren om een bepaald doel te bereiken en dit gedrag succesvol is om dit doel te behalen, dan zal de actie uiteindelijk mentaal gekoppeld worden aan het doel (Ouelette & Wood, 1998). Activatie van een doel resulteert vervolgens automatisch in gedrag en wij verwachten op basis hiervan dat ook in een impulsieve staat de beslissingen van mensen door hun langetermijndoelen worden beïnvloed.

In drie experimenten, beschreven in Hoofdstuk 2, hebben we bij deelnemers of een impulsieve of een reflectieve staat geïnduceerd. Vervolgens hebben we hen een scenario voorgelegd waarin zij iemand van de andere sekse ontmoeten die ze aantrekkelijk vinden. Vervolgens komen ze in een situatie waarin ze wel seks willen hebben, maar geen condoom hebben (zie voor het scenario ook; Ditto, Pizarro, Epstein, Jacobson, & MacDonald, 2006; MacDonald, Zanna, & Fong, 1996; MacDonald et al., 2000;). Deelnemers beslissen daarna of zij in het beschreven scenario seks zonder condoom zouden hebben. In de experimenten hebben we ook gemeten hoe belangrijk mensen hun langetermijngezondheidsdoelen vonden (bv. hoe gemotiveerd mensen waren om zichzelf tijdens seks te beschermen tegen seksueel overdraagbare aandoeningen).

De bevindingen van Experiment 2.1 en Experiment 2.2 laten zien dat mensen die hun langetermijngezondheidsdoelen belangrijker vinden minder risicovolle beslissing nemen dan mensen die hun gezondheidsdoelen minder belangrijk vinden. Daarnaast vonden we dat, los van dit effect van langetermijndoelen, mensen in impulsieve staat meer risicovolle beslissingen nemen dan mensen in reflectieve staat. Langetermijndoelen en de cognitieve staat waarin mensen verkeerden interacteerden niet met elkaar. Dat mensen

in impulsieve staat minder door hun langetermijngezondheidsdoelen worden beïnvloed is in licht van deze bevindingen onwaarschijnlijk.

In Experiment 2.3 hebben we ook de sterkte van de verleiding gemanipuleerd. De persoon in het scenario werd hiertoe beschreven als redelijk aantrekkelijk of zeer aantrekkelijk. De redenering is dat als verleidingen inderdaad langetermijndoelen activeren in het associatieve netwerk en deze activatie proportioneel is, langetermijndoelen worden sterker geactiveerd naarmate verleidingen sterker worden (Fishbach & Shah, 2006). Onze bevindingen tonen aan dat dit inderdaad het geval is. Mensen in reflectieve staat nemen meer risico naarmate de verleiding aantrekkelijker wordt, terwijl mensen in impulsieve staat evenveel risico nemen als de verleiding redelijk of zeer aantrekkelijk is. Mensen in impulsieve staat lijken dus niet meer risico's te nemen door een verminderde invloed van langetermijndoelen. Sterker nog, de bevindingen suggereren dat er situaties zijn waarin mensen in impulsieve staat minder risicovolle beslissingen nemen dan mensen in reflectieve staat. Toch vinden wij, in lijn met de literatuur (Clift et al., 1993; Donohew et al., 2000; Dudley et al., 2004), dat mensen in impulsieve staat over het algemeen meer risicovolle beslissingen nemen en de vraag blijft waarom. In de experimenten gerapporteerd in Hoofdstuk 3 hebben we deze vraag verder onderzocht.

Aandacht

In een eerste serie experimenten (zie Hoofdstuk 2) vinden we geen ondersteuning voor een veronderstelde relatie tussen impulsiviteit en verminderde activatie van langetermijndoelen. Op basis van het 'Reflective-Impulsive Model' van Strack en Deutsch (2004) zou een andere verklaring voor waarom mensen in impulsieve staat meer risicovolle beslissingen nemen gezocht kunnen worden in de focus van aandacht. Het idee is dat mensen in reflectieve staat de beschikbare informatie integreren om tot een weloverwogen beslissing te komen, en om dat te kunnen doen moeten mensen hun aandacht verdelen over die informatie. Bij mensen in impulsieve

staat daarentegen activeert saillante informatie associaties in het associatief netwerkt, hun aandacht richt zich op deze saillante informatie en die informatie bepaalt dan ook gedrag.

In drie experimenten, gerapporteerd in Hoofdstuk 3, hebben we onderzocht of er inderdaad een verschil in de focus van aandacht is tussen mensen in impulsieve of reflectieve staat. Net als in de studies gerapporteerd in Hoofdstuk 2, hebben we allereerst een impulsieve of reflectieve staat geïnduceerd. Vervolgens hebben we met behulp van een eye-tracker onderzocht of mensen in impulsieve en reflectieve staat verschillen in waar zij hun aandacht op richten. Eye-tracker registeren onder ander waar, hoe lang, en hoe vaak mensen hun aandacht op bepaalde informatie richten. Een verschil in de focus van aandacht is met behulp van de eye-tracker te registreren.

Onze bevindingen in Experiment 3.1 laten zien dat, zoals verwacht, mensen in een reflectieve staat hun aandacht verdelen over de beschikbare informatie. Wanneer we twee plaatjes toonden (één van een schaars gekleed persoon en één van een naakt persoon), dan keken mensen in reflectieve staat even lang en even vaak naar beide plaatjes. Mensen in impulsieve staat keken daarentegen langer en vaker naar het plaatje met de naakte persoon. In Experiment 3.2 lieten we één plaatje zien van een schaars gekleed persoon tegen een achtergrond. Zoals verwacht verdeelden mensen in reflectieve staat hun aandacht over zowel de persoon als de achtergrond. Mensen in impulsieve staat daarentegen richtten hun aandacht alleen op de saillante informatie, de schaars geklede persoon.

In Experiment 3.3 hebben wij aangetoond dat dit verschil in aandacht ook invloed heeft op evaluatieve beoordelingen. We hebben mensen foto's getoond met daarop aantrekkelijke of onaantrekkelijke personen in hun ondergoed, met op de achtergrond een bibliotheek of een slaapkamer. In lijn met onze verwachtingen vonden wij dat mensen in een reflectieve staat, die hun aandacht over de informatie verdelen, werden beïnvloed door de achtergrond van de foto als hen gevraagd werd te beoordelen hoe seksueel aantrekkelijk de personen op de foto waren. Zij

beoordeelden mensen in een bibliotheek als minder seksueel aantrekkelijk dan mensen in een slaapkamer. Mensen in impulsieve staat, die zich op de meest saillante informatie richtten, in dit geval de mensen in hun ondergoed, werden niet beïnvloed door de achtergrond van de foto.

Samengenomen laten de experimenten in Hoofdstuk 3 zien dat mensen in impulsieve of reflectieve staat hun aandacht op een andere manier verdelen en dat dit beoordelingen van seksuele aantrekkelijkheid beïnvloed. We hebben echter de invloed die het richten van de aandacht op saillante informatie heeft op risicobeslissingen niet direct onderzocht. Het is echter aannemelijk dat saillante informatie vaak verleidelijke informatie is. Verleidingen zijn inherent positief en gelinkt aan de motieven van overleving en voortplanting. Eerder onderzoek heeft al aangetoond dat stimuli gekoppeld aan motieven van overleving en voortplanting aandacht trekken (Neuberg, Kenrick, Maner, & Schaller, 2004). Het is aannemelijk dat wanneer iemand aandacht besteed aan een verleiding, deze verleiding eerder gedrag beïnvloedt.

Perceptie

De experimenten in Hoofdstuk 3 laten zien dat de cognitieve staat waarin mensen verkeren beïnvloedt waar mensen hun aandacht op richten. Een gerelateerde vraag is of cognitieve staat ook invloed heeft op perceptie van doelrelevante objecten. In eerder onderzoek naar de invloed van doelen op perceptie is vaak gevonden dat als een object doelrelevant is, dit als groter wordt waargenomen (bv., Bruner & Goodman, 1947; Veltkamp, Aarts, & Custers, 2008). De verklaring die hiervoor gegeven wordt is dat het object dan meer opvalt in een omgeving met andere stimuli, wat een benaderingsreactie bevordert, en daarmee het bereiken van het doel.

Met de experimenten in Hoofdstuk 4 onderzoeken wij of de perceptie van mensen in impulsieve staat meer wordt beïnvloed door doelen dan de perceptie van mensen in reflectieve staat. De eerste hypothese die wordt onderzocht is of het vertekend waarnemen van doelrelevante objecten

doelspecifieker werkt dan alleen het groter schatten van objecten om zo benaderingsreacties te bevorderen. Als bijvoorbeeld het hedonische doel eten is geactiveerd, dan betekent het groter schatten van een brownie niet alleen dat de brownie makkelijker waargenomen wordt. Het betekent ook dat er meer brownie, dus meer lekker eten, is. Wij veronderstellen dat mensen objecten niet alleen vertekent schatten om benaderingsreacties te bevorderen, doelrelevante objecten worden niet altijd groter geschat, objecten kunnen ook kleiner worden geschat als dit bevorderlijk is voor het behalen van een doel. Om te onderzoeken of het formaat van doelrelevante objecten ook kleiner worden geschat afhankelijk van het doel wat mensen nastreven is in drie experimenten gekeken naar het geschatte formaat van objecten die kleiner geschat zouden moeten worden om het behalen van een doel te bevorderen.

In Experimenten 4.1 en 4.2 hebben we bij de helft van de deelnemers het doel een basketbal in de ring te gooien geactiveerd; de andere helft van de deelnemers kreeg als doel de basketbal op te ruimen. Vervolgens schatten deelnemers de grootte van een basketbal of van een basketbalring. Zoals verwacht schatten deelnemers de basketbal kleiner in als het doel om de basketbal in de ring te gooien geactiveerd was dan als het doel de basketbal in de ring te gooien niet geactiveerd was. Daarnaast schatten deelnemers, zoals verwacht, de ring juist groter als het doel om de basketbal in de ring te gooien geactiveerd was.

Het kan zijn dat groter of kleiner schatten kenmerkend is voor bepaalde objecten; sommige worden nu eenmaal groter en andere kleiner geschat. In Experiment 4.3 onderzochten we daarom of hetzelfde object zowel groter als kleiner geschat kan worden, afhankelijk van het geactiveerde doel. In lijn met de andere studies in dit proefschrift, onderzochten we in Experiment 4.3 perceptie in het domein van seksuele beslissingen. We hebben allereerst bij de helft van de deelnemers een seksdoel geactiveerd door deelnemers naar een plaatje van een zoenend half-ontkleed stel te laten kijken in plaats van naar een plant. In een zogenaamd ongerelateerd onderzoek schatten deelnemers daarna de lengte en cupmaat

van een vrouw op een foto. Vrouwen zijn voor de heteroseksuele mannen doelrelevant. Voor mannen is het doelrelevant om de borsten van een vrouw als groter in te schatten, aangezien dit seksuele aantrekkelijkheid signaleert (Furnham, Dias, & McClelland, 1998). Voor heteroseksuele vrouwen is een andere vrouw ook doelrelevant, maar als competitie. Voor vrouwen is het daarom doelcongruent om de borsten van een andere vrouw als minder groot te schatten, om zo zichzelf als optimaler waar te nemen.

Zoals verwacht schatten mannen de borsten van de vrouw groter in als er een seksdoel geactiveerd is; vrouwen schatten de borsten juist kleiner in als er een seksdoel geactiveerd is. We hebben onze hypothese bevestigd: doelrelevante objecten worden groter of kleiner geschat afhankelijk van wat doelcongruent is. Een vraag die rest is of mensen in impulsieve staat, die gevoeliger zijn voor beloningen (Bechara et al., 2000; Dawe et al., 2004; Martin & Potts, 2004; Patton et al., 1995), objecten meer doelcongruent inschatten. In Experiment 4.4 hebben wij daarom een impulsieve of reflectieve staat geïnduceerd en vervolgens de procedure van Experiment 4.3 herhaald. Zoals verwacht schatten mannen in impulsieve staat de borsten van een vrouw groter in als er een seksdoel geactiveerd is; vrouwen in impulsieve staat schatten de borsten juist kleiner in als er een seksdoel geactiveerd is. Mensen in reflectieve staat vertoonden geen verschil in hun schatting.

Experimenten 4.1-4.4 bevestigen dat doelrelevante objecten niet altijd groter worden geschat, maar zowel groter als kleiner geschat kunnen worden, als dit bevorderlijk is om een doel te bereiken. Groter is niet altijd beter en Experimenten 4.1-4.4 suggereren dat ons perceptuele systeem het ons makkelijker probeert te maken door obstakels en concurrentie te minimaliseren. Dit optimistisch inschatten van het formaat van doelcongruente objecten blijkt vooral op te gaan voor mensen in impulsieve staat, wat mogelijk kan verklaren waarom mensen in impulsieve staat meer risicovolle beslissingen nemen.

Temperatuur

In Hoofdstukken 2, 3, en 4 hebben we onderzocht waarommensen in impulsieve staat meer risicovolle beslissingen nemen. In een volgende serie onderzoeken beschreven in Hoofdstuk 5, wilden we een manier vinden om gedrag te veranderen. Wat ons opviel was dat er in verschillende talen aanwijzingen zijn dat toegeven aan verleidingen en temperatuur wellicht gerelateerd zijn. Mensen geven, bijvoorbeeld, toe aan een verleiding 'in the *heat* of the moment' en als mensen een seksuele verleiding moeten weerstaan wordt een koude douche aangeraden. Wij hebben onderzocht of temperatuur een factor is die risicogedrag van mensen mogelijk beïnvloedt. Als dit zo is dan zou temperatuur mogelijk aangepast kunnen worden om risicogedrag te beïnvloeden.

Er is nog weinig onderzoek gedaan naar de relatie tussen temperatuur en risicobeslissingen, maar al naar de relatie tussen temperatuur en agressie. Zowel experimentele als studies in het veld hebben associaties gevonden tussen hoge temperaturen en agressief gedrag (Anderson, 1989; Anderson, Anderson, Dorr, DeNeve, & Flanagan, 2000; Rotton & Cohn, 2004). Er zijn verschillende redenen gegeven waarom hogere temperaturen tot meer agressie zouden kunnen leiden. Hogere temperaturen leiden tot negatief affect, en negatief affect bijvoorbeeld, leidt tot meer frustratie (zie voor een overzicht Anderson, 1989). Meer recent onderzoek laat echter zien dat een vermindert vermogen om impulsen te onderdrukken een rol zou kunnen spelen. Honkbalspelers nemen bijvoorbeeld eerder wraak bij hogere temperaturen, maar alleen na een provocatie (Larrick, Timmerman, Carton, & Abrevaya, 2011). Mogelijk leiden hogere temperaturen tot een impulsieve staat, in vergelijking met lagere temperaturen.

In Experimenten 5.1 en 5.2 hebben we het effect van temperatuur op risicobeslissingen onderzocht. In het eerste experiment hebben we temperatuur gemanipuleerd door mensen een beker warme of koude chocolademelk te geven (Williams & Bargh, 2008); in het tweede experiment door de temperatuur in de onderzoeksruimtes te variëren. In het

eerste experiment kregen deelnemers vervolgens een foto van iemand van de andere sekse te zien, die zij beoordeelden op onder andere aantrekkelijkheid. In het tweede experiment hebben we de aantrekkelijkheid van de persoon op de foto gemanipuleerd. In beide experimenten lazen de deelnemers vervolgens het scenario dat ook is gebruikt in de experimenten in Hoofdstuk 2 (bv. MacDonald et al., 1996).

In Experiment 5.1 als deelnemers de persoon op de foto als aantrekkelijk beoordeelden (en er sprake was van een verleiding) dan namen zij bij hogere temperaturen meer risicovolle beslissingen dan bij lagere temperaturen. Als de persoon op de foto als onaantrekkelijk werd beoordeeld (en er dus geen sprake was van een verleiding) was er zoals verwacht geen effect van temperatuur op risicobeslissingen. In Experiment 5.2 vonden we vergelijkbare resultaten. Als deelnemers een aantrekkelijk persoon op een foto te zien kregen namen zij meer risicovolle beslissingen bij hogere dan bij lagere temperaturen. Ook als deelnemers een onaantrekkelijk persoon op een foto te zien kregen was er geen effect van temperatuur op risicobeslissingen. Deze bevindingen zijn in lijn met onze verwachtingen en laten zien dat mensen meer risicovolle beslissingen nemen bij hogere temperaturen.Het hoofd koel houden lijkt dan ook letterlijk te werken. Het aanpassen van de temperatuur is mogelijk dan ook een manier om risicobeslissingen te beïnvloeden als alternatief voor het proberen om de kracht van een verleiding af te zwakken of de kracht van de langetermijndoelen te versterken.

Conclusies

Waarom leidt impulsiviteit tot meer risicovolle beslissingen? Op basis van de studies in dit proefschrift kan worden geconcludeerd dat het niet zo is dat mensen in impulsieve staat langetermijndoelen helemaal niet meer meenemen in beslissing. Zelfs in impulsieve staat nemen mensen minder risicovolle beslissingen als zij hun langetermijndoelen belangrijker vinden. Sterker nog, als mensen geconfronteerd worden met een sterke verleiding

dan nemen mensen in impulsieve staat *minder* risicovolle beslissingen. Een verklaring voor waarom mensen in impulsieve staat meer risicovolle beslissingen nemen die op basis van onze bevindingen wel plausibel is, is een verschil in het richten van de aandacht tussen mensen in impulsieve en reflectieve staat. Mensen in impulsieve staat richten hun aandacht op saillante informatie, terwijl mensen in reflectieve staat hun aandacht verdelen over de aanwezige informatie. Omdat verleidelijke informatie vaak saillant is bestaat de kans dat beslissingen van mensen in impulsieve staat overwegend door deze informatie wordt beïnvloed. Een andere mogelijke verklaring is dat de perceptie van mensen in impulsieve staat meer gekleurd wordt door de doelen die zij nastreven. Zowel aandacht als perceptie van bepaalde informatie beïnvloedt mogelijk risicobeslissingen. Het goede nieuws is dat de temperatuur verlagen een simpele manier is om mensen minder impulsief te maken. 'In the heat of the moment' focussen mensen in impulsieve staat de aandacht en is perceptie vertekend, maar we kunnen de heat afkoelen om zo gedrag te beïnvloeden.

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Curriculum Vitea

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