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CHAPTER 25

Implicit Cognition in Health Psychology

Why Common Sense Goes Out the Window

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In the 1990s Tara MacDonald and colleagues performed a beautiful series of experiments that nicely illustrate a number of the central concepts in this chapter. The goal of these studies was to investigate systematically why seemingly sensible people (students, admittedly only males)[1] often reported to have unprotected sex after drinking alcohol while knowing the dangers in the era of HIV and other sexually transmitted diseases. Interestingly, many of the same students, when asked in a survey, indicated that it would be very foolish to have sex without a condom. This discrepancy illustrates a central issue in health psychology: why many people in specific situations act against their own health-related interests or, as MacDonald and colleagues put it, "why common sense goes out of the window" (MacDonald, Zanna, & Fong, 1996). In this chapter, we argue that dual-process models may provide interesting answers to this important question.

Let us consider the experiments first. MacDonald and colleagues selected students who did not have a steady relationship and who regularly used condoms. Participants received alcohol or not[2] and were shown a video. In this video, two students, Mike and the attractive Rebecca, go out on a date and then go back to her apartment. There they begin to kiss on the couch and continue to make out until Mike awkwardly discloses that he did not bring any condoms. Rebecca states that she also does not have condoms but is taking birth control pills. They discuss whether it is possible to obtain a condom, decide that this is not feasible, and discuss their sexual history. Mike states that he is "clean" and Rebecca states that she does not "sleep around." At the end of the video, Mike asks Rebecca, "What do you want to do?" Rebecca responds, "I don't know. What do *you* want to do?" The video then ends with a freeze frame, and participants complete the dependent measures while viewing the freeze frame. Across seven studies, it was found that male participants were more willing to engage in unsafe sex when they were in the alcohol condition *and* sexually aroused by the video (MacDonald, Fong, Zanna, & Martineau, 2000; MacDonald, MacDonald, Zanna, & Fong, 2000; MacDonald et al., 1996).[3]

This example illustrates some of the central concepts available to help explain a wide range of perplexing findings in health psychology. First, there is an internal conflict between the "cold," or rational, attitudes and beliefs about the health behavior (it is foolish not to use condoms) on the one hand and the actual intentions and behavioral inclinations in a tempting, or "hot," situation on the other. We argue that similar internal conflicts are central in many areas of health psychology, often (but not always) with associative, "implicit" processes triggering approach reactions, while "reflective" processes "know better" and suggest re-

frain from approach. Importantly, participants can differ regarding both their impulsive or associative processes and the contents and strength of their reflective or controlled processes, and both can be assessed (Hofmann, Friese, & Wiers, 2008).

Another key feature illustrated by this research is that "cold" measures (e.g., a survey of attitudes and intentions regarding unsafe sex) may be suboptimal to predict actual health behavior in "hot" situations. People (especially the "usual subjects": undergraduate students) often know rather well what is good or bad for their health; the problem is that they still engage in a number of unhealthy and risky behaviors, such as binge drinking, smoking, binge eating, unhealthy eating, unsafe sex, and so on. Recent research has confirmed the relevance of this discrepancy for health psychology: In a "cold" state, people underestimate the influence of "hot cognitions" under influence of visceral states, such as hunger, thirst, sexual arousal, and craving, a phenomenon called the "cold-to-hot empathy gap" (Nordgren, van der Pligt, & van Harreveld, 2007, 2008; Sayette, Loewenstein, Griffin, & Black, 2008). The underestimation of "hot" inclinations is likely to play a role in the underestimation of the risk of becoming addicted and of risky situations in quitters (Sayette et al., 2008) as well as in judgments of impulsive ("irrational") behaviors of oneself and of others. This is likely to contribute to the negative stigma of impulsive problem behaviors such as addiction and obesity. In a "cold" state, it appears far more difficult to feel empathy with impulsive drives compared with a judgment made in a "hot" state (Nordgren et al., 2007).

Note that we are not arguing that it is useless to assess "cold" attitudes or intentions but rather that they are insufficient alone to predict health behaviors in "hot" situations. We need indices of the associative processes that are triggered in a "hot" situation. One way to conceive the large number of recently developed implicit or indirect measures is as mini-experiments aimed at triggering and assessing spontaneous associative processes in reaction to relevant stimuli, similar to the video used by MacDonald and colleagues (De Houwer, 2006). The difference is that indirect measures usually provide simpler stimuli (pictures or words presented one at the time rather than a tempting video) to which participants have to react fast, by providing either a first association without reflection or a speeded response (see Sekaquaptewa, Vargas, & von Hippel, Chapter 8, Teige-Mocigemba, Klauer, & Sherman, Chapter 7, and Wentura & Degner, Chapter 6, this volume). In the studies of MacDonald and colleagues, participants indicate their subjective arousal and intention to have unprotected sex in this situation on a questionnaire. Hence, the example should not be read as indicating that implicit measures always assess "hot" processes and explicit measures "cold" processes. Rather, implicit measures aim to elicit the same processes as are operating in the actual "hot" situation, but, of course, that claim should be validated (De Houwer, 2006; De Houwer, Teige-Mocigemba, Spruyt, & Moors, 2009). In other words, the whole MacDonald experiment can be taken as an analogy of what implicit measures try to do, irrespective of the fact that a simple attitude scale is used to assess the "hot" cognitions. Note further that it is incorrect to equate implicit measures to reaction time measures, as witnessed by memory association and affect misattribution measures (Payne, Cheng, Govorun, & Stewart, 2005; Payne, Govorun, & Arbuckle, 2007; Payne, McClernon, & Dobbins, 2007; Stacy, Leigh, & Weingardt, 1997; Stacy, Newcomb, & Ames, 2000). Finally, this condom-use example illustrates a common theme in health psychology: Many unhealthy behaviors occur in combination; for example, unsafe sex occurs frequently after alcohol use.

A SHORT REVIEW OF HEALTH PSYCHOLOGY APPROACHES TO PREDICT HEALTH BEHAVIOR

In our view, the idea to explicitly incorporate the notion of impulsive processes in health behavior is a relatively new one. Initially, the field of health psychology has received much stimulation and is still somewhat dominated by the application of reasoned action approaches (Ajzen, 1991; Fishbein & Ajzen, 1975) to health-related decisions and behaviors such as with protection motivation theory (Rogers, 1983) or the health belief model (Janz & Becker, 1984). One common element of these models, in a nutshell, is the assumption that health behavior is the result of cognitive appraisal processes of the (1) expectancy and value of potential health threats and (2) possible coping responses. From these appraisal processes, a behavioral intention to avoid a health threat and to engage in healthy behavior may be formed. Importantly, these appraisal processes and the resulting goal-directed behavior are typically seen as reasoned, conscious, and intentional acts that require a person's willpower in order to be effective. Therefore, these models largely speak to reflective processes by which health behavior is regulated. They typically do not, however, integrate the no-

tion of impulsive influences on behavior (in other words treating impulsive influences on behavior as error variance). This neglect may be one reason why the predictive validity of reasoned action models is typically far from perfect (Conner & Sparks, 2002; Stacy, Bentler, & Flay, 1994).

A second general approach has been to get to know better the situational and dispositional risk factors that play a role in determining health-related behavior outcomes. On the one hand, social psychology-oriented health research has identified the situational risk factors under which people are particularly prone to engage in unhealthy behavior, such as when they are depleted of self-regulatory resources (Vohs & Heatherton, 2000), cognitively occupied (Ward & Mann, 2000), drunk (Cooper, 2002; Steele & Josephs, 1990), or emotionally distressed (Baucom & Aiken, 1981). Personality research, on the other hand, has helped to identify stable traits that are associated with risky health behaviors, such as high impulsivity (Waldeck & Miller, 1997), high negative emotionality (Caspi et al., 1997), low conscientiousness (Bogg & Roberts, 2004), and low self-control (Tangney, Baumeister, & Boone, 2004). However, note that these findings typically do not address the *processes* by which successful or unsuccessful health behavior is brought about. For instance, if we find that people who consumed alcohol are more likely to engage in risky sex than sober people, we typically infer that they must have been driven more strongly by their sexual impulses (and less by reflective considerations), but the mere group difference does not tell us much about the underlying processes that drive behavior in such circumstances.

The idea that health behavior is not solely the result of reasoned processes and planning has led to extensions of reasoned action approaches in various directions and degrees with the aim of tapping more strongly into irrational, impulsive influences of health behavior. For instance, it has been suggested to assess *behavioral willingness,* that is, whether one might be willing to perform a risky behavior despite the fact that one originally intends not to engage in it (Gibbons, Gerrard, Blanton, & Russell, 1998; Gibbons, Gerrard, & Lane, 2003). Other researchers have proposed to extend reasoned approaches on an affective dimension by using more affect-based (as opposed to cognitively based) attitude measures (Kiviniemi, Voss-Humke, & Seifert, 2007) or assessing the anticipated emotional consequences (i.e., regret) of indulgence in health behaviors that are immediately gratifying but problematic in the long run (Richard, De Vries, & van der Pligt, 1998). Moreover, it has been suggested to incorporate the notion of habit (i.e., routine past behaviors) in order to account for additional variance not accounted for by markers of intentional goal pursuit (Aarts, Verplanken, & van Knippenberg, 1998; Verplanken, Aarts, van Knippenberg, & Moonen, 1998). Note that all these approaches tend to rely on self-report methodology. Hence, incremental predictive validity may be limited by the known problems of introspective access or by self-presentational concerns associated with this method.

THE PRESENT FRAMEWORK

Relatively few attempts have been made thus far to apply the insights and the measurement technology that emanated from social cognitive dual-system or dual-process models (Evans, 2008; Smith & DeCoster, 2000; Strack & Deutsch, 2004) to models of health behavior (Hofmann, Friese, & Wiers, 2008; Marsh, Johnson, & Scott-Sheldon, 2001; Tiffany, 1990; Wiers, Bartholow, et al., 2007). This chapter is part of this ongoing endeavor to bridge this gap. Specifically, we argue that an integrative approach should consider at least four crucial (sets of) variables that together predict individual differences in health behaviors (see Figure 25.1):

1. Individual differences in associative (or impulsive) processes in a given health domain.
2. Individual differences in reflective processes, including executive control (EC) capacity as well as motivation to control (fueled by beliefs and attitudes).
3. Global individual differences in personality across domains (e.g., impulsivity).
4. The health behavior–relevant situation.

The core of the model is a dual-process model that distinguishes between associative/impulsive processes and reflective processes (1, 2). However, we want to emphasize that these processes interact not only with each other to determine health behaviors but also with situational variables (4), which may bias information processing more toward either associative or reflective processing. Furthermore, there are individual differences across specific health behaviors that can be conceptualized as personality variables (3) but from the present framework also as relatively stable individual differences in associative and controlled processes (e.g., tendency toward approach or avoidance, tendency to react on impulse or on further reflection).

How do these variables interact? At the heart of dual-process models applied to health psychology is conflict, between associative (or "impulsive," often affective) processes in response to health-relevant stimuli (depicted in the bottom part of the figure) and controlled (or reflective) processes depicted in the top of the Figure 25.1. In line with Deutsch and Strack (2006), we believe that the internal conflict between associative and reflective processes is central in both addictive behaviors and in many other health behaviors (Hofmann, Friese, & Wiers, 2008) as well as in many areas of psychopathology (Teachman, Cody, & Clerkin, Chapter 26, this volume; Wiers, Teachman, & De Houwer, 2007). In many cases, the associative process will activate approach tendencies, while reflective processes will suggest that there may be good reasons to refrain from approach (with many examples in addictive behaviors, obesity, risky sex, etc.). However, in some cases of health psychology, this pattern may be reversed, for example, when proactive health action is needed (e.g., exercise, health checkups, wearing seat belts), automatically activated associations (e.g., tired: watch TV) may interfere with health behaviors. In some health behaviors, including coping with chronic pain, automatically activated avoidance may be the primary problem (see later discussion). In some cases, a conflict between incompatible associations (e.g., approach and avoidance) may also play a role rather than a conflict between associations steering in one direction and reflection in the opposite direction (de Liver, van der Pligt, & Wigboldus, 2007; McEvoy, Stritzke, French, Lang, & Ketterman, 2004; Wiers, Houben, Smulders, Conrod, & Jones, 2006).

Regarding the reflective pathway, traditional models of health psychology are largely applicable and they predict variance in a variety of health behaviors. When participants (often students!) are motivated and able to do so, they can estimate pros and cons of behavioral options in view of their goals in life (e.g., not become fatally ill). From a dual-process perspective, reflective processes are seen as evolutionarily relatively recent processes that serve to shield goal-directed behavior from interfering associative processes (Baddeley, 2007; Evans, 2008; Hofmann, Friese, & Wiers, 2008; Strack & Deutsch, 2004). The reflective system uses higher order mental operations, which provides flexibility and control over decisions and actions. These operations include executive functions such as making reasoned judgments and evaluations, putting together strategic action plans for goal pursuit, and inhibiting or overriding prepotent responses (e.g., impulses or habits). They are achieved through relatively slow, controlled processes based on symbolic representations and operations (Evans, 2008; Smith & DeCoster, 2000; Strack & Deutsch, 2004). Importantly, for present purposes, people differ in their EC capacity, which leads to the prediction that individuals with relatively low EC capacity are more prone to act on strong impulses, a hypothesis recently confirmed in a series of studies (Grenard et al., 2008; Hofmann, Friese, & Roefs, 2009; Hofmann, Gschwendner, Friese, Wiers, & Schmitt, 2008; K. Houben & Wiers, 2009; Thush et al., 2008; Wiers, Beckers, Houben, & Hofmann, 2009).

How should constructs from the impulsive and reflective systems be measured? Reflective processes are traditionally assessed with measures of verbal self-report (questionnaires), assessing beliefs, expectancies, attitudes, self-efficacy, and related constructs. The recent surge of implicit or indirect measures was fueled by the idea that these measures could tap into associative or impulsive processes directly without interference and censorship of the reflective system. It is now clear that current indirect measures are not process-pure indicators of associative processes only, and estimates can be made of the contributions of associative and controlled processes (Conrey, Sherman, Gawronski, Hugenberg, & Groom, 2005; Sherman et al., 2008). Similarly, questionnaire measures are not process-pure measures of reflective processes, as evidenced by influences on test scores by seemingly trivial variations in item orders (Schwarz, 1999).

The third set of variables concern personality factors. Personality traits such as impulsivity or behavioral undercontrol have been related to addictive behaviors for a long time (e.g., Sher, 1991; Verdejo-Garcia, Lawrence, & Clark, 2008) as well as to other health behaviors, including obesity (Nederkoorn, Smulders, Havermans, Roefs, & Jansen, 2006) and sexual risk taking (Hayaki, Anderson, & Stein, 2006). In addiction research, it has been difficult to tear apart to what extent these traits were predisposing factors or the result of addictive behaviors. We propose that both are true: Some traits can increase the vulnerability for many problematic health behaviors (including impulsivity, sensation seeking), but people can also become more impulsive as a result of substance use during adolescence, which may increase risks for other problematic health behaviors (see later discussion). Individual differences in personality may be related to genetic factors, environmental influences, or interplay between these factors (Caspi & Moffitt, 2006). Genetic differences can moderate

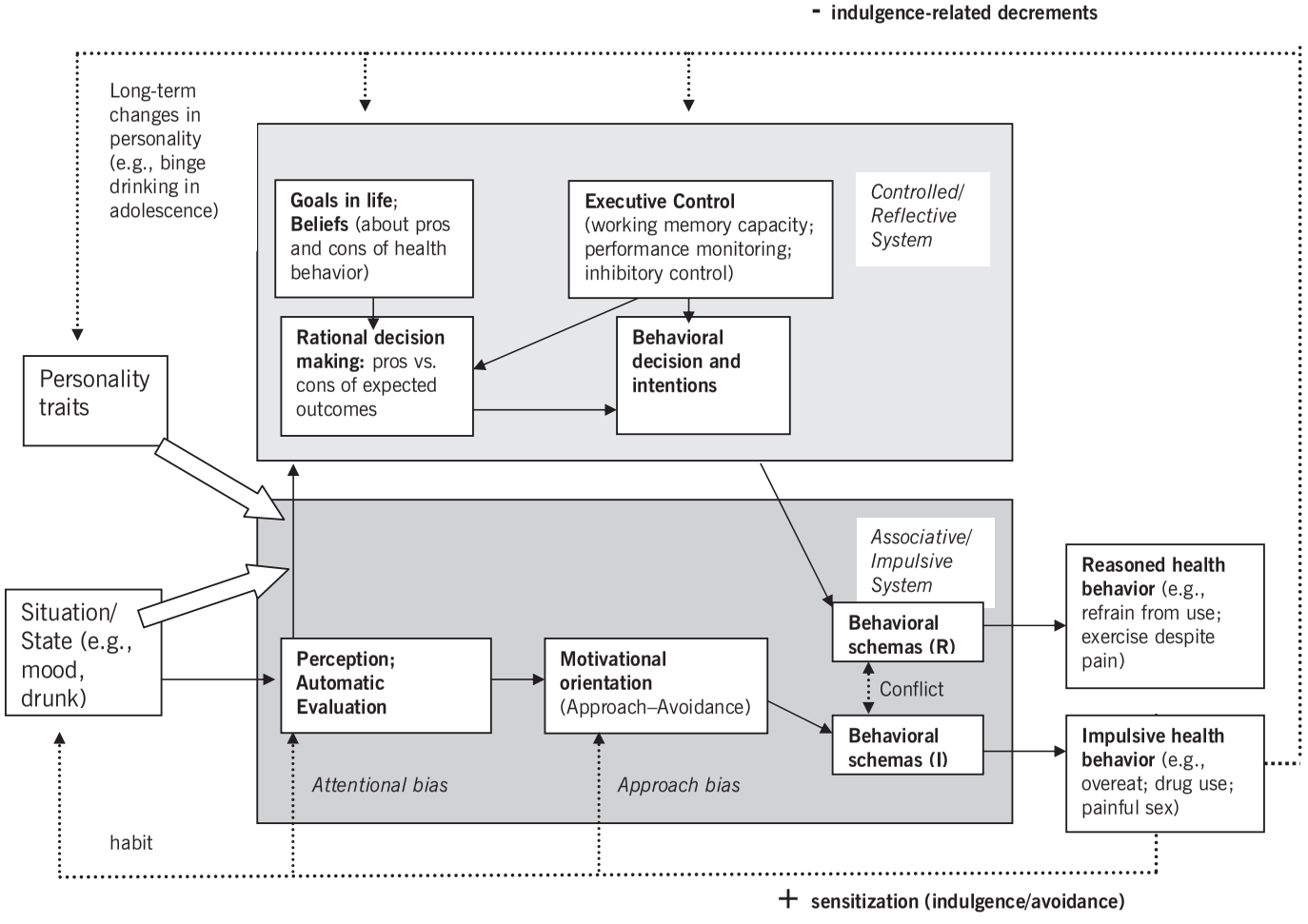

FIGURE 25.1. A general dual-process model of health behaviors. At the core of the model is that health behaviors are predicted by the combined input of associative or impulsive processes and controlled and reflective processes, where the relative contribution of these two classes of processes is determined by personality and situational factors. Note that the two dashed feedback loops indicate that, as a result of the (health) behavior, the cognitive processes are influenced, which will affect future behavioral tendencies.

automatic appetitive reactions, as was recently demonstrated (Filbey et al., 2008; Wiers, Rinck, Dictus, & van den Wildenberg, 2009), and can also moderate individual differences in the ability to self-regulate impulses (M. D. Robinson, 2007). Individual differences in self-control ability can at least partly be related to environmental factors such as upbringing and education, as early interventions in self-control (Blair & Diamond, 2008; Diamond, Barnett, Thomas, & Munro, 2007) and self-regulation of emotions demonstrate (Izard et al., 2008). Religion, likewise, strongly influences the way people deal with temptations; religiosity has been shown to be a protective factor for many health behavior problems, including addictions (Baumeister & Exline, 1999; Wills, Gibbons, Gerrard, Murry, & Brody, 2003).

The fourth variable is the health behavior–relevant situation. The role of tempting situations has long been recognized in addiction research (e.g., Marlatt & Gordon, 1985) and in other health behaviors, including obesity (Irving & Neumark-Sztainer, 2002). A major difficulty in many health psychological problems is the high prevalence of tempting situations in modern society. Moreover, regarding relapse, recent research on conditioned appetitive motivation has stressed the importance of contextual cues, both in addiction and eating behaviors (Thewissen, van den Hout, Havermans, & Jansen, 2005; Van Gucht, Vansteenwegen, Beckers, & Van den Bergh, 2008). Note that acute intoxication as well as other temporary effects on the balance between associative and reflective processes (e.g., fatigue or ego depletion resulting from a previous task, which temporarily depleted control resources; Baumeister, 2003) is also conceived of in our framework as a situational factor. Similarly, enhanced internal motivational states (e.g., hunger, craving after deprivation; Nordgren et al., 2007) are also conceived of here as situational factors (in the latter case often triggered by a physical environment, interacting with the motivational system).

Finally, regarding the general framework, we emphasize the relevance of the feedback loops (see Figure 25.1). Health-related behaviors can influence subsequent appraisals of a situation. This can happen in a variety of ways: It can bias (1) subsequent associative processing (lower feedback loop) and/or (2) subsequent reflective processing (upper feedback loop). Considering the lower feedback loop, as a result of many drinking occasions, a heavy drinker's attention is more readily captured by stimuli previously associated with alcohol (attentional bias; Cox, Fadardi, & Pothos, 2006; Field & Cox, 2008), and approach tendencies can be automatically triggered (Field, Kiernan, Eastwood, & Child, 2008; Wiers, Rinck, et al., 2009). Through repeated experience, situational cues may also directly trigger overlearned behavioral schemas (e.g., habitual actions) without necessarily activating affective processes (Everitt & Robbins, 2005; Tiffany, 1990). Regarding the upper feedback loop, there is increasing evidence that alcohol and drug use negatively affect reflective processes, especially during adolescence: The still-developing ability to self-regulate impulsive action tendencies is negatively affected, and motivation to perform alternative behaviors is impeded (Volkow, Fowler, & Wang, 2004; Wiers, Bartholow, et al., 2007). Both feedback loops may be especially strong for addictive behaviors, but their effects may affect subsequent addictive behaviors as well as other health-related behaviors (e.g., through reduced EC). The reason for the stronger feedback loops as a consequence of addictive behaviors is that pharmacological properties of drugs may enhance the normal effects of repeated experience, which is thought to subsequently enhance appetitive biases (Franken, 2003; Robinson & Berridge, 2003; Volkow et al., 2004; Wiers, Bartholow, et al., 2007) as well as habit formation (Everitt & Robbins, 2005). The latter process may be particularly relevant in smoking, given the important role of nicotinic receptors in habit formation (Davis & Gould, 2008). Taken together, the general picture is that addictive behaviors involve many of the same processes as other health behaviors, with differences being related to pharmacological moderation of the feedback loops involved. Because of these enhanced feedback loops and the acute effects of alcohol and many other drugs of abuse on health behaviors (as illustrated in the opening example), substance use and misuse may play a more central role in health psychology than often appreciated: not only as "just another health behavior" but also as a moderator of cognitive processes involved in other health behaviors. For example, automatic sweet attitudes better predict sweet consumption after alcohol than when participants are sober (Hofmann & Friese, 2008).

In the remainder of this chapter, we review what is known about the "four ingredients" (associative processes, reflective processes, personality, risky situations) and their interplay in a number of domains: substance use and misuse, overeating and dieting, sexual risk taking, and coping with pain and stress. In line with the emphasis of this Handbook on *implicit* social cognition, the emphasis in each section is on associative processes, but we also briefly consider the other factors (reflective

processes, personality, and situation). In the final section, we discuss implications for interventions and avenues for further research.

SUBSTANCE USE AND MISUSE

Associative Processes

In recent years, many studies have been conducted using either varieties of memory paradigms or reaction time paradigms to assess associative processes. We first briefly introduce the memory measures and findings with these measures in relation to substance use and misuse. We then turn to more commonly known RT measures.

A number of studies of health behavior have used measures and paradigms that assess associations and implicit processes without reliance on response latency methods. In these paradigms, implicit processes are revealed in the absence of requests for deliberate or conscious recollection of the target association or content, consistent with traditional definitions of implicit memory (Graf & Schacter, 1985). Assessment methods used in these studies have focused primarily on either production responses or memory tests that have consistently been linked to implicit processes in basic research on memory (see Stacy, Ames, & Grenard, 2006). Some of the memory measures used in health psychology are identical to those that have detected implicit processes in more basic research, in which manipulations of test instructions and study populations (e.g., amnesic vs. nonamnesic patients) have demonstrated implicit processes. Memory paradigms that manipulate study and test trials have often been structured to reveal the operation of implicit or automatic processes. Examples of such paradigms include illusory memory (e.g., Roediger, Watson, McDermott, & Gallo, 2001), process dissociation (Jacoby, Debner, & Hay, 2001), extralist cued recall (Nelson, McEvoy, & Pointer, 2003), and a variety of "priming" designs (e.g., Zeelenberg, Pecher, Shiffrin, & Raaijmakers, 2003) that manipulate exposure to the target materials and type of test instructions (e.g., indirect or direct). A few of these paradigms have been used in health areas, particularly in research on alcohol use and misuse. For example, Reich and colleagues used the Deese-Roediger-McDermott (Deese, 1959; Roediger et al., 2001) illusory memory paradigm to determine whether effects of alcohol are remembered as cohesive structures and whether an alcohol context automatically activates these structures (Reich, Goldman, & Noll, 2004). Their results revealed that heavier, but not lighter, drinkers showed higher levels of false recognition to alcohol expectancy adjectives in response to an alcohol setting (naturalistic bar) compared with a neutral condition. This is consistent with the operation of an automatic template model of alcohol expectancies and with the implicit activation of alcohol concepts that were never explicitly presented.

Fillmore, Vogel-Sprott, and Gavrilescu (1999) used the process dissociation procedure to show that acute alcohol use administered experimentally impaired control processes but did not affect automatic processes. Krank and colleagues adapted the "famous name" memory paradigm (Jacoby, Woloshyn, & Kelley, 1989) to show that attempted negation of myths about the benefits of alcohol paradoxically increased the self-generation of these myths as expected outcomes of the behavior (Krank, Ames, Grenard, Schoenfeld, & Stacy, 2008). Findings were consistent with unconscious, and counterproductive, effects of negation, predicted by dual-process models (cf. Deutsch, Gawronski, & Strack, 2006; Deutsch & Strack, 2006). Stacy (1994) used an extralisted cued-recall procedure (Nelson et al., 2003; Nelson, McKinney, Gee, & Janczura, 1998) to show that previous experience with alcohol predicted the effectiveness of extralist cues (not presented at study) in a surprise recall test of ambiguous alcohol words presented in the earlier exposure trial. Results were consistent with findings that previous experience with a behavior influences the strength of its associations in memory (Stacy et al., 1997) and with implicit activation of associations with nonpresented cues during exposure trials (Nelson et al., 1998).

Word production procedures in health-related research on implicit processes have most commonly used word association tests with indirect test instructions, providing an indirect assessment of associations in memory between different health behaviors and other concepts. Word association tests are valuable for this purpose because evidence across diverse paradigms from basic cognitive research shows that these tests are capable of detecting implicit conceptual memory (Seger, Rabin, Desmond, & Gabrieli, 1999), and associations uncovered in these tests strongly predict the activation of cognitions across a wide range of experimental procedures (for a review, see Stacy, Ames, & Grenard, 2006). Indeed, it is a challenge to find another test of association that predicts such a wide range of responses. Indicators of associations compiled from these tests also form common factors with sufficient internal consistency and good predictive utility in research on health

behavior (e.g., Ames, Grenard, Thush, Sussman, & Wiers, 2007; Stacy, 1997; Stacy, Ames, Ullman, Zogg, & Leigh, 2006).

Word association tests in this literature have typically used either free-association instructions, in which the participants are requested to write the first word that comes to mind in response to a cue word, phrase, or picture (e.g., feeling good: _____), or verb-generation instructions, in which respondents react with the first action word or behavior that comes to mind in response to the cue. Either procedure has the capability of including cues that are neutral as well as those linked to target behaviors, making within-subject analysis possible. The procedures also allow for an assessment of *relative cognition* because the participant is free to answer with any response that comes to mind. This provides an index of *relative* spontaneous memory for a potentially enormous set size of alternatives not captured by any present test of response latency or other test format (Ames et al., 2007; Thush et al., 2007). It is important to emphasize that the nature of test instructions in word association is *critical*. Indirect-association instructions, asking respondents to list the first word that comes to mind, lead to dramatically different results than asking participants to recollect (Stacy, Ames, & Grenard, 2006). The basic findings across a number of studies using indirect test instructions and word association is that associative responses to cues, using indirect tests that do not mention the target behavior, are consistently predictive of alcohol and drug use (for reviews, see Ames, Franken, & Coronges, 2006; Stacy, Ames, & Grenard, 2006). Importantly, some studies have revealed predictive effects in prospective studies in which previous habits and a variety of different confounders have been controlled for (Kelly, Masterman, & Marlatt, 2005; Stacy, 1997). A recent meta-analysis of 89 effect sizes obtained from studies sampling nearly 20,000 participants found that associations assessed with word association procedures had the strongest effects compared with all other measures of implicit processes in addictive behaviors (Rooke, Hine, & Thorsteinsson, 2008). Other measures of associative processes have been developed that rely not on response latencies but on the affective rating of a neutral stimulus (e.g., a Chinese character) preceded by an affective prime. This strategy is the affect misattribution procedure (Payne et al., 2005), which has been successfully applied to predict alcohol use and smoking (Payne, Govorun, et al., 2007; Payne, McClernon, et al., 2007).

In addition to these measures derived from basic memory research, many of the more commonly known RT measures in social cognition research have been used to assess automatic associations with alcohol and drugs. Studies using varieties of the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998), perhaps surprisingly, have consistently demonstrated strong *negative* alcohol associations in heavy drinkers (De Houwer, Custers, & De Clercq, 2006; Houben & Wiers, 2006a, 2006b, 2008; Wiers, van de Luitgaarden, van den Wildenberg, & Smulders, 2005; Wiers, van Woerden, Smulders, & de Jong, 2002) as well as with smoking in smokers (Huijding, de Jong, Wiers, & Verkooijen, 2005; Sherman, Presson, Chassin, Rose, & Koch, 2003; Swanson, Rudman, & Greenwald, 2001). IAT scores of implicit alcohol attitudes also predicted drinking behavior above the variance explained by explicit measures using the same words (Houben & Wiers, 2006a, 2007a, 2007b; Wiers et al., 2002; for a meta-analysis, see Rooke et al., 2008). Note that the direction of this effect is that less strong negative implicit attitudes (or relatively strong positive attitudes) for alcohol predicted drinking behavior. Implicit attitudes have also been studied for some other substances. Research has demonstrated neutral or ambivalent implicit associations with cannabis in cannabis users, while nonusers showed negative implicit associations (Field, Mogg, & Bradley, 2004). Cocaine users have relatively strong implicit associations between cocaine and positive affect (Wiers, Houben, & de Kraker, 2007).

When positive and negative associations were assessed separately, findings indicated that both alcohol (Houben & Wiers, 2006a, 2008; Jajodia & Earleywine, 2003; McCarthy & Thompsen, 2006) and smoking (McCarthy & Thompsen, 2006) are, in fact, automatically associated with both negative and positive affect. Importantly, positive associations predicted unique variance in drinking and smoking behavior above that explained by explicit measures, whereas negative associations were unrelated to drinking and smoking behavior (Houben & Wiers, 2006a, 2008; Jajodia & Earleywine, 2003; McCarthy & Thompsen, 2006). This suggests that positive associations may be more personally relevant, while negative associations may primarily reflect "cultural wisdom" (Houben & Wiers, 2007b). In line with this idea, studies using personalized versions of the IAT, which prevent the activation of extrapersonal associations (Olson & Fazio, 2004), have also demonstrated positive implicit associations with both alcohol (Houben & Wiers, 2007b) and smoking (De Houwer et al., 2006). Moreover, in smokers, positive implicit associations with smoking have also been

demonstrated when focusing on the sensory aspects of smoking (Huijding & de Jong, 2006; Sherman et al., 2003) rather than the negative health-related aspects (Sherman et al., 2003). In line with these findings, studies using the (bipolar) Extrinsic Affective Simon Task (EAST; De Houwer, 2003) have demonstrated ambivalent implicit associations with alcohol (de Jong, Wiers, van de Braak, & Huijding, 2007) and in one study even positive implicit alcohol associations (De Houwer & De Bruycker, 2007) related to drinking behavior.

Besides associations between addictive substances and positive or negative affect (or implicit attitudes), other associations have been studied, including with arousal, the second major dimension in emotion research (Lang, 1995), and between addictive substances and approach tendencies. First, studies that have used the IAT to examine implicit associations between alcohol and arousal have consistently demonstrated strong implicit arousal associations with alcohol (De Houwer, Crombez, Koster, & De Beul, 2004; Houben & Wiers, 2006a; Wiers et al., 2002, 2005). Moreover, these implicit arousal associations predict drinking behavior above explicit measures and are also strongly related to implicit positive associations with alcohol (Houben & Wiers, 2006b; Wiers et al., 2002, 2005). Although no studies have yet examined implicit associations between smoking and arousal, research has demonstrated implicit associations between cannabis and arousal that predict unique variance in cannabis use (Ames et al., 2007). Cocaine users also show stronger implicit associations between cocaine and both arousal and sedation than nonusers (Wiers, Houben, et al., 2007). Second, research has shown that alcohol is also implicitly associated with approach orientation, and that these associations are related to drinking behavior (Palfai & Ostafin, 2003) and show incremental validity with respect to drinking behavior (Ostafin & Palfai, 2006). Similarly, smokers show implicit associations between smoking and approach while nonsmokers do not (De Houwer et al., 2006).

In summary, many studies using memory association measures and RT measures have demonstrated that substance cues trigger different clusters of associations: appetitive associations related to positive, arousing effects and approach motivation, and aversive associations either related to the negative stigma of alcohol and drug use in many cultures or to negative personal experiences. Subtle accents in the environment may determine whether the appetitive or aversive associations are triggered more strongly (Sherman et al., 2003). There are also many studies that show that negative associations are relatively strong but not strongly related to behavior. One reason may be that the time interval between substance use and negative consequences is usually much longer than for positive and arousing consequences. It is noteworthy that results of both open-ended memory association measures and reaction time (RT) tests of associations are related to substance use and that they both uniquely predict substance use (Ames et al., 2007; Thush et al., 2007). Both types of measures show a similar pattern of prediction of substance use, which is moderated by individual differences in executive functions (Grenard et al., 2008; Houben & Wiers, 2009; Thush et al., 2008). Both types of measures have their own merits: The open-ended measures can assess unique patterns of associations in each individual, and RT measures assess predetermined associations, which allows for specific comparisons (e.g., Do arousal associations predict unique variance over and above positive associations?). In sum, research in this area has demonstrated that appetitive associations are positively related to use (moderated by executive functions), and that, in addition to appetitive associations, there are strong negative associations, but there is little evidence that these are predictive of substance use.

Reflective Processes

There is a long history of positive correlations between alcohol use and a variety of cognitive motivational constructs, including positive attitudes (O'Callaghan, Chant, Callan, & Baglioni, 1997), motives (Cooper, Frone, Russell, & Mudar, 1995), and expectancies (Goldman, Del Boca, & Darkes, 1999; Jones, Corbin, & Fromme, 2001). It should be noted that predictive power of these constructs is far stronger when both attitudes or expectancies and alcohol or drug use are assessed cross-sectionally compared with prospective prediction, especially after controlling for previous use (Jones et al., 2001; Sher, Wood, Wood, & Raskin, 1996). Nevertheless, long-term prediction has been found (Stacy, Newcomb, & Bentler, 1991). Negative expectancies, attitudes, and motives to abstain predict some variance in social drinkers but appear to become more important in problem drinkers, related to motivation to change behavior (Jones et al., 2001; Jones & McMahon, 1998).

Second, there is some evidence that a relatively poor development of EC functions may play a role in the etiology of alcohol and drug use, a factor closely related to the personality construct of im-

pulsivity or behavioral undercontrol (Nigg et al., 2006; Peterson, Finn, & Pihl, 1992; Peterson & Pihl, 1990; Wiers, Gunning, & Sergeant, 1998). Recent studies have shed new light on these two aspects of reflective processes: In a series of studies, it was found that measures of implicit appetitive associations (when assessed both with memory association and with RT measures) are better predictors of alcohol and drug use in participants with a relatively low score on a global index of executive functions than in participants with a high score (Grenard et al., 2008; Houben & Wiers, 2009; Thush et al., 2008). The opposite was true in participants with relatively high scores on executive functions: In these participants explicit expectancies were the best predictor of prospective alcohol use (Thush et al., 2008). Similar moderating effects of executive functions have been found for other impulsive behaviors (Hofmann, Gschwendner, et al., 2008; Wiers, Beckers, et al., 2009). In summary, explicit cognitions, including positive attitudes, expectancies, and motives, are strongly related to current drinking and moderately related to prospective drinking. Recent evidence suggests that they may be most important in participants with relatively well-developed executive functions, while relatively automatic appetitive tendencies are a prime predictor in individuals with relatively poor executive functions.

Personality

Behavioral disinhibition is a major personality risk factor for the development of alcohol and drug use problems (de Wit, 2009; Sher, Grekin, & Williams, 2005; Sher, Walitzer, Wood, & Brent, 1991; Verdejo-Garcia et al., 2008). However, other personality risk factors have also been identified, including personality profiles related to internalizing problems (anxiety and depression), and recent research suggests that these different personality risk factors can be successfully targeted in adolescence (Conrod, Castellanos, & Mackie, 2008; Conrod, Stewart, Comeau, & Maclean, 2006). Note that individual differences in EC, which were shown to moderate appetitive impulses (Grenard et al., 2008; Houben & Wiers, 2009; Thush et al., 2008), are also related to personality (with relatively poor EC being related to behavioral disinhibition; see prior discussion).

Risk Situations

As noted early in this chapter, it is hard to underestimate situational factors in alcohol and drug use in the Western world, where especially alcohol use is part of many social situations (as was smoking until recently). Situational influences are also related to developmental period: College campuses have been recognized as a risk situation for alcohol abuse, which peaks during late teen and early 20s (Sher et al., 2005). During these years, drinking usually takes place in the peer group, and the speed of drinking of the peer groups appears to be the strongest predictor of alcohol consumption, with stronger effects than expectancies or personality (Bot, Engels, & Knibbe, 2005; van Schoor, Bot, & Engels, 2008). In some cultures, excessive drinking takes place in these unsupervised peer groups, for example, in recent studies on youth at campsites, consumption of more than 20 alcohol units per day has been reported (van de Luitgaarden, Wiers, Knibbe, & Candel, 2007). It is interesting from this perspective that reduced availability of alcohol has been related to lower levels of alcohol use and problems at the population level (Room, Babor, & Rehm, 2005).

In addition to the large number of contextual factors that promote alcohol and drug use, there are internal situational factors that can promote alcohol and drug use as well, including stress (Sher, Bartholow, Peuser, Erickson, & Wood, 2007), fatigue or ego depletion (Baumeister, 2003), "hot" visceral states or craving (Nordgren et al., 2008; Sayette et al., 2008), and acute alcohol or drug use (Field, Schoenmakers, & Wiers, 2008; Schoenmakers, Wiers, & Field, 2008). From the present model, all of these factors can be viewed as temporarily favoring associative or impulsive processes over reflective or controlled processes.

IMPLICIT COGNITION AND PROTECTION AGAINST HIV/AIDS

Concepts and tasks related to implicit cognition have only rarely been used in research on protection against HIV or AIDS. The dearth of studies on implicit cognition and protection against HIV or AIDS is surprising, given the critical problem of this infection and the palpable implications of implicit or automatic processes to sexual behavior. Given the large situational overlap with substance use (in unsafe sex, alcohol and drug use often play a role) and for reasons of space, we discuss this topic relatively briefly. Among the relatively few studies in this domain, most of the studies on implicit cognition and protection against HIV or AIDS have investigated the correlation between implicit cognition and condom use.

Several different assessment methods have been used in this research, focusing primarily on either memory strategies like word production tests or the IAT. For word production, studies on implicit processes and condom use also have used indirect assessment procedures, as described previously, in which the target behavior is not mentioned in the assessment. Stacy, Ames, and colleagues have used several different word production tests in this topic area, using indirect instructions in which the target behavior is not mentioned. Using ambiguous words as cues (homographs), they found that free-word association responses containing sexual contents predicted unprotected sex in a high-risk sample who should be using condoms because of risky sexual behavior (Stacy et al., 2000). Associative responses did not predict unprotected sex in a low-risk sample and did not predict sex with multiple partners in either sample. A second study (Stacy, Ames, Ullman, et al., 2006) used three different, indirect word production tests to evaluate elicitation of sexual content: letter-completion and two different (behavior and event) phrase-completion tasks. In a high-risk sample of adult drug users, these diverse measures formed a common factor that correlated with having sex with multiple partners in both genders and with (less) condom use in males.

For the IAT, the basic goal has been to measure implicit attitudes toward condom use, not other associations that can be measured with this procedure (e.g., sexual arousal or approach motivation; see prior discussion). Czopp, Monteith, Zimmerman, and Lynam (2004) found that implicit attitudes measured with the IAT predicted intentions to use condoms with main but not casual partners. Marsh and colleagues (2001) used an attitudinal IAT, a self-identity IAT, and evaluative priming (Fazio, Sanbonmatsu, Powell, & Kardes, 1986) in a study of condom use (Marsh et al., 2001). Both IATs were positively related to condom use with casual, but not main, partners, whereas the priming measure was not correlated with condom use. Although these two studies are somewhat contradictory in correlations involving condom use with main versus casual partners, the studies had several procedural differences, such as use of a different form of the IAT. Together, the studies show at least that the IAT can be predictive of condom use and is promising for future research.

Taken together, the studies using indirect measures of cognition to study risky or protective sexual behavior are promising and suggest that investigation by a wide range of alternative measurement paradigms to assess implicit processes may be successful. Such an effort may lead to substantial new insights on risky sexual behavior and provide explanations that depart from traditional models of focus in health research. Regarding the other general variables in our framework, these are largely overlapping with those in the previous section: impulsivity and risk taking (Justus, Finn, & Steinmetz, 2000; Lejuez, Simmons, Aklin, Daughters, & Dvir, 2004). Work by Cooper and colleagues has suggested that, in addition to enhancement motives in extroverted and impulsive people, there is also a subgroup of neurotic individuals who engage in risky sex as a means of dealing with negative emotions, similar to the enhancement and coping motives in alcohol use (Cooper, 2002; Cooper, Agocha, & Sheldon, 2000). Furthermore, as for addictive behaviors, working memory capacity has been found to moderate the impact of sexual impulses on sexual behavior (Hofmann, Gschwender, et al., 2008). Finally, as noted for alcohol-related stimuli, it can hardly be underestimated how abundant sexual stimuli are in modern society (Friedman, 1992). Hence, the scarce evidence points to similar risk factors and processes for sexual risk behavior as for substance misuse, but more research in this area is needed.

OVEREATING AND DIETING

What do you think of the famous Belgian chocolate? You probably find it delicious, irresistible even, but you also likely see drawbacks to overeating chocolate, such as weight gain. Which of these associations comes to mind spontaneously: the pleasurable aspects of consumption or the consequences of consumption? Which association determines how much you eat? How do these associations differ among obese people, chronic dieters, and healthy-weight people?

Individual Differences in Associative Processes

Obesity

Obesity is ultimately caused by an energy imbalance: eating too much or expending too little energy for the amount of food eaten (Ravussin & Bogardus, 2000). High-fat foods are the main problem because they are high in energetic density and palatability, thereby easily promoting overconsumption (Schrauwen & Westerterp, 2000). A straightforward hypothesis relating implicit cognition to obesity is that obese people are charac-

terized by spontaneous positive associations with high-fat foods, contributing to their overconsumption. However, as will become apparent, there is not much empirical evidence to support this hypothesis.

On an IAT assessing associations with high-fat versus low-fat foods in obese and healthy weight adults, exactly the opposite was found. All participants had more positive associations with low-fat foods than with high-fat foods, an effect that was even especially pronounced in the obese group (Roefs & Jansen, 2002). This finding was corroborated in a sample of obese children using a personalized version of the IAT. It was found that both obese and lean children had a relative preference for healthy over unhealthy foods (Craeynest, Crombez, Haerens, & De Bourdeaudhuij, 2007). One could argue that these effects are caused by the prominent labels in the IAT (e.g., high fat vs. low fat; cf. De Houwer, 2001). However, similar effects were found using the affective priming paradigm (APP; Roefs, Stapert, et al., 2005) and the EAST (Craeynest et al., 2005). Moreover, using a semantic priming paradigm, it was found that both obese and healthy-weight controls automatically associated palatable high-fat foods with restraint rather than with disinhibition (Werrij et al., 2008). Therefore, the lack of differentiation between obese people and healthy-weight controls on associations with high- versus low-fat foods appears to be a stable finding, obtained using a variety of methodologies.

Chronic Dieting

Chronic dieting is also hypothesized to be related to high-calorie foods, which are often forbidden in diets, being extra desirable (Gendall & Joyce, 2001; Stice, 2002). Here the evidence is somewhat mixed. On an APP and EAST measure, participants showed an automatic preference for palatable over unpalatable foods independent of their dieting status and the fat content of the stimuli (Roefs, Herman, MacLeod, Smulders, & Jansen, 2005). However, when stimuli referring to the caloric density (e.g., fried, steamed) were used in place of food stimuli, chronic dieters exhibited more positive associations with high-calorie content compared with nondieters (Hoefling & Strack, 2008). In addition, using a different type of paradigm (rapid serial visual presentation), chronic dieters, but not nondieters, were found to activate hedonic thoughts when presented with sentences including palatable foods compared with sentences with neutral food (Papies, Stroebe, & Aarts, 2007).

On measures of approach and avoidance, again there is mixed evidence. On the one hand, chronic dieters exhibited a faster approach to both high- and low-calorie foods in comparison to nondieting controls (de Jong & Veenstra, 2007); however, on the other hand, other research demonstrated an ambivalent response. Chronic dieters displayed an equally strong approach and avoidance response to high-fat foods (Fishbach & Shah, 2006). Nondieters in this study exhibited approach behavior toward the high-fat foods. Thus, no evidence was found for approach behavior specifically toward high-fat foods.

Do Automatic Associations with Food Predict Eating Behavior?

Hofmann and colleagues conducted a series of experiments in which they showed that both momentary manipulations of self-control resources and trait cognitive resources moderate the automatic association to behavior link. More specifically, they showed that automatic candy associations were predictive of the amount of candy consumed only when self-control resources were temporarily depleted by an emotion suppression task (Hofmann, Rauch, & Gawronski, 2007) or by alcohol consumption (Hofmann & Friese, 2008). In addition, it was found that measures of executive attention, inhibitory control, and affect regulation acted as moderators. Automatic candy associations were predictive of candy consumption only in participants low in these three factors of impulse control (Hofmann et al., 2009). These effects were independent of an additional moderating effect of body mass index (BMI),[4] indicating that automatic candy associations were significantly positively related to consummatory behavior in high-, but not low-, BMI individuals (Hofmann et al., 2009).

Reflective Processes

In the studies by Hofmann and colleagues just discussed, measures of dietary restraint were negatively related to candy consumption in the control conditions. Thus, when self-control resources were available, participants could stick to their restraint standards, but not when they have less cognitive resources available. This fits well with the typical pattern of results in counterregulation experiments (Herman & Mack, 1975), in which intake is precisely measured in the laboratory in a so-called taste test. Results of these experiments show that restrained eaters can regulate their intake under

normal circumstances. They then eat less than unrestrained eaters. However, when a disinhibitor is present, such as the consumption of a preload (a small portion of food, similar to an appetizer; Herman & Mack, 1975), the induction of an emotional state (Ruderman, 1986), or merely smelling a preload (Jansen & van den Hout, 1991), restrained eaters counterregulate and consume more than the unrestrained eaters.

Personality

Considering that inhibitory control was found to be a moderator of the automatic association to behavior link, it is highly relevant to assess the degree of inhibitory control and impulsivity in obese people. Indeed, it was found that both obese adults (Nederkoorn, Smulders, et al., 2006) and obese children (Guerrieri, Nederkoorn, & Jansen, 2008; Nederkoorn, Braet, Van Eijs, Tanghe, & Jansen, 2006) are more impulsive than healthy-weight controls. This heightened degree of impulsivity in obese participants may cause them to act on positive automatic associations with high-fat food more often.

The Health Behavior–Relevant Situation

Current Western society contains copious reminders for the enjoyment of high-fat, palatable foods, but there is also a conflicting incentive to be thin. Situations differ in the extent to which enjoying high-fat palatable food is emphasized and to which being thin and dieting are emphasized. Roefs and colleagues investigated how these situations would affect automatic associations with high-fat foods using the APP in obese and healthy-weight people (Roefs et al., 2006). The results showed that when eating enjoyment was emphasized (restaurant condition), participants showed an automatic relative preference for palatable, high-fat foods, whereas when health was emphasized, participants preferred low-fat foods. Weight status (obese vs. healthy weight) did not impact results at all.

Consequently, situations seem to influence automatic food associations more strongly than does weight status. The lack of consistent findings of strong positive associations with high-fat foods in obese people and chronic dieters raises the question of whether automatic associations with high-fat foods can explain overeating and obesity at all. Considering that the situation (i.e., the extent to which eating enjoyment vs. health is apparent) does influence automatic associations, it may be that obese people are more often in a situation in which eating enjoyment is primed. In addition, obese people may focus their attention differently than healthy-weight individuals, and their attention may be captured more strongly by these cues. Finally, it may also be that obese people are more likely to act on such automatic positive associations with high-fat foods. There is some evidence for this latter possibility, in that automatic candy associations more strongly affected candy consumption in participants with an above-average BMI compared with those with a below-average BMI (Hofmann et al., 2009).

PAIN AND STRESS

In contrast to substance misuse and obesity, the critical problems in coping with (chronic) low back pain seem related to dysfunctional avoidance rather than approach. Current models emphasize the critical role of specific fear of (re)injury in the maintenance of symptoms and associated disability (Asmundson, Norton, & Vlaeyen, 2004). Following these models, exaggerated fear of pain, movement, or injury will lead to enhanced attentional focus on pain-related sensations and an enhanced tendency to interpret these sensations in a threatening fashion (Vancleef, Peters, & de Jong, 2008). In turn, this will give rise to avoiding many daily activities. In the longer term, such a strategy can lead to increased disability and the development of a vicious cycle between attention to pain-related sensations, fear, pain, and activity avoidance.

Individual Differences in Associative Processes

Despite our advances in understanding the role of fear and avoidance beliefs, a number of important issues remain unsolved. For example, why do some patients persist in avoiding physical activities while knowing that immobility is harmful? Along the same lines, it remains puzzling why some clinicians, in contrast to what they know to be the correct advice and in contrast to what they explicitly proclaim, implicitly and subtly induce (or reinforce) activity-avoiding attitudes in their communication with pain patients. In an attempt to clarify these types of "illogical" behaviors, several authors referred to the possible role of more automatically activated (implicit) attitudes toward pain/movements that may be incongruent with the more deliberate (explicit) appraisals and beliefs (Gheldof, de Jong, Vinck, & Houben, 2004).

It appears that immobility and recuperative quiescence are primitive and "natural" responses to harm and pain (Keay, Li, & Bandler, 2000; Morgan & Carrive, 2001). Accordingly, the tendency to avoid movement in response to pain or injury may be viewed as a rather instinctive and deeply ingrained response stereotype that may well be further strengthened by immediate pain relief and by social models. To the extent that pain-related physical sensations indeed automatically elicit this type of alarming associations and response tendencies in memory, this may help explain why people may refrain from physical activities even when they actually know that physical activities result in positive health outcome.

A recent affective priming study provided evidence that indeed people are generally characterized by a negative automatic attitude toward back-stressing activities (Goubert, Crombez, Hermans, & Vanderstraeten, 2003). The influence of this type of memory associations on people's behavior is assumed to be especially relevant under time constraints (e.g., physicians) or under acute pain or emotions (e.g., in patients). Thus, especially under these conditions, automatic pain–threat associations may give rise to dysfunctional avoidance behaviors and pain-enhancing information processing (in patients) and to inadequate advice (by physicians).

Although recent work showed enhanced self–pain associations in chronic pain patients (Grumm, Erbe, von Collani, & Nestler, 2008), there is no convincing evidence to indicate that the automatic associations between pain or movement and threat are relatively strong in individuals suffering from chronic low back pain. The major difference between patients and healthy volunteers seems, therefore, to reside in the (in)ability to correct or override the automatic negative movement stereotype (de Jong, van den Hout, Rietbroek, & Huijding, 2003). This ability may not only vary as a function of relatively stable personality characteristics such as working memory capacity but also of variable motivational (e.g., absence vs. presence acute pain) and contextual conditions (e.g., absence vs. presence time pressure). The primary importance of automatic associations versus reflective processes and cognitive control may also vary across the various types of pain symptoms. For example, recent research in the domain of tension headaches found evidence for individual differences in associative processes (Armstrong, Wittrock, & Robinson, 2006). Although participants generally displayed automatic associations between headache and negative evaluations (regardless of headache complaints), these associations were particularly strong among headache patients. Obviously, it remains to be seen whether these automatic associations have a causal influence. As a first step, it would be interesting to test the prognostic value of these associations for future headaches and to see whether these associations reduce in strength following treatment (cf. Grumm et al., 2008).

Pain is also critically involved in dyspareunia (pain during sexual intercourse). In the vast majority of women suffering from dyspareunia, pain is located at the entrance of the vagina and, therefore, directly interferes with sexual intercourse. The observation that women with dyspareunia report more negative affect, less positive affect, and less subjective arousal than controls to exposure to sexual stimuli suggests that, at least at the explicit level, negative fear-related beliefs regarding sexual intercourse are present in symptomatic women (Payne, Binik, Amsel, & Khalife, 2005). In line with information-processing models of sexual arousal, it has been proposed that the prospect of penile–vaginal intercourse may also automatically activate fear-related associations that are likely to interfere with the development of sexual arousal (Laan & Janssen, 2007). In turn, this would further aggravate the dyspareunia-related complaints.

In apparent support of this view, women with dyspareunia showed delayed responding toward pain words in the context of a color-naming interference task (Payne et al., 2005) as well as toward sexual pictures (irrespective of required response) in the context of an affective Simon task (Brauer, de Jong, Kuile, Huijding, & Laan, 2009). This enhanced interference effect has been explained in terms of enhanced vigilance and selective attentional bias (Payne et al., 2005). However, the affective Simon effects indicated that, regardless of their persistent intrusive painful intercourse experiences, symptomatic women displayed relatively positive rather than negative automatic associations with sexual stimuli (Brauer et al., 2009). At the self-report level, however, affective associations were far less positive and more negative for women with dyspareunia than for controls. This may indicate the relevance of conscious appraisal and deliberate rather than automatic processes in the maintenance of dyspareunia.

The apparent robustness of positive automatic associations in dyspareunia is consistent with emotion theories, stating that species' survival requires that emotionally significant stimuli are

processed by automatic mechanisms, which immediately activate physiological responses (Lang, Bradley, & Cuthbert, 1990). Accordingly, defensive responses are activated when confronted with stimuli that threaten survival (e.g., harm, pain), whereas approach responses are primed by stimuli that promote survival, such as sexual stimuli. In agreement with such view, it has been suggested that there must be a strong link between sexual stimuli and genital responses, and that this link is likely to be highly prepared (in a biological sense) and automatic (in a cognitive sense) (Laan & Janssen, 2007). In line with this, the available evidence suggests that exposure to sexual stimuli automatically elicits a genital response in women with and without dyspareunia, but that in women with dyspareunia the sexual stimulus is deliberately appraised as relatively negative, thereby impeding genital arousal (i.e., lubrication). In turn, this may hamper genital intercourse and promote the generation of pain, resulting in a vicious cycle.

Influence of Automatic Associations and Explicit Cognitions of Health Care Providers

Increasing evidence indicates that physicians' recommendations concerning advisable levels of activity may influence clinical outcomes in terms of decreasing disability (Burton, Waddell, Tillotson, & Summerton, 1999) and encouraging fear-avoidance (Linton, Vlaeyen, & Ostelo, 2002). Accordingly, clinicians' judgments regarding the harmfulness of physical activities and recommendations for return to work or to normal activities were shown to relate to their treatment orientation (biomedical vs. biopsychosocial) (Houben, Ostelo, et al., 2005). Importantly, these recommendations may be based not only on their deliberate convictions but also on automatically activated associations that may well diverge from the explicit convictions. This possibility was demonstrated by Teachman and colleagues in their studies on weight stigma showing that even health care professionals specialized in treating obesity display an implicit antifat bias (Teachman & Brownell, 2001). In a similar vein, nurses treating drug users showed discrepant negative automatic associations with intravenous drug users (von Hippel, Brener, & von Hippel, 2008), which may interfere with providing proper care. Further emphasizing the relevance of differentiating between more deliberate (explicit) and more automatic (implicit) attitudes, specifically implicit attitudes toward intravenous drug users predicted intentions to change jobs in these drug and alcohol treatment nurses. Together, these studies also show how stigma and prejudice can survive on a deeply engrained latent level and may inadvertently influence treatment efficacy despite the therapist's best intentions.

Elaborating on this, subsequent work in the context of chronic pain showed not only that health care providers may be characterized by dysfunctional automatic movement–threat/injury associations but also that these automatic associations may have differential predictive validity for their treatment recommendation (Houben, Gijsen, Peterson, de Jong, & Vlaeyen, 2005). The impact of implicit attitudes can be expected to be especially prominent under time pressure, a condition that is typical for health care situations. Whether attitudinal complexities (automatic vs. deliberated) in clinicians interact with those of their patients and have an influence on the process and outcome of treatment is a virtually unexplored but fascinating area that clearly merits further attention.

Global Individual Differences in Personality across Domains

Anxiety sensitivity (AS) is one of the most prominent personality traits that has been considered as a risk factor for the maladjustment to (chronic) pain because it is characterized by dysfunctional beliefs regarding bodily sensations. Indeed, there is evidence indicating that AS is associated with fear of pain, pain-specific avoidance, and negative pain responses after experimental pain induction (e.g., Keogh & Birkby, 1999). More recently, it has been proposed that the habitual tendency to excessively worry about future injury (injury or illness sensitivity [IS]) may also be involved in chronic pain. In support of this hypothesis, IS was found to be even a better predictor for fear of pain than AS and to be the single best predictor of imminent fear of experimentally induced pain (Vancleef, Peters, Roelofs, & Asmundson, 2006). In a subsequent study, it was tested whether IS may also facilitate the automatic evaluation of pain stimuli as threatening. Using an EAST to test individuals' automatic threat appraisal of pain-related words, it was shown that higher IS levels were indeed associated with more pronounced automatic threat appraisals of health-threatening stimuli (Vancleef, Peters, Gilissen, & de Jong, 2007). Together, the available evidence indicates that IS may contribute to the "chronification" of pain symptoms by influencing both associative and more reflective processes.

The Health Behavior–Relevant Situations

The types of memory associations that are activated may vary as a function of temporary influences such as motivational cues. Hence, patients may react very differently when triggered by differential motivational states. For instance, experimental manipulation of patients' anticipation of future pain (e.g., being faced, or not, with a certain object that has to be lifted immediately) may result in motivational changes influencing the type of associations that are elicited by (the prospect of) particular physical activity (Vlaeyen et al., 1999). In addition, patients' pain behavior might be ruled by associations varying across situational contexts, in that being alone or being surrounded by colleagues, family, or a therapist most probably will result in different pain or disability outcomes.

A recent study on implicit associations in tension-type headaches (TTH) provided preliminary empirical support for the importance of relevant context cues in this domain (Armstrong et al., 2006). This IAT study showed that the enhanced automatic associations between headache and negative evaluations in TTH patients were especially pronounced when headache stimuli were immediately preceded by a negative attribute stimulus. This finding suggests that the activation of negative associations differentially triggers the headache category among TTH patients. The activated negative–headache associations may, in turn, bias the interpretation of somatic experience in a manner that is consistent with the activated associations, thereby leading to pain experiences among individuals prone to TTH but not among controls. Similar context effects may be at work related to other pain symptoms. To the extent that this type of (context dependent) automatic memory associations indeed predisposes one to develop a pain symptom such as headache, altering these associations may have important clinical value in reducing pain (e.g., headache) suffering. Germane to this, it has been shown that an attentional training procedure that involves repeatedly ignoring social threat and searching for acceptance ("Find the happy face in the crowd" task) resulted in stress-reducing effects at both the subjective and physiological levels and improved work performance (Dandeneau, Baldwin, Baccus, Sakellaropoulo, & Pruessner, 2007). Thus, an intervention specifically designed to reduce automatic selective attention to threat appeared helpful to "cut stress off at the pass" (Dandeneau et al., 2007, p. 664). In a similar vein, it might be helpful to modify the early stages of memory activation in the face of negative events or potential threats because reducing the strength of associations between negative events and headache (or other pain symptoms) may prevent the start of a cascade that eventually results in headache or other pain symptoms.

IMPLICIT COGNITION AND HEALTH PSYCHOLOGY: GENERAL ISSUES

In this chapter, we reviewed a selection of the literature in which methods from implicit cognition research were applied to a variety of health-related behaviors, while realizing that we did not cover the full range of health behaviors or applications of implicit cognition. Nevertheless, we believe an interesting broader picture emerges that may also apply to a wider range of health behaviors than covered here. In this final section, we sketch the broader picture, suggest further lines of research, and briefly discuss implications for interventions.

The Broader Picture

Dual-process models distinguish between relatively automatic associative responses to a situation and reflective or "reasoned" processes, which until recently dominated theorizing in health psychology. Regarding the associative processes, two motivational orientations are distinguished: approach and avoidance (Strack & Deutsch, 2004). As noted in the previous section, specific situations are likely to automatically trigger these motivational tendencies: Appetitive stimuli trigger approach, whereas the natural response to pain and threatening stimuli is avoidance. From a dual-process perspective, people can differ either in their associative responses or in their ability to control the associative processes. A straightforward idea has been that people with problematic health behaviors may have especially strong associations; for example, obese people may have stronger automatic reactions to food, drug users to drugs, and chronic pain patients to painful stimuli. Generally, this pattern of results has only received fairly consistent support in the area of substance use and misuse, where many studies found stronger appetitive associations in heavy versus light users. In research on eating, pain, and stress, this pattern of results has not been broadly supported. This difference may be related to the lower feedback loop in Figure 25.1, which is moderated by pharmacological properties of drugs.

The second obvious explanation for differences in health-related behaviors concerns the role of executive control and related concepts (e.g., impulsivity). Both in research on substance misuse and in eating disorders involving excessive eating, impulsivity is associated with the problem, and there are indications that this may, in fact, be a causal factor (Guerrieri et al., 2007; Verdejo-Garcia et al., 2008). Moreover, recent research has consistently confirmed predictions from dual-process models that the impact of associative processes on overeating and addictive behaviors is moderated by executive functions (Grenard et al., 2008; Hofmann et al., 2009; Hofmann, Gschwendner, et al., 2008; Houben & Wiers, 2009; Thush et al., 2008), and acute depletion of executive control capacity appears to have similar effects (Hofmann & Friese, 2008; Hofmann et al., 2007). Individual difference variables reflecting a general tendency to rely on associative or reflective processes when making decisions (habit strength and need for cognition) appear to have similar moderating qualities (Conner, Perugini, O'Gorman, Ayres, & Prestwich, 2007). It is possible that relatively weak EC functions also play a role in avoidance-related health problems (e.g., pain, stress), as has been suggested in anxiety research (Eysenck, Derakshan, Santos, & Calvo, 2007; Price & Mohlman, 2007). From that perspective, relatively weak EC could be a general risk factor for the development of psychopathology and health-related problems, and individual differences in associative processes (either related to personality or to learning history and situational factors) would then predict which specific problems are most likely to develop. For example, individuals with high anxiety sensitivity may be more likely to develop pain-related problems than cocaine abuse, although use of alcohol or drugs to alleviate negative affect may also be a risky outcome in this group. In view of this general importance of EC and the emerging evidence of a negative impact of substance use and misuse during adolescence (when the frontal cortices are still in development), substance use in this period may contribute to such a general risk for later psychopathology and health problems.

Issues for Future Research

A review across different health-related behaviors shows that there are similarities as well as differences in methods used, which may partly be coincidental (e.g., measures derived from basic memory research were first introduced in addiction research in health psychology). There are also some interesting developments emerging in specific domains that may be of interest for other domains. First, there is evidence that in some cases different aspects of the situation may trigger different motivational tendencies: When the appetitive qualities are evident, appetitive responses are triggered, but subtle changes in the context may trigger avoidance responses (Roefs et al., 2006; Sherman et al., 2003). For many health behaviors, people may have both approach- and avoidance-related associations, and the environment (including both the external and the internal environments in terms of EC depletion and visceral state) will determine which associations are activated more strongly.

Second, a related issue concerns measurement: There is some emerging evidence that priming relevant concepts, either cognitively (Perugini, O'Gorman, & Prestwich, 2007) or physically (e.g., administering a prime dose of alcohol in heavy drinkers) (Schoenmakers et al., 2008), may optimize assessment of the associative processes involved. In case of alcohol priming, there are alternative explanations, including a better "context match" for memory processes or differential effects of alcohol on the associative versus control components in the measure used (cf. Sherman et al., 2008). Optimizing measurement of associative processes by relevant priming in different ways is clearly an important topic for further research. Related, general vulnerability factors may only become apparent in specific situations. Studies on classically conditioned contextual stimuli may shed important light on the influence of context on the psychological processes involved (Thewissen et al., 2005; Van Gucht et al., 2008).

Third, studies on interactions between the processes we identified may advance our understanding. We discussed studies on interactions between EC and associative processes, but other interactions may be relevant as well, for example between personality and specific tempting situations (e.g., Guerrieri et al., 2008). Fourth, an interesting and as yet understudied topic is the transmission of associations, which was discussed between therapist and client (p. 477) but may also be relevant in the transmission of relevant associations from parent to child (Chassin, Presson, Rose, Sherman, & Prost, 2002). Fifth, associative processes may involve more than just approach and avoidance tendencies, as the literature on automatic goal processing suggests (e.g., Aarts, Custers, & Holland, 2007). There are some first attempts to link this concept to health psychology, for example, in research assessing automatic activation of alternative concerns and goals in life next to drinking in

relation to alcohol use (Palfai, 2006; Sheeran et al., 2005) and dependence (Cox, Hogan, Kristian, & Race, 2002) and to eating behaviors (Palfai & Macdonald, 2007; Papies, Stroebe, & Aarts, 2008). Activating and stimulating alternative goals may be a relevant strategy for interventions, which brings us to the final topic.

Implications for Interventions

A thorough discussion of implications of this review and model for health interventions is beyond the scope of this chapter. However, we briefly mention some issues. From the perspective of our model, it is important for a wide range of health behaviors to prevent adolescent substance misuse because of the likely negative effects on the development of EC processes. Regarding the efficacy of primary prevention, there is not much support for efficacy in the field of alcohol and addiction, and in some cases ironic effects have been noted (i.e., making youngsters curious for the substances they should not use) (Foxcroft, Ireland, Lister-Sharp, Lowe, & Breen, 2003). Age and price policies appear to do better (Room et al., 2005), which is consistent with the present framework, especially for adolescents, who may be less willing and able to reason rationally about health issues (Casey, Jones, & Hare, 2008). Still, as noted earlier in this chapter, the modern world is full of appetitive temptations, and this is unlikely to change. Regarding targeted prevention and intervention strategies, from the dual-process model, one can try to change either associative processes or control processes (Wiers et al., 2008). With respect to associative processes, one can attempt to reduce an attentional bias or appetitive associative reactions (see Wiers et al., 2008). Alternatively, one can try to automate associations to alternative behaviors, incompatible with the unhealthy behaviors, as is successfully done in implementation intentions (Sheeran, 2002). With respect to the reflective system, most existing health-promoting interventions are aimed at changing beliefs and motivations to choose healthy instead of unhealthy behavioral options. Most likely, these interventions primarily change explicit cognitions while leaving associations mostly intact (Wiers et al., 2005) or even, paradoxically, increasing their strength (Deutsch et al., 2006; Krank et al., 2008). Regarding the reflective system, it is noteworthy that not only beliefs relating to the health behavior, but also the ability to control impulses, can be targeted, as recent research on training of working memory in impulsive children has demonstrated (Klingberg et al., 2005). Given the central role of impulse moderation for psychopathology and health behaviors, such training may be beneficial in high-risk children (Diamond et al., 2007). Finally, as noted earlier in this chapter, from dual-process models, it does not follow that intervention strategies that target explicit cognitions are useless (there is a wealth of data showing that they are not); rather, additional strategies may be necessary to change associative processes relevant for health behaviors. In ending, we hope that this review will stimulate further research into implicit cognitive processes in health behaviors and ways to moderate their impact on health behaviors.

NOTES

1. Only males were included as participants for the practical reason that it is easier to administer alcohol (no risk of unknown pregnancy). Note that alcohol appears to have similar effects on females at least with respect to attractiveness ratings of the opposite sex (Jones, Jones, Thomas, & Piper, 2003).
2. In fact, there were two control conditions: Participants received either a placebo alcoholic drink or no drink at all, which did not affect results over the studies; therefore, conditions were collapsed (MacDonald, MacDonald, et al., 2000).
3. Note that MacDonald and colleagues explained their results with the alcohol-myopia theory of Steele and Josephs (1990), which they contrasted with the popular notion that alcohol has a main disinhibiting effect. According to alcohol-myopia theory, alcohol intoxication makes the most salient cues more important in determining the reaction and the more distal cues (e.g., long-term consequences) less important. As they demonstrated, when the most salient cues trigger aggression, alcohol intoxication leads to aggression, but when the most salient cues trigger helpfulness, that is what alcohol leads to. In line with this idea, MacDonald, MacDonald, and colleagues (2000) found that when they made the unsafe sex cues more salient, alcohol use led to *less* intention to engage in unsafe sex. The alcohol-myopia account is consistent with the current dual-process model, given that attentional control is one of the executive functions in the reflective system, when we assume that the salient cues trigger the corresponding associative processes.
4. BMI is an index comparing a person's weight and height. BMI is defined as the individual's body weight divided by the square of his or her height (kg/m^2). A BMI between 18.5 and 25 is considered normal, lower values indicate underweight, higher values overweight, and a BMI above 30 is used to define obesity.

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