

The Self-Perception Process as a Cause of Implicit-Explicit Consistency in the Domain of Disgust Sensitivity

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Abstract

Based on dual process models of information processing, the present research addressed how explicit disgust sensitivity is re-adapted according to implicit disgust sensitivity via self-perception of automatic behavioral cues. Contrary to preceding studies (Hofmann, Gschwendner, & Schmitt, 2009) that concluded that there was a "blind spot" for self- but not for observer perception of automatic behavioral cues, in the present research, a re-adaption process was found for self-perceivers and observers. In Study 1 ($N = 75$), the predictive validity of an indirect disgust sensitivity measure was tested with a double-dissociation strategy. Study 2 ($N = 117$) re-investigated the hypothesis that self-perception of automatic behavioral cues, predicted by an indirect disgust sensitivity measure, led to a re-adaption of explicit disgust sensitivity measures. Using a different approach from Hofmann et al. (2009), the self-perception procedure was modified by (a) feeding back the behavior several times while a small number of cues had to be rated for each feedback condition, (b) using disgust sensitivity as a domain with clearly unequivocal cues of automatic behavior (facial expression, body movements) and describing these cues unambiguously, and (c) using a specific explicit disgust sensitivity measure in addition to a general explicit disgust sensitivity measure. In Study 3 ($N = 130$), the findings of Study 2 were replicated and display rules and need for closure as moderator effects of predictive validity and cue utilization were additionally investigated. The moderator effects give hints that both displaying a disgusted facial expression and self-perception of one's own disgusted facial expression are subject to a self-serving bias, indicating that facial expression may not be an automatic behavior. Practical implications and implications for future research are discussed.

Zusammenfassung

Ausgehend von Zwei-Prozess-Modellen der Informationsverarbeitung beschäftigt sich die vorliegende Forschungsarbeit mit der Frage, inwieweit die explizite Ekelsensitivität, vermittelt über die Selbstwahrnehmung automatischer Verhaltenscues, an die implizite Ekelsensitivität angepasst wird. Im Unterschied zu vorangegangenen Studien (Hofmann et al., 2009), die einen „blind spot“ für die Selbst-, nicht aber für die Fremdwahrnehmung automatischer Verhaltenscues folgerten, wurde in der vorliegenden Forschungsarbeit in zwei Studien eine Anpassung der expliziten an die implizite Ekelsensitivität gemäß der Selbstwahrnehmungshypothese gezeigt. In Studie 1 ($N = 75$) wurde die prädiktive Validität eines indirekten Ekelsensitivitätsmaßes mit Hilfe einer doppelten Dissoziation belegt. Studie 2 ($N = 117$) untersuchte die Selbstwahrnehmungshypothese. Gegenüber den Studien von Hofmann et al. (2009) wurde eine modifizierte Selbstwahrnehmungsprozedur verwendet: (a) Das Verhalten wurde mehrmals zurückgemeldet, wobei jeweils eine geringere Anzahl an Verhaltenscues beurteilt wurde, (b) als Domäne wurde die Emotion Ekel mit klaren, eindeutigen automatischen Verhaltenscues (Gesichtsausdruck, Körperbewegungen) verwendet, (c) neben einem globalen, wurde ein spezifisches explizites Ekelsensitivitätsmaß eingesetzt. In Studie 3 ($N = 130$) wurden die Ergebnisse von Studie 2 repliziert. Weiterhin wurden mit Display Rules und Need for Closure Moderatoren der prädiktiven Validität und des Selbstwahrnehmungs- und Adaptionsprozesses untersucht. Die Moderatoreffekte weisen darauf hin, dass sowohl das Zeigen von Ekel im Gesichtsausdruck, als auch die Wahrnehmung des eigenen Ekel-Gesichtsausdrucks einer selbstbilddienlichen Verzerrung unterworfen sind. Praktische Implikationen und Anregungen für zukünftige Forschung werden diskutiert.

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1. Introduction

Validity of the trait model is one of the central postulates of personality psychology. High consistency and stability across time of different indicators or outcomes of a trait (e.g., answers to a questionnaire, behavior, physiological reactions) is seen as a crucial basis for the validity of the trait model. However, in the past, it turned out to be difficult to empirically verify this postulate. Indeed, the empirically found diversity of different indicators and trait outcomes had become a major problem in personality psychology in the last century: The first consistency debate in the 1930s was inspired by the research of Hartshorne and May (1928) on cross-situational consistency of moral behavior and by LaPiere's (1934) findings on attitude behavior consistency. A second controversy was initiated in the 1970s by the reviews of Mischel (1968) and Wicker (1969), which stated that correlations between self-report trait measures and behavior were generally not higher than .30 and concluded that behavior was predominantly determined by the situation.

In both controversies, the line of argumentation and the problems investigated followed a typical pattern, which Zanna and Fazio (1982) describe as generations of research: First, the existence and the size of consistency were investigated. Second, the boundary conditions of consistency were investigated, which are, for example, methodological factors but also moderator effects that identify under which conditions behavior is predicted. Third, the findings were combined and merged into a theoretical model to explain why consistency arises under certain conditions whereas it does not under other conditions. In succession, the model was also subjected to specific empirical tests.

Along with the invention of the Implicit Association Task (IAT, Greenwald, McGhee, & Schwartz, 1998), the consistency debate was inspired again, this time focused on the diversity of traits measured via the IAT and traits measured via self-report. The IAT, as a so-called indirect measurement procedure, makes use of reaction times during a categorization task and is therefore considered to reflect an automatic, possibly subconscious¹ *implicit* representation of a trait (Greenwald et al., 1998). By contrast, outcomes of direct measurement procedures such as self-reports reflect controlled and consciously accessible intrapersonal properties and therefore identify an *explicit* representation of a trait.

Regarding the recent implicit-explicit consistency debate, in line with Zanna and Fazio's (1982) generations of research, the mean correlation of indirect and

¹From a historically viewpoint implicit measures may be interpreted as a rediscovery and operationalization of the psychological "unconscious" as postulated by the early pioneers of psychological research (e.g., Carpenter, 1874; James, 1890; Freud, 1915).

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direct measurement procedures has been estimated to range somewhere between $r = .24$ and $r = .48$ (Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2005; Nosek, Greenwald, & Banaji, 2007). Moderators or boundary conditions of consistency have also been investigated (e.g., Hofmann, Gschwendner, Nosek, & Schmitt, 2005; Nosek, 2005, 2007) and condensed into an elaborated model of implicit-explicit consistency (Gschwendner, Hofmann, & Schmitt, 2006b, 2006a; Hofmann, Gawronski, et al., 2005) that also fits well into the predominant view of dual information processing systems in the literature (Chaiken & Trope, 1999; Evans & Frankish, 2009; Smith & DeCoster, 2000).

However, less is known about the specific psychological processes that may affect consistency of the implicit and the explicit representations of a trait. This is an interesting question because from a theoretical viewpoint, the two representations are seen as largely unrelated, but in meta-analyses, a moderate positive correlation between the two representations is evident (Hofmann, Gawronski, et al., 2005; Nosek, 2005; Nosek et al., 2007). Although a consistency generating effect has been assumed to work in both directions (e.g., Gawronski & Bodenhausen, 2006; Strack & Deutsch, 2004), in this research I will focus on the—in my view more interesting—effect of the implicit representation on the explicit representation, or in other words, a pathway for how people can gain insight into their subconscious implicit selves.

For this purpose I present the theoretical prerequisites in Chapter 2: The IAT as an indirect measurement procedure and its predictive validity is introduced in Sections 2.1 and 2.2. In Section 2.3 I argue for self-perception as a process that affects implicit-explicit consistency, and Section 2.4 presents a model that allows for the investigation of this conjecture. Because Hofmann et al. (2009) have investigated this self-perception hypothesis, but unexpectedly did not find confirmation, I offer in Section 2.5 theoretical and procedural suggestions that are intended to confirm the self-perception hypothesis. Therefore, in Section 2.6, I argue for a change of the domain to the emotion of disgust and for a re-investigation of the self-perception hypothesis. In Section 2.7, existing indirect disgust sensitivity measurement procedures are presented and I argue for the development of a specific disgust sensitivity measure based on the IAT. According to Zanna and Fazio's (1982) generations of research in Section 2.8, I present assumptions of theoretically plausible moderator effects, which are intended to further validate the implicit-explicit consistency model and the self-perception hypothesis.

In Chapter 3, the main research questions, the resulting specific hypotheses, and the resulting research program are presented. Therefore, Chapter 4 presents

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a study that investigates the predictive validity of the developed indirect disgust sensitivity measurement procedure. The study presented in Chapter 5 investigates the self-perception hypothesis, and the study presented in Chapter 6 replicates the findings of the previous study and also investigates the assumed moderator effects for the implicit-explicit consistency model. The results of all three studies are discussed in Chapter 7 with its limitations and practical implications.

2. Theoretical Background

2.1. Indirect Measurement Procedures

Indirect measurement procedures are considered to be implicit measures because they share the following requirements (De Houwer, 2006; De Houwer & Moors, 2007; De Houwer, Teige-Mocigemba, Spruyt, & Moors, 2009; Moors & Houwer, 2007): (a) The implicit measure is *uncontrolled* by participants in the sense that the subjects cannot change, stop, or avoid the measurement process because the process is activated and driven in an automatic manner; (b) The implicit measure is *unintentional* and *goal independent* in the sense that participants have no or little control over the outcome and are not able to fake or bias the outcome in a desired direction (e.g., according to impression management goals) because the participants are unaware of the construct measured; (c) The implicit measure is *purely stimulus driven* in the sense that no information (e.g., memory recall) is needed to perform the task except for the reaction to the stimuli; (d) The implicit measure is very *efficient* because it uses only a minimal amount of cognitive resources.

Since the invention of the IAT (Greenwald et al., 1998), several new implicit measures have been developed (Petty, Fazio, & Briñol, 2008) in addition to already existing measurement procedures that can be considered to be implicit. A collection of these measures can be found in Appendix A, Table 9, but this table does not claim to be exhaustive (for an overview, see also De Houwer, 2003b; Fazio & Olson, 2003; B. E. Wittenbrink & Schwarz, 2007). The IAT (Greenwald et al., 1998) is one representative of an implicit measure that conforms to the above-mentioned criteria (e.g., De Houwer, 2006) and is also among the most frequently used implicit measures (Hofmann, Gawronski, et al., 2005). One reason might be that the reliability (internal consistency) achieved with this measurement procedure is high compared to other indirect measurement procedures (Hofmann, Gawronski, et al., 2005; Nosek et al., 2007).

The basic idea of the IAT procedure is to assess the strength of association

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of concepts in an associative network (Greenwald et al., 1998). To achieve this, the IAT is conducted on a computer to assure a reaction time measurement in the millisecond range. The procedure of the IAT is based on two concurrent discrimination tasks in which participants have to categorize target (e.g., flowers, insects) and attribute (e.g., positive, negative) stimuli according to target and attribute category label pairs (e.g., flowers & positive vs. insects & negative), which are presented at the top left and right of the computer screen. Participants are asked to assign a single target or attribute stimulus (e.g., orchid, beetle, love, pain) to one of the four types of stimuli (e.g., flowers, insects, positive, negative) using the two category label pairs (e.g., flowers & positive vs. insects & negative). The target and attribute stimuli are presented in a random order in the center of the screen. The classification should be performed as quickly as possible with two response keys on the computer keyboard. The first block of the procedure presents a compatible associative combination of category labels (flowers & positive vs. insects & negative), whereas in the second block, an incompatible associative combination (flowers & negative vs. insects & positive) is used. The difference in mean reaction times of the incompatible minus the compatible block represents the individual strength of association of the compatible (flowers & positive vs. insects & negative) versus the incompatible condition (flowers & negative vs. insects & positive). The IAT is therefore a relative measure because the difference in reaction times of the incompatible minus the compatible block is interpreted as the difference in strength of association between these two concepts (flowers & positive vs. insects & positive). An improved scoring algorithm is used to control for age influences; this algorithm averages out individual differences in general reaction speed (Greenwald, Nosek, & Banaji, 2003). The IAT measurement procedure can be used to assess interindividual differences and has been used in a wide area of psychological research (Nosek et al., 2007).

2.2. Predictive Validity of Implicit Measures

The divergence of explicitly and implicitly measured properties, which induced the recent consistency debate, may be well explained by theoretical models. For example, the RIM (Strack & Deutsch, 2004) as a representative of recent dual process models of information processing (see also Gschwendner, Hofmann, & Schmitt, 2006c) assumes two structurally distinct systems, which follow different rules to infer information and determine judgment and behavior in different ways (Evans, 2008; Strack & Deutsch, 2004). The explicit or reflective system has conscious access to knowledge that is stored in a propositional format. Use

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of this knowledge follows syllogistic rules. Knowledge and new information are processed in a deliberate manner and lead to rational and self-conscious behavioral choices. This system works slowly and needs cognitive capacity. Chronic preferences, judgments, and behaviors that are the products and parts of this system are called explicit dispositions (attitudes, motives, self-concept, self-esteem, personality traits). Explicit dispositions can be measured directly via self-report.

The implicit or impulsive system draws upon a database that is assumed to be represented in an associative network and is considered not to be directly accessible via introspection. This system processes information automatically, without conscious awareness, quickly, efficiently, and with little or no use of cognitive resources. Behavior is shaped automatically via the activation of schemata and scripts. Automatic evaluations and behavioral impulses that are generated within this system are called implicit dispositions. Because these dispositions operate outside of conscious self-awareness, they cannot be measured directly via self-report but rather, must be inferred from behavioral outcomes.

The two systems are assumed to complement each other in shaping behavior. More specifically, they are responsible for and predictive of different types of behavior (Frieze, Hofmann, & Schmitt, 2008; Gschwendner, Hofmann, & Schmitt, 2008a). Whereas the explicit system predicts deliberate decisions, the implicit system predicts automatic behavior such as spontaneous facial expressions and immediate motor reactions to stimuli (Fazio, 1990). Several studies have tested and confirmed these predictions. For example, these predictions have been successfully tested in the domains of implicit/automatic attitudes (Fazio, Sanbonmatsu, Powell, & Kardes, 1986; Greenwald & Banaji, 1995), implicit self-esteem (Back, Krause, et al., 2009; Greenwald & Farnham, 2000; Rudolph, Schröder-Abé, Riketta, & Schütz, 2010; Schröder-Abé, Rudolph, & Schütz, 2007), implicit self-concept (Dislich et al., in press), implicit stereotypes (Devine, 1989), and implicit personality self-concept (Asendorpf, Banse, & Mücke, 2002; Back, Schmukle, & Egloff, 2009; for an overview see Frieze et al., 2008; Greenwald, Poehlman, Uhlmann, & Banaji, 2009; Hofmann, Gschwendner, Nosek, & Schmitt, 2005; Hofmann & Schmitt, 2008).

2.3. How Self-Perception Affects Implicit–Explicit Consistency

Because the implicit and explicit systems use different databases, follow different information processing rules, and serve different adaptive functions, the two types of dispositions may well be unrelated. Consequently, direct measures of explicit dispositions may not correlate with indirect measures of implicit

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dispositions.

In the dual-process literature two lines of reasoning make different assumptions of the implicit and explicit systems (Gawronski & Bodenhausen, in press):

The first conceptualization of the systems assumes two distinct, independently operating memory structures for which no convergence of explicit and implicit dispositions is expected (e.g., Banaji, 2001; Rydell & McConnell, 2006). Therefore, if implicit dispositions are activated automatically and feed into behavior without conscious awareness, they should not be part of a person's explicit self-knowledge (Dovidio, Kawakami, & Beach, 2001; Petty, Tormala, Briñol, & Jarvis, 2006; Rudman, 2004; Wilson, Lindsey, & Schooler, 2000). Moreover, if the database of the implicit system is not accessible to conscious thinking, automatic preferences should not be included in deliberate judgments and behavioral choices. Accordingly, explicit and implicit dispositions should be dissociated and should have distinct effects on behavior with implicit dispositions shaping automatic behavior and explicit dispositions shaping reasoned and controlled action (cf. Asendorpf et al., 2002; Greenwald & Banaji, 1995; Wilson et al., 2000).

The second conceptualization of the implicit and explicit systems assumes a common memory structure in which unconscious contents are characterized by activation levels that do not pass the threshold of conscious awareness (e.g., Gawronski & Bodenhausen, 2006; Strack & Deutsch, 2004). Therefore, at least partial insight into implicit dispositions may be possible according to the threshold level of conscious awareness. This conceptualization is supported by recent meta-analyses, which report a typical correlation between direct measures of explicit dispositions and indirect measures of implicit dispositions ranging from $r = .24$ (Hofmann, Gawronski, et al., 2005), $r = .36$ (Nosek, 2005), to $r = .48$ (Nosek, 2007). Also, some moderator effects affecting implicit-explicit consistency may be interpreted as a higher sensitivity toward and conscious awareness of implicit dispositions (for an overview, see Hofmann, Gschwendner, Nosek, & Schmitt, 2005): private self-consciousness (Gschwendner et al., 2006c), introspection (Hofmann, Gawronski, et al., 2005), and attitude importance (Hofmann, Gschwendner, & Schmitt, 2005). The associative-propositional evaluation model (APE; Gawronski & Bodenhausen, 2006) proposes pathways of implicit dispositions that influence explicit dispositions and vice versa, which both account for the consistency of implicit and explicit dispositions. For the aim of this research however, the self-perception of implicit dispositions, only the latter pathway is relevant. The APE model (Gawronski & Bodenhausen, 2006) argues generally "that people usually use their automatic affective reactions toward an object as a basis for evaluative judgments about this object"

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(Gawronski & Bodenhausen, 2006, p. 694). However, less is known about the specific processes that may account for the weak but significant convergence between measures of implicit and explicit dispositions. Accordingly, the authors of the APE suggest that "changes in each kind of evaluation can be due to several processes" (Gawronski & Bodenhausen, 2006, p. 697).

Filling this gap, Hofmann and Wilson (2010) have proposed three possible processes of implicit dispositions that influence explicit dispositions:

First, people may have direct introspective access to their mental associations. Self-knowledge of implicit dispositions may therefore be dependent upon the motivation to introspect one's own mental associations. Regardless of which conceptualization of the implicit and explicit systems is preferred, this process seems very unlikely from a theoretical viewpoint. To my knowledge, there are no studies that have investigated directly "reading" mental association strengths of the implicit system.

Second, people may have indirect access to their implicit dispositions through subjective experiences that result from their mental associations. In this case, the associative system may be used as a foundation for an explicit disposition (e.g., evaluative associations that elicit affective gut feelings). This process is also proposed in the APE model (Gawronski & Bodenhausen, 2006) and has been tested in empirical studies. LeBel and Gawronski (2006) found a higher correlation of implicit and explicit attitudes when participants were asked to concentrate on their feelings toward the attitude object. Similarly, Nier (2005) found that participants had introspective access to their implicit attitudes and achieved a higher implicit-explicit correlation under bogus-pipeline conditions in the racial attitudes domain. Hofmann, Gschwendner, Nosek, and Schmitt (2005) found that spontaneity and self-consciousness in the course of making a judgment led to an increase in implicit-explicit consistency. Consistency decreased with high propositional elaboration and when the validity of the automatic associations was challenged by the participants.

As a third process, Hofmann and Wilson (2010) suggest that people may have indirect access to their implicit dispositions via self-perceptions of the behaviors that result from these mental associations (Bem, 1972). This self-perception hypothesis, which may cause implicit-explicit consistency, was investigated by Hofmann et al. (2009). However, the authors found that neutral observers were able to infer an implicit disposition by perceiving behavioral cues, but self-perceivers did not make use of these cues to infer their own implicit disposition. Hofmann et al. (2009) concluded that there is a "blind spot" for self-perceivers (cf. Luft & Ingham, 1955). This finding was quite unexpected and constitutes

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the starting point for the present research: The re-investigation of the self-perception hypothesis, however, with some procedural changes to facilitate the self-perception of implicit dispositions.

2.4. The Implicit–Explicit Consistency Model

As a theoretical framework for re-investigating the self-perception hypothesis that may cause implicit-explicit consistency, Hofmann, Gschwendner, Nosek, and Schmitt (2005) and Gschwendner et al. (2006a, 2006c) proposed a research model that is based on the RIM (Strack & Deutsch, 2004) and the MODE model (Fazio, 1990) and has been extensively and successfully tested (for a recent model version and summary of studies, see <http://www.uni-landau.de/schmittmanfred/english/forschung/IAT/>).

For the aim of this research, which is to test the self-perception hypothesis as a cause for implicit-explicit consistency, a reduced model is sufficient (see Figure 1). Hofmann et al. (2009) tested this hypothesis in three related studies. Their research began with three main assumptions. First, a double dissociation of direct measures predicting controllable behavior and indirect measures predicting automatic behavior was assumed. This assumption has received some support in previous research (e.g., Asendorpf et al., 2002; Hofmann, Rauch, & Gawronski, 2007). Second, and based on self-perception theory (Bem, 1972), it was assumed that people can acquire explicit knowledge of their implicit dispositions if they self-perceive behavior that was driven by these dispositions. These inferences are assumed to be similar to trait inferences that observers make when they observe the behavior of a target person. Third, it was assumed that the self-perception of automatic behavior would lead to changes in the person’s self-concept. Implicit dispositions thus become part of the explicit self-concept and this explains the correlation between indirect measures of implicit dispositions and self-reported explicit dispositions. Figure 1 depicts these assumptions as a path model.

The model can be considered to be a special version of the general lens model that was proposed by Brunswik (1956). Figure 2 displays the lens model for both self-perceivers and observers. The model assumes that implicit dispositions shape automatic behavior. Therefore, measures of these dispositions will predict cues of automatic behavior. The effects in this part of the lens model are called cue validity. Next, both self-perceivers and observers make inferences from these cues of automatic behavior. In observers, these inferences generate previously nonexistent beliefs about the actor’s disposition that can be measured directly using observer ratings. In actors or self-perceivers, these inferences lead to a re-

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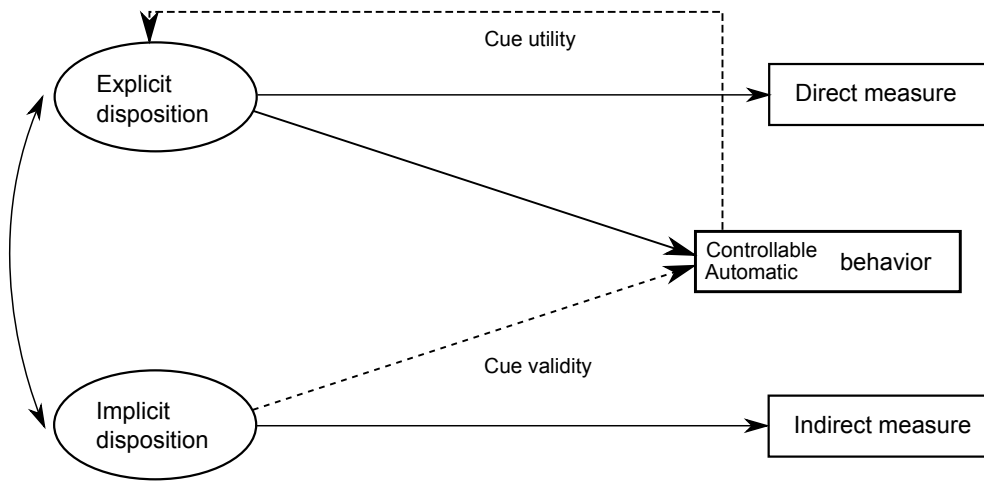


Figure 1: Path model of explicit and implicit dispositions predicting controllable and automatic behavior. Feedback of automatic behavior mediates the convergence of implicit and explicit dispositions (dashed line).

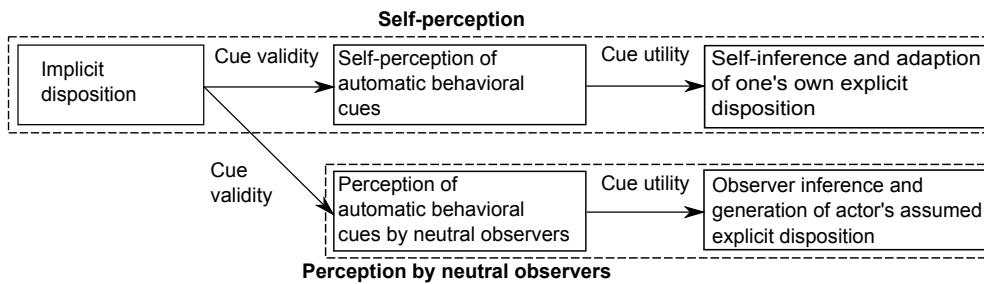


Figure 2: Adaptation of the Brunswik (1956) lens model for the analysis of self- and observer perception of implicit dispositions, mediated by automatic behavioral cues.

adaptation of self-ascribed explicit dispositions that can be measured directly with self-ratings. The effects in this part of the lens model are called cue utility.

2.5. Differences in Cue Validity and Cue Utility Between Self-Perceivers and Observers

Hofmann et al. (2009) tested the self-perception hypothesis with three studies in the domains of anxiety (Studies 1 and 2) and extraversion (Study 3). At a first occasion, indirect and direct measures of trait anxiety and extraversion were obtained. At a second occasion, anxious and extraverted behavior was evoked and videotaped. Participants and observers were shown the videos and asked to rate several cues of automatic behavior. Subsequently, they were asked to rate the participants' trait anxiety and extraversion. Hofmann et al. (2009) found

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that observers used automatic behavior cues and provided adequate ratings of the targets' trait anxiety and extraversion. Participants themselves did not use these cues to infer their own dispositions, however. With regard to the lens model, cue validity, cue utility, as well as the mediating effect of automatic behavioral cues were found for observers but not for self-perceivers.

A first reason for the low cue validity and cue utility that Hofmann et al. (2009) found for self-perceivers might be that the number of times the video was shown to them was too small, and the number of cues that had to be rated per video view was too large to afford an accurate behavior rating. In Studies 1 and 2 of Hofmann et al. (2009), the video was shown once, and four behavior cues had to be rated. Participants, seeing their own behavior unexpectedly on video, might have been surprised and curious, and their attention might not have been focused enough on the behavior indicators they had to rate. By contrast, neutral observers did not have to deal with their own (probably unexpected) appearance and behavior on the video. Supporting this hypothesis, the correlation between self-ratings and observer ratings was low in these studies ($r = .29$ in Study 1 and $r = .15$ in Study 2). In Study 3, the video was shown twice to self-perceivers. Following this reasoning, the correlation between self-ratings and observer ratings was higher compared to Studies 1 and 2 ($r = .47$). However, the cue utility was still not significant for self-perceivers but only for observers. It may be deducible from this pattern of results that self-perceivers need to be trained in self-perception by means of repeated exposure to their own automatic behavior before they can provide self-ratings that are as accurate as the ratings of observers. Because the observers in the Hofmann et al. (2009) studies rated the automatic behavior of several targets, they became experts over time and provided more accurate ratings compared to self-perceivers. This conclusion was tested in the present studies.

A second reason for the difference in cue-utility between self-perceivers and observers might be that the behavior cues that had to be rated were not described specifically enough to assure that self-perceivers and observers interpreted them identically. For instance, Hofmann et al. (2009) instructed their participants and observers to rate “the extent to which their facial expression was either inviting or off-putting” (extraversion) and the “fluency of speech” (anxiety). It is possible that, the level of inference of these ratings is too high to assure that self-perceivers and observers used the same cues for answering these questions. For neutral observers, because the behavioral cues on the video were the only source of information² to infer a target's disposition, they used it. By con-

²In Study 1 there was additionally personal contact between neutral observers and participants.

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trast, self-perceivers may take advantage of ambiguities in trait definitions by interpreting the meaning of traits in a self-serving way. Furthermore, they may consider additional information from former experiences in similar situations, which are not accessible to neutral observers. This may also be the case for the self-perception of automatic behavior and may lead to a different self-perception compared to neutral observers. In order to test this explanation in the present research, the rather abstract ratings that Hofmann et al. (2009) used needed to be substituted with more concrete and well-defined cues on a lower level of inference.

Besides the need for clearly defined and unambiguous cues of automatic behavior, there are also implications for the domain that is used for testing the self-perception hypothesis: The self-other knowledge asymmetry model (SOKA; Vazire, 2010) assumes that self-perception and perception by neutral observers differs because of informational differences in perspective and differences in motivational significance for a trait. According to this model, traits differ regarding the salience of overt versus covert aspects of the trait. Therefore, they differ in their observability and available information for self-perceivers and neutral observers. For example, others may know more than the self about highly observable traits, whereas the self knows more than others about traits low in observability. Despite the observability of a trait, self- and neutral observer ratings of traits differ also in their degree of ego-involvement. According to the SOKA model (Vazire, 2010), individuals may take advantage of ambiguities in trait definitions by interpreting the meaning of traits in a self-serving way. Therefore, the self's ego-protection motive may disrupt the ability to form a reality-based perception for self-perceivers, whereas for neutral observers, only an additive bias may occur. This may also be the case for cues of automatic behavior. Therefore, although extraversion and anxiety in the studies by Hofmann et al. (2009) may serve observable information equally for self-perceivers and neutral observers³, these traits may be susceptible to a self-serving bias (Greenwald, 1980; Paulhus & John, 1998; Robins & Beer, 2001), which may account for the differences in ratings of self-perceivers and neutral observers.

If these explanations are correct, the cue validity and cue utility in self-perceivers should be higher if (a) the chosen domain serves observable information equally for self-perceivers and neutral observers, (b) the domain is minimally subjected to a self-serving bias, (c) the domain delivers clear and unequivocal cues of automatic behavior, and (d) these clearly defined and unambiguous cues are rated.

³Extraversion is among the best observable personality traits (e.g., Borkenau & Liebler, 1992a, 1992b).

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A third reason for the differences between self-perceivers, and raters could have been that for self-perceivers the re-adaptation of an explicit self-concept, which is based on accumulated experience over a longer time period, seems premature if the person is confronted with just a few specific behaviors that differ from a more generalized self-concept. To test this assumption, the re-adaptation of a narrow facet of a trait should be compared to the re-adaptation of the (broader) trait itself. According to the symmetry principle (Ajzen & Fishbein, 1977), a more pronounced re-adaptation of the facet was expected because specific behaviors are conceptually and empirically more closely related to narrow traits than to broad traits.

2.6. The Emotion of Disgust as an Appropriate Domain for a Re-Investigation

Disgust is seen as an evolutionarily early emotion and is included “in almost every list of basic emotions that has at least four emotions in it” (Rozin, Haidt, & McCauley, 2000, p. 638). Its basic function is to avoid diseases and contamination of the body (Matchett & Davey, 1991; Oaten, Stevenson, & Case, 2009; Rozin et al., 2000; Tybur, Lieberman, & Griskevicius, 2009). However, disgust is also seen to serve more general functions (e.g., protecting the self; Miller, 2004): According to Rozin et al. (2000), disgust functions in three other domains besides core disgust (which protects the body from contamination). Animal reminder disgust protects the soul by preventing people from recognizing their animal nature and mortality, interpersonal disgust protects the soul and social order, and moral disgust functions to protect the social order and is elicited by moral offenses. However, it is not clear whether the classification of these domains, especially the animal reminder domain, resists experimental verification. For example, Tybur et al. (2009) found three relevant disgust domains related to pathogens, sexuality, and morality. Common to all classifications of domains, however, is a domain subsuming core disgust.

Therefore, interindividual disgust sensitivity seems to be an appropriate trait for testing the conjectures of the present research. According to Ekman (1992, 1999) disgust as a basic emotion is accompanied by a unique facial expression. In conformity with theories assuming motor programs for emotion-specific facial displays (Ekman, 1997; Fridlund, 1994; Izard, 1991; Leventhal, 1984; Tomkins, 1962), these facial displays are shown automatically. Furthermore, the behavioral tendency of disgust is routed in the approach-avoidance program (Izard, 1993; Rozin et al., 2000). Disgusting stimuli instigate bodily avoidance reactions (e.g., drawing the hands back from a disgusting stimulus). Because of

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the automaticity of disgust behavior, these cues should be equally salient for self-perceivers and neutral observers. Furthermore, these cues are related only to the disgust emotion and should be unambiguously interpretable. According to Nussbaum (2004), elicitors of disgust are often shared among members of a given society. The motivation to report disgust should therefore not be (or only minimally) affected by a self-serving bias because it is assumed that the emotional response to a disgusting stimulus is based on a socially shared factor.

For re-investigating the self-perception hypothesis (Hofmann et al., 2009; Hofmann & Wilson, 2010), the change of the domain to the emotion of disgust may be advantageous because it may result in a reduced difference in the perception of automatic behavior for self-perceivers and neutral observers. In terms of the realistic accuracy model⁴ (Funder, 1995, 1999), the four steps to assure an accurate judgment of (automatic) behavior should be equal for both self-perceivers and neutral observers: (a) relevant information exists for the trait, (b) the information is available to the perceiver, (c) the information is noticed by the perceiver, and (d) the information is interpreted correctly.

Besides, the emotion of disgust meets also the rather practical prerequisites for re-investigating the self-perception hypothesis: Explicit disgust sensitivity has been assessed successfully by self-report questionnaires (Cavanagh & Davey, 2000; Haidt, McCauley, & Rozin, 1994; Rozin, Fallon, & Mandell, 1984) and implicit disgust sensitivity has been successfully assessed by indirect measurement procedures (Charash, McKay, & Dipaolo, 2006; Huijding & de Jong, 2007; Teachman, Gregg, & Woody, 2001; Teachman & Woody, 2003). As argued before and according to the research model (see Figure 1), explicit and implicit disgust sensitivity should be dissociated, with explicit disgust sensitivity shaping controlled disgust behavior and implicit disgust sensitivity shaping automatic disgust behavior. Cues of controllable behavior have been proposed by Rozin, Haidt, McCauley, Dunlop, and Ashmore (1999). As argued before, disgust is one of the basic emotions (Ekman, 1992, 1999) and has a typical facial expression that is specifically related to disgust. According to theories assuming motor programs for emotion-specific facial displays, the facial expression of the emotion disgust can be assumed to be a valid cue of automatic behavior. Furthermore, disgust is associated with the approach-avoidance system and activates avoidance reactions that occur automatically. Therefore, bodily reactions can be used in addition to facial expressions as automatic disgust behavior cues. Both the facial disgust expression and the automatic withdrawal of the body from dis-

⁴Although the model was developed to account for the accuracy of other-perceptions, it can be used to identify potential points of diversion between self- and other-perception (Vazire, 2010), especially from a self-perception perspective (Bem, 1972).

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gusting stimuli are unambiguous reactions that are clearly identifiable in a very similar way by self-perceivers and observers. This should reduce the discrepancy between self-perceivers and observers in the perception, interpretation, and use of these cues for inferring explicit disgust sensitivity ratings.

2.7. Implicit Disgust Sensitivity Measures

Indirect measurement procedures of implicit disgust sensitivity have been used mostly in clinical studies on animal phobias. Teachman et al. (2001) and Teachman and Woody (2003) have employed several IATs in order to examine the role of disgust sensitivity in snake and spider anxiety. Their disgust IAT employed spiders and snakes as target categories and "disgusting" and "appealing" as attribute categories. Huijding and de Jong (2007) modified the IATs proposed by Teachman et al. (2001). To measure disgust sensitivity, they used pictures of spiders and pictures of maggots as target stimuli and "dirty" versus "not dirty" as attribute categories.

Both sets of IATs demonstrate, and possibly suffer from, a drawback of the standard IAT. The standard IAT is a relative measurement procedure that relies on psychological contrasts between the two target categories and the two attribute categories. In many applications, natural and semantic contrasts exist. For instance, "male" is the natural contrast of "female," and "good" is the semantic contrast of "bad." However, many targets and many attributes do not have a natural or semantic antipode. Snakes and spiders are neither biological nor psychological opposites. Several solutions for overcoming this well-known limitation of the IAT have been proposed. The single target IAT (Karpinski & Steinman, 2006) is one of these solutions, and it was adopted for the conjectures of the present research.

A second limitation of the standard IAT is its susceptibility to recoding strategies (Mierke & Klauer, 2003; Rothermund & Wentura, 2001, 2004) and other response strategies that change the discrimination task and thus attenuate construct validity (Olson & Fazio, 2004; Schnabel, Banse, & Asendorpf, 2006a). For instance, recoding strategies could be applied in the compatible condition of the IAT in order to follow the instruction to respond as quickly and accurately as possible. This might have the effect that no task switching between target and attribute items is performed, and stimuli are classified upon a consistent mapping of target and attribute categories (e.g., valence or salience asymmetries; Rothermund & Wentura, 2004). Recently, a single block variant of the IAT was proposed to overcome this limitation (SB-IAT; Teige-Mocigemba, Klauer, & Rothermund, 2008). Therefore, it seems advantageous to aim for a combined

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version of this variant of the IAT with the single target variant of the IAT (Karpinski & Steinman, 2006) and to develop a single block single target IAT (SB-ST-IAT; Zinkernagel, Hofmann, Dislich, Gschwendner, & Schmitt, 2011).

2.8. Moderators of Cue Validity and Cue Utility

In line with with Zanna and Fazio's (1982) third step in the generations of research, besides testing the implicit-explicit consistency model itself, an additional validation of the model can be performed by the assumption (and confirmation) of theoretically plausible moderator effects on the paths of the model. Since the proposal of the IAT (Greenwald et al., 1998) as a measure of implicit dispositions, several studies have investigated the idea that the convergence versus divergence of implicit and explicit dispositions and their impact on behavior are not constant, but vary depending on boundary conditions (Hofmann, Gawronski, et al., 2005; Nosek, 2005). Boundary conditions or moderators can be attributes of the person such as self-consciousness (Hofmann, Gschwendner, & Schmitt, 2005) and working memory capacity (Hofmann, Gschwendner, Friese, Wiers, & Schmitt, 2008), attributes of the situation such as the depletion of control resources (Hofmann, Gschwendner, Castelli, & Schmitt, 2008) or incentives to introspect (Gschwendner et al., 2006c), attributes of the behavior such as its impulsive versus reflective nature (Dislich, Zinkernagel, Ortner, & Schmitt, 2010), and attributes of the measurement procedures such as their similarity in content and specificity (Gschwendner et al., 2008a).

In the present research, some of these moderators that are expected to impact either the cue validity part of the model or its cue utility part or both parts of the model were tested. In Study 2, as a general moderator effect, the effect of social desirability on cue validity and cue utility was tested. In line with previous studies that proposed social desirability as a moderator (e.g., Hofmann, Gschwendner, Nosek, & Schmitt, 2005), for the cue validity part of the model, it was assumed that participants high in social desirability would be guided more by social forces such as instructions, social norms, and self-presentational concerns, whereas the behavior of individuals low in social desirability would be guided more by their true dispositions. In the cue utility part, it was assumed that participants high in social desirability would perform inference and re-adaptation of their explicit disposition to a lesser extent compared to subjects low in social desirability. These moderator effects should affect only explicit measures and controllable behavior because these adjustment processes need cognitive capacity to be engaged. Related to implicit-explicit consistency, a higher consistency was expected for subjects low in social desirability because

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both explicit measures and controllable behavior are adjusted to social concerns.

In Study 3, based on the findings of Study 2, the set of moderators was extended and specified, and included display rules (Matsumoto, Yoo, Hirayama, & Petrova, 2005) and need for closure (Webster & Kruglanski, 1994). Why these variables were expected to moderate cue validity and cue utility and the expected moderator effects will be discussed in the relevant section (see chap. 6.1, page 48).

3. Research Questions, Hypotheses, and Research Program

The main goal of this research program was the re-investigation of the self-perception hypothesis proposed and investigated by Hofmann et al. (2009) and Hofmann and Wilson (2010): Self-perception of automatic behavioral cues, which are predicted by implicit measures, should lead to a re-adaptation of explicit measures.

As pointed out before, compared to the studies of Hofmann et al. (2009), the following three changes were applied in order to diminish the differences in cue utility between self-perceivers and neutral observers: (a) Automatic behavior was fed back several times with no more than two indicator cues having to be rated at a time. (b) Unequivocal and clearly defined indicators were used in order to reduce interpretational ambiguity in a domain with clear cues of automatic behavior that are easy to identify and highly specific for this domain: disgust sensitivity. (c) A specific, narrow measure of explicit disgust sensitivity (picture rating) was used in addition to a measure of general disgust sensitivity (FEE).

Additionally for the model and the self-perception feedback pathway, theoretically plausible moderator effects were assumed. These moderator effects were tested to further assure the validity of the model and the pathway of self-perception as a cause for implicit-explicit consistency.

The resulting research program was structured as follows:

1. Study 1: Predictive Validity of the Single Block Single Target IAT

The aim of the first study was to validate the developed indirect measure of disgust sensitivity. Based on the dual process model, as a validation strategy, a double dissociation of explicit measures predicting controlled behavior and implicit measures predicting automatic behavior was tested. This validation strategy required measuring three constructs in addition

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to implicit disgust sensitivity: explicit disgust sensitivity, controlled behavior, and automatic behavior.

2. Study 2: Feedback of Automatic Behavioral Cues and Re-Adaption of Explicit Measures

The aim of the second study was to test the self-perception hypothesis in the domain of disgust. This study was intended to be comparable to the studies by Hofmann et al. (2009). Therefore, the basic changes were (a) to use another domain (disgust sensitivity), (b) to use a different procedure in the self-perception of behavioral cues, and (c) to use a specific explicit disgust sensitivity measure in addition. Furthermore, as a basic moderator effect, social desirability (Paulhus, 1994) was assumed. This moderator was expected to affect the cue validity of explicit disgust sensitivity measures in predicting controlled behavior and was intended to indicate if (assumed) automatic behavior may be partly controllable. Subjects low in social desirability were expected to behave more in accordance with their explicit disposition, and the behavior of subjects high in social desirability was expected to be rather oriented toward external social forces. Social desirability was also expected to have an effect on cue utility because self-knowledge of behaving according to social demands may reduce the effect of self-inferences because it is not recognized as a person's authentic "own" behavior.

3. Study 3: Replication of Results and Moderator Effects of Cue Validity and Cue Utility

The third study had three aims. First, the findings of Study 2 were expected to be replicated. Second, the hypothesis was tested that cue validity and cue utility are not constants but differ interindividually among self-perceivers. Moreover, it was tested whether these interindividual differences in cue validity and cue utility can be accounted for by theoretically plausible moderators. This second aim follows up on previous studies showing that implicit-explicit consistency depends on a number of boundary conditions (cf. Friese et al., 2008; Hofmann, Gschwendner, Nosek, & Schmitt, 2005; Nosek, 2005). Based on the results of Study 2, display rules (Ekman & Friesen, 1975; Matsumoto et al., 2005) and need for closure (Webster & Kruglanski, 1994)) for cue validity of direct measures and cue utility of facial expression cues were investigated as moderators. Third, and also based on the results of Study 2, the temporal stability of the implicit disgust sensitivity measure was examined.

4. Study 1: Predictive Validity of the Single Block Single Target IAT

4.1. Method

4.1.1. Participants

Seventy-five students (age: $M = 22.6$, $SD = 3.7$; 84% female) from different disciplines were recruited and received either course credit or were paid for their participation.

4.1.2. Design and procedure

Data collection occurred at two measurement occasions. At each occasion, participants were tested in groups of up to five, and were seated individually in separate cubicles. At Occasion 1, indirect and direct measurement procedures of disgust sensitivity were obtained. First, participants performed a single block single target IAT (Zinkernagel et al., 2011) as a representative of an indirect measurement procedure of implicit disgust sensitivity. Subsequently, with the German Questionnaire for the Assessment of Disgust Sensitivity (FEE; Schienle, Walter, Stark, & Vaitl, 2002), explicit disgust sensitivity was collected. At Occasion 2, which took place 2 weeks later, controlled and automatic behavior were measured. Participants performed a disgust-related behavior task as a measurement of controlled disgust behavior. During this task, participants were unobtrusively recorded by a web cam. Behavioral cues on the video served as a measure of automatic behavior. The videotaped cues were rated by two neutral observers after data collection was complete. At the end of Occasion 2, participants received course credit or payment and were debriefed. All measures and measurement procedures are described in detail below.

4.1.3. Measures

Indirect measurement procedure. Although indirect measurement procedures of disgust sensitivity exist (Teachman et al., 2001; Teachman & Woody, 2003), a decision was made to adapt an IAT (Greenwald et al., 1998) for the purposes of this research. This was done with respect to there being no natural or semantic antipode to disgust and to the susceptibility to recoding strategies of the standard IAT. Therefore, the IAT proposed by Teachman et al. (2001; Teachman & Woody, 2003) was adapted and transformed into an single block single target IAT (SB-ST-IAT; Zinkernagel et al., 2011). Pictures of flour worms were chosen as target items rather than words based on findings attesting higher

4. Study 1: Predictive Validity of the Single Block Single Target IAT

external validity to pictorial compared to semantic stimuli (e.g., Rapee, McCallum, Melville, & Ravenscroft, 1994). Flour worms were used as stimulus material to achieve a behavioral measure of medium difficulty to avoid ceiling or bottom effects: According to Davey (1994) and Davey et al. (1998), in Western European countries, worms are estimated as moderately disgusting whereas they are rated low in eliciting fear at the same time. Further, flour worms are stored product pests and may be classified into the core disgust facet of the disgust emotion (Rozin & Fallon, 1987). Flour worms were the only target category, which defined this IAT as an ST-IAT (Karpinski & Steinman, 2006). Attribute categories were "pleasant" and "unpleasant." Positive and negative pictures served as attribute stimuli (see Appendix B.1). For the reasons outlined earlier, the block structure of the classic IAT was replaced by a single block structure as proposed by Teige-Mocigemba et al. (2008). Figure 1 shows screen shots of the SB-ST-IAT. The SB-ST-IAT presents compatible and incompatible trials concurrently on the computer screen such that the upper half of the screen represents the compatible mapping of categories and the lower half of the screen represents the incompatible mapping. In the upper left and the lower right corners of the screen, the target category label is shown ("worm"). The screen is divided horizontally by a line. At the two ends of this line, the attribute categories ("unpleasant," "pleasant") are presented. Target and attribute stimuli are presented in a randomized order, either above or below the horizontal line, thus creating a compatible trial ("worm" & "unpleasant") or an incompatible trial ("worm" & "pleasant"). Participants were instructed to respond as quickly as possible and to classify an unpleasant attribute stimulus or a target stimulus in the compatible condition with the "A"-key and a pleasant attribute stimulus or a target stimulus in the incompatible condition with the "5"-key on the numeric keypad. Whenever a stimulus was classified incorrectly, a red "X" appeared in the middle of the screen until the item was classified correctly. Six target pictures of flour worms were used; these were obtained from the authors picture libraries. Six pleasant and six unpleasant pictures served as attribute stimuli. The pictures were taken from the international affective picture system (IAPS; Lang, Bradley, & Cuthbert, 1995; pleasant: 2070, 5780, 5831, 7326, 8200; unpleasant: 5970, 9340, 9620) and from the authors' picture libraries. Attribute pictures were pretested for valence and disgust (see Table 1). Selected attribute pictures were high in positive or negative valence and low in disgust (e.g., negative valenced picture: sinking ship, IAPS 9620; Lang et al., 1995). All pictures were balanced for size, color, and orientation.

One hundred sixty attribute and target trials were presented in a randomized

4. Study 1: Predictive Validity of the Single Block Single Target IAT

Table 1: Means and Standard Deviations of Pretest Picture Ratings for Studies 1, 2, and 3

Study 1						
	Pos. pictures		Neg. pictures		Worm pictures	
Ratings	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Valence	4.39	1.08	1.66	1.69	4.94	0.98
Disgust	1.19	0.74	3.04	1.58	4.30	1.60
Studies 2 and 3						
	Pos. pictures		Neg. pictures		Cockroach pictures	
Ratings	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Valence	5.55	0.64	1.68	0.65	1.68	0.75
Disgust	1.18	0.48	1.93	0.95	4.76	1.17

Note. Pretest for Study 1: $N = 92$; Pretest for Study 2 and 3: $N = 103$; Valence ratings (1 = *unpleasant* to 6 = *pleasant*); Disgust ratings (1 = *not disgusting* to 6 = *very disgusting*).

order. Half of these trials were compatible trials and half were incompatible trials. The D600-algorithm (Greenwald et al., 2003) was used to calculate the IAT score with positive values reflecting a quicker reaction in the compatible condition ("worm" & "unpleasant"). Thus, positive IAT scores reflect implicit disgust sensitivity. According to the procedure in Teige-Mocigemba et al. (2008), Cronbach's alpha was computed for the four IAT scores of the four test blocks. The internal consistency of the SB-ST-IAT was $\alpha = .64$. Therefore, the estimated reliability of the SB-ST-IAT was in the expected range, as Teige-Mocigemba et al. (2008) reported internal consistencies ranging from $\alpha = .58$ (flower-insect SB-IAT) to $\alpha = .88$ (TSA SB-IAT⁵). The outcomes of this measurement procedure are considered to be implicit because participants (a) did not have to follow particular goals except responding as quickly as possible, (b) therefore, did not have substantial time to respond, and (c) were aware of neither the functionality of the measurement process nor the formation of the measurement outcome (De Houwer et al., 2009).

Direct measurement procedure. Explicit disgust sensitivity was measured with the German Questionnaire for the Assessment of Disgust Sensitivity (Ein Fragebogen zur Erfassung der Ekelempfindlichkeit; FEE; Schienle et al., 2002).

⁵Single block version of the Task-Switching Ability IAT (TSA IAT; Back, Schmukle, & Egloff, 2005)

4. Study 1: Predictive Validity of the Single Block Single Target IAT

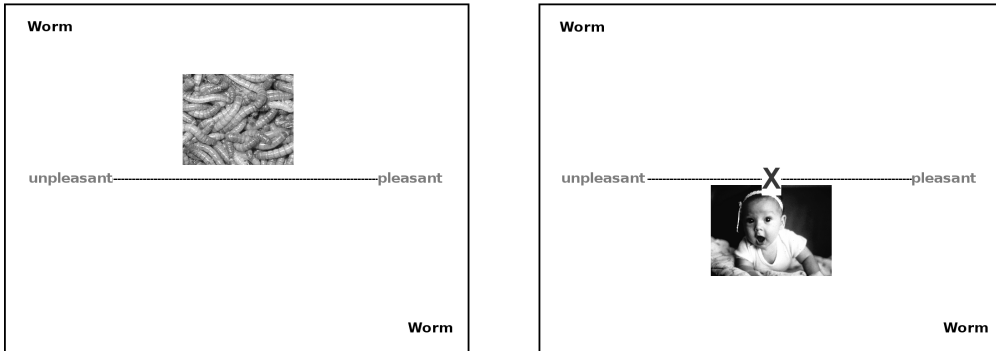


Figure 3: Example screen shots of the single block single target IAT (SB-ST-IAT). The left screen shot shows a target stimulus of a compatible trial correctly classified with the "A"-key, and the right screen shot shows an attribute stimulus of an incompatible trial incorrectly classified with the "A"-key with error feedback.

The questionnaire is based on the Disgust Scale (DS; Haidt et al., 1994) and consists of 37 items that are divided into five subscales (death, body secretions, spoilage, hygiene, and oral rejection). The questionnaire covers hypothetical situations and their disgust-eliciting potential (e.g., “You see someone vomit,” “You are about to drink a glass of milk when you smell it is spoiled”). Items are answered on a 6-point rating scale ranging from 1 (*not disgusting*) to 6 (*very disgusting*). The total score of the FEE was used as a measure of general explicit disgust sensitivity ($\alpha = .88$).

Controlled behavior. The cockroach task proposed by Rozin et al. (1999) was transformed into a worm task. A small closed box that contained flour worms was placed next to the computer monitor. The contents of the box were unknown to participants at the beginning of the task. Instructions were presented on the computer screen. Four tasks of increasing difficulty were requested. Participants were allowed to abort the task at every step. Participants were instructed to: (a) open the box and look into it, (b) put one finger into the flour worms, (c) take some flour worms into their hands, (d) put some flour worms to their lips. Controlled avoidance (vs. approach) behavior was scaled as follows: 4 = refused to perform a; 3 = stopped after performing a; 2 = stopped after performing b; 1 = stopped after performing c; 0 = performed all steps. The reliability of the worm task is unknown because it was performed only once.

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Automatic behavior. During the worm task, participants were filmed unobtrusively with a web cam (320×240 pixels at 25 frames per s) that was placed on top of the monitor. The video was started at the onset of the worm task without participants' awareness. At the end of the worm task, participants were asked for permission to use the video. If they denied permission, the video was deleted immediately. Two neutral observers (one male, one female) rated the videos for disgust-related automatic behavioral cues. More specifically, observers were instructed to rate (a) the facial disgust expression and, as a bodily disgust indicator, (b) withdrawal of hands or the upper body away from the box or the worms. Both ratings were performed on rating scales ranging from 1 (not observable) to 4 (clearly observable). The internal consistency of the four items (2 observers \times 2 ratings) was $\alpha = .74$. The four items were aggregated in order to obtain a single index of automatic disgust behavior. This index may be appropriate for two reasons: (a) Video recording was performed without participants' awareness, and (b) basic emotions are assumed to elicit facial expressions and immediate motor reactions automatically (e.g., Ekman, 1997; Fridlund, 1994; Izard, 1993; Rozin et al., 2000).

4.2. Results

4.2.1. Descriptive statistics

Means, standard deviations, internal consistencies, and correlations for the indirect (SB-ST-IAT) and the direct (FEE) disgust sensitivity measures, the controlled behavior measure (worm task), and the automatic behavioral cues index are presented in Table 2. A nonsignificant negative correlation was obtained between the indirect and direct disgust sensitivity measures ($r = -.18$) as well as a nonsignificant negative correlation of the indirect measure with controlled behavior ($r = -.19$), whereas the indirect measure had a nonsignificant positive correlation with the automatic behavioral cues indicator ($r = .15$). The direct measure was significantly correlated with controlled behavior ($r = .46$) as well as with automatic behavior cues ($r = .33$). The correlation of controlled and automatic behavior measures was significant with $r = .47$.

4.2.2. Double dissociation analysis

The predictive validity of the indirect measure of implicit disgust sensitivity (SB-ST-IAT) and the direct measure of explicit disgust sensitivity (FEE) was tested via a path analysis according to the double dissociation model. The path analysis was performed with Mplus (Muthen & Muthen, Ver. 6) on the

4. Study 1: Predictive Validity of the Single Block Single Target IAT

Table 2: Correlations, Internal Consistencies (Diagonal Elements), Means, and Standard Deviations of Measures in Study 1 ($N = 75$)

Measurement	1	2	3	4
1. SB-ST-IAT	(.64)			
2. FEE	-.18	(.88)		
3. Worm task	-.19	.46**	NA	
4. Automatic behavioral cues	.15	.33**	.47**	(.53)
M	-.04	4.01	2.87	1.97
SD	0.24	0.72	0.93	0.79

Note. $N = 75$. SB-ST-IAT = single block single target Implicit Association Test; FEE = Disgust Sensitivity Questionnaire; Diagonal values in brackets represent internal consistencies; NA = Not Applicable because worm task is a single behavior measure with no reliability estimate.

* $p < .05$. ** $p < .01$.

manifest level with simultaneous parameter estimation. Significant paths that were obtained in this analysis are presented in Figure 4.

In line with the double dissociation model, the SB-ST-IAT had a unique effect on automatic behavior but no unique effect on controlled behavior. This pattern of results supports the construct validity of the SB-ST-IAT as a measure of implicit disgust sensitivity. The difference between the nonsignificant positive correlation ($r = .15$) and the significant path in the path analysis (standardized path coefficient = .22, $p < .05$) can be traced back to a small suppression effect because variance due to the direct measure (FEE) was controlled for in the path analysis. Also in line with the double dissociation model, the FEE had a unique effect on controlled behavior. However, the FEE also had a unique effect on automatic behavior, and this effect is not consistent with the double dissociation model. Thus, a partial but not the full double dissociation between the two systems that is assumed by dual process theories was obtained.

4.3. Discussion

The aim of Study 1 was (a) to develop an indirect measurement procedure of implicit disgust sensitivity and (b) to validate this measure based on dual process models and the double dissociation hypothesis. In order to avoid well-known limitations of the classic IAT, the procedure of the single target IAT (Karpinski & Steinman, 2006) was combined with the procedure of the single block IAT (SB-IAT Teige-Mocigemba et al., 2008) into a new procedure called

4. Study 1: Predictive Validity of the Single Block Single Target IAT

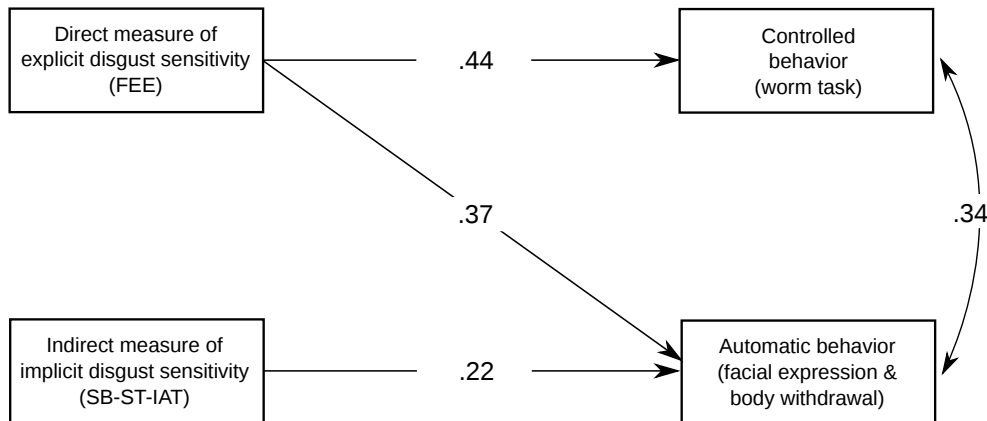


Figure 4: Double dissociation analysis of Study 1: Significant ($p < .05$) standardized path coefficients of implicit and explicit disgust sensitivity on indicators of controlled and automatic behavior in reaction to disgust stimuli.

the single block single target IAT (SB-ST-IAT). This measure was tested using flour worms as disgust targets and pictures of flour worms as stimuli.

Although the reported internal consistencies of the standard IAT range from .7 to .9 (Nosek et al., 2007), the internal consistency of the SB-ST-IAT was slightly lower ($\alpha = .64$), but in an expected range compared to internal consistencies reported for the SB-IAT ($\alpha = .58$ to $.88$; Teige-Mocigemba et al., 2008). Despite the limited reliability of the SB-ST-IAT, the SB-ST-IAT had a unique effect on automatic behavior. Taking the reliability of both measures into account, the size of the unique effect of implicit disgust sensitivity on automatic behavior (standardized path coefficient = .22) was similar to results from meta-analyses (Friese et al., 2008; Greenwald et al., 2009).

Regarding the predictive validity of the explicit disgust sensitivity measure that was used, the German version (FEE; Schienle et al., 2002) of the Disgust Sensitivity Scale (DS; Haidt et al., 1994), this study revealed an interesting partial-dissociation pattern (e.g., Perugini, Richetin, & Zogmaister, 2010). In line with the double dissociation model, the FEE had a unique effect on controlled approach versus avoidance behavior toward a disgusting stimulus. Moreover, the size of this effect was remarkable given that a single act criterion was used (cf. Epstein & O'Brien, 1985; Fishbein & Ajzen, 1974).

From the viewpoint of dual process theories and the double dissociation model, the unexpected effect of explicit disgust sensitivity on automatic reactions to disgusting stimuli can mean at least four things: It can mean that (a)

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dual process theories and the double dissociation model have limited validity, (b) the FEE lacks construct validity, (c) the FEE contains automatic components, or (d) the automatic behavior cues have limited validity in that they contain controlled components. Given the vast empirical evidence in support of the general dual systems model, the first interpretation does not seem very convincing (e.g., Chaiken & Trope, 1999; Evans & Frankish, 2009; Smith & DeCoster, 2000). The second hypothesis does not seem very convincing either because the construct validity of the FEE has been demonstrated in several studies (Rohrman, Schienle, Hodapp, & Netter, 2004; Stark, Walter, Schienle, & Vaitl, 2005) and because in the present study, the FEE was found to predict controlled behavior quite well. It seems unlikely that the effect of the FEE on controlled behavior was inflated by consistency or carry-over effects because explicit disgust sensitivity and controlled disgust behavior were measured in independent sessions and several weeks apart from each other.

Although the correlation between the indirect and direct measurement procedures was negative, according to the third interpretation, it seems likely that implicit disgust sensitivity influences responses to questionnaire items (Gawronski & Bodenhausen, 2006). This seems to be likely because the indirect and the direct measurement procedures measure disgust sensitivity on different levels of specificity. In order to rule out cross-correlations in future studies, a more specific direct measurement procedure (e.g., a picture rating) should be used.

The fourth interpretation seems also very convincing. Several authors have argued that most kinds of behavior are neither exclusively controlled nor exclusively automatic (cf. Friesen et al., 2008). Rather than being exclusively controlled or exclusively automatic, most kinds of behavior can be located on a continuum ranging from fully controlled to fully automatic. According to a process dissociation framework (e.g., Jacoby, 1991), it may be possible to separate automatic and controllable processes respectively to estimate the automatic and controllable parts of a behavior.

In particular, facial expression cues may not be cues of automatic behavior. Although it was argued before that (a) due to motor programs for specific emotional facial displays, the emotion is shown in an automatic manner, and (b) the self-serving bias should be low in the domain of disgust sensitivity, it may be possible that facial expressions of emotions can be faked or suppressed due to self-presentational concerns or culturally determined display rules (e.g., Ekman & Friesen, 1975; Gross, John, & Richards, 2000). In order to clarify this issue, a larger number of specific indicators of facial expressions and bodily reaction cues were used in the following studies. The next studies also took into

5. *Study 2: Feedback of Automatic Behavioral Cues and Re-Adaption of Explicit Measures*

account the moderating role of self-presentational concerns for the cue validity and cue utility parts the our model. These strategies were expected to contribute not only to a better understanding of the boundary conditions for using facial expressions and bodily movements as cues of automatic behavior, but also to a better understanding of the validity of the proposed SB-ST-IAT for measuring implicit disgust sensitivity.

The results of this initial investigation of the construct validity of the proposed SB-ST-IAT were promising. However, to clarify the discussed issues, the next study included (a) a specific explicit disgust sensitivity measure, (b) several cues of facial expression and bodily reactions, and (c) social desirability as a general moderator representing self-presentational concerns.

5. Study 2: Feedback of Automatic Behavioral Cues and Re-Adaption of Explicit Measures

In Study 1, the predictive validity of the SB-ST-IAT was shown with a double dissociation strategy. In Study 2, the self-perception hypothesis (cf. Hofmann et al., 2009; Hofmann & Wilson, 2010) was investigated. Different from the studies by Hofmann et al. (2009), a modified self-perception procedure was used. Additionally, and because of the outcome of Study 1, a specific disgust sensitivity measure was used and several cues for facial expression and bodily reaction were applied to measure automatic behavior. Social desirability as a general moderator of cue validity and cue utility were tested.

5.1. Method

5.1.1. Participants

One hundred seventeen students (age $M = 22.4$, $SD = 3.7$; 93% female) from different disciplines at the University of Koblenz-Landau were recruited and received either course credit or were paid for participation.

5.1.2. Design and procedure

In order to be comparable to the studies by Hofmann et al. (2009), the experiment was divided into two measurement occasions. An anonymous code was used to link the data from the two measurement occasions. At both measurement occasions, participants were seated in separate cubicles so that they could not communicate with each other. All measures as well as instructions for the behavioral tasks were presented on a computer screen.

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At the first measurement occasion, indirect and direct measures of implicit and explicit disgust sensitivity and the moderator social desirability were collected. At the beginning of the experiment, participants performed the implicit disgust sensitivity measure (SB-ST-IAT). Subsequently, as explicit disgust sensitivity measures, the German Questionnaire for the Assessment of Disgust Sensitivity (FEE) and a picture rating were collected. Afterwards, participants completed the Balanced Inventory of Desirable Responding Questionnaire (Musch, Brockhaus, & Bröder, 2002; Paulhus, 1994).

At the second measurement occasion, which took place 2 weeks later, behavioral data were collected, and the feedback for their behavior was provided. First, participants performed the German State Disgust Scale (Ihme & Mitte, 2009). Subsequently, the behavior task was conducted and unobtrusively recorded by a web cam. After that, participants completed the German State Disgust Scale again. Next, participants were instructed to rate disgust-related behavioral cues for their own video. Then participants were shown their own video, and the self-rating of behavioral cues was performed. Finally, explicit disgust sensitivity measures (FEE, picture rating) were collected again. At the end of the second occasion, participants received their credit or payment, were fully debriefed, and thanked. Upon completion of data collection, three neutral observers (two male, one female) rated the videos of the participants regarding the disgust-related behavioral cues and two marker items of the direct measure of general explicit disgust sensitivity (FEE) and two exemplary pictures of the picture rating as a measure of specific disgust sensitivity.

All measures and measurement procedures are described in detail below.

5.1.3. Measures

Indirect measurement procedure. In Study 2, the implicit measurement procedure was the same as used in Study 1 (SB-ST-IAT, Zinkernagel et al., 2011, see Figure 3). However, the target concept was changed to "cockroach" with the aim of achieving a more pronounced automatic behavior. According to Davey (1994; Davey et al., 1998), cockroaches are reported to be higher in eliciting the emotion of disgust compared to worms, whereas the level of eliciting fear is still low. As target pictures, six pictures of cockroaches in disgust-eliciting settings (e.g., cockroaches on skin, cockroaches next to food) were used (see Appendix B.2). These pictures were taken from the authors' picture libraries. Six positive and six negative pictures served as attribute stimuli. These pictures were partly taken from the IAPS (Lang et al., 1995; pos.: 2070, 2550, 5780, 5831, 7325; neg: 5970, 9620) and partly from the authors' picture libraries. At-

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tribute pictures were pretested for valence and disgust (see Table 1). Selected attribute pictures were high in positive or negative valence and low in disgust. The procedure and the scoring algorithm of this SB-ST-IAT was the same as in Study 1. The internal consistency (Cronbach's alpha) of the SB-ST-IAT estimated at the item level was $\alpha = .32$.

Direct measurement procedures

German Questionnaire for the Assessment of Disgust Sensitivity. As in Study 1, the FEE (Schienle et al., 2002) as a general measure of disgust sensitivity was used. It contains 37 items that are answered on rating scales ranging from 1 (*not disgusting*) to 6 (*very disgusting*). Internal consistency of the FEE was $\alpha = .88$.

Picture Rating. In addition to the FEE used in Study 1, as a specific explicit disgust sensitivity measure, the target pictures of the SB-ST-IAT were used in a picture rating. The pictures were answered on 6-point rating scales ranging from 1 (*not disgusting*) to 6 (*very disgusting*). The internal consistency of the picture rating was $\alpha = .97$.

German State Disgust Scale. The German State Disgust Scale (Ekel-State-Fragebogen; ESF; Ihme & Mitte, 2009) was administered at the second measurement occasion directly before and after the behavioral task. This was done to perform a manipulation check to verify whether participants perceived disgust during the behavioral task. The ESF consists of 15 items, including items about feeling disgusted and showing avoidance behavior (e.g., "I feel miserable," "I want to escape from the situation") as well as proprioceptive perception of autonomous bodily reactions (e.g., "I have a bad taste in my mouth," "My stomach is churning"). Items are answered on a 6-point rating scale ranging from 1 (*do not agree*) to 6 (*fully agree*). High scores represent a high state of disgust. The internal consistency was $\alpha = .82$ before and $\alpha = .91$ after the behavioral task.

Balanced Inventory of Desirable Responding. A German version of the Balanced Inventory of Desirable Responding (BIDR; Musch et al., 2002; Paulhus, 1994) was administered right after the collection of implicit and explicit disgust sensitivity at the first measurement occasion. The BIDR consists of 20 items divided into two subscales with 10 items each: self-deceptive enhancement and

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impression management. Self-deceptive enhancement denotes a tendency to perceive reality biased in an optimistic way to preserve self-perception (e.g., “I am very confident of my judgment”). Impression management is defined as the tendency to consciously bias responses and reactions in order to achieve a positive impression to an audience (e.g., “Sometimes I lie if I have to”; reverse scored). Items are answered on a 6-point rating scale ranging from 1 (*do not agree*) to 6 (*fully agree*). High scores represent high social desirability. The internal consistency for the subscales of the BIDR was $\alpha = .45$ for self-deceptive enhancement and $\alpha = .68$ for impression management.

Behavioral measurement procedures

After responding to the State Disgust Scale at the beginning of the second measurement occasion, participants performed a disgust-related behavioral task similar to the one in Study 1. As stimulus material for this task, dead cockroaches (*Gromphadorrhina portentosa*) were used because these vermin are perceived to be strongly disgusting and do not arouse fear (Davey, 1994; Davey et al., 1998). Furthermore, cockroaches as potential carriers of disease elicit disgust in order to prevent contamination and spread of pathogens (Douglas, 1966) and are not appraised as edible in Western European countries.

Controlled behavior. Similar to the task in the first study, in the “Cockroach Task” (Rozin et al., 1999), participants had to perform four consecutive tasks with a small closed box containing three dead and sterilized cockroaches. The box was placed next to the computer monitor and the contents of the box were unknown to the participants. Again, the participants had to perform four consecutive steps and the measure was scaled such that high scores reflect high disgust sensitivity. For both ethical and theoretical reasons, participants were free to stop at any step of the task and continue with the State Disgust Scale. The Cockroach Task measures controlled behavior because taking the next step or not is a conscious decision. The internal consistency of the Cockroach Task cannot be determined because the items (steps) cannot be performed independently.

Automatic behavior. Also similar to Study 1, participants were filmed unobtrusively by a web cam (320 × 240 pixel at 25 frames per s) that was placed on top of the monitor during the Cockroach Task. The recording of the video was started at the onset of the Cockroach Task without participants’ awareness. At the end of the second measurement occasion, participants were asked for per-

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mission to use the video. If they denied permission, the video was deleted immediately. After finishing the Cockroach Task and answering the State Disgust Scale, participants were asked to rate their own facial expression and bodily reactions. To focus their attention on typical characteristics of the facial expression of disgust, three example pictures emphasizing characteristics of facial disgust expression on the forehead, around the nose, and around the mouth were shown (Ekman & Friesen, 1975). Participants rated their own facial expressions based on a simplified description of disgust cues according to the Facial Action Coding System (FACS; Ekman & Friesen, 1978). Ratings were performed on 6-point scales ranging from 1 (*not observable*) to 6 (*clearly observable*) regarding the following cues: (a) wrinkled forehead, (b) nasolabial fold, (c) dragged down corners of a closed mouth, (d) lifted upper lip and protruded tongue of an open mouth, as well as (e) facial disgust expression of the whole face. Furthermore, using the same 6-point scale, participants rated the following cues of bodily reactions: (a) drawing the hands or body back from the stimulus, (b) putting the hands protectively in front of the mouth, (c) averting one's gaze from the stimulus, and (d) turning the head away from the stimulus. To assure a precise and valid rating, participants saw their own video five times and had to judge two cues each time (except for "facial disgust expression of the whole face," which was rated separately). The internal consistency of all self-rated facial and bodily cues was $\alpha = .75$. This measurement may be a measure of automatic behavior because biological models of emotion suppose a direct link between emotion and facial expression (Izard, 1971; Rosenberg & Ekman, 1994). Moreover, it seems plausible to assume that bodily reaction cues were not displayed consciously for several reasons. First, the setting was not a social situation. Second, participants were not aware of being recorded. Third, participants did not know the contents of the box in the Cockroach Task. Therefore, due to their unfamiliarity with the situation and an element of surprise, their facial expression and bodily reactions were likely to occur spontaneously and without intentional control.

In addition to self-ratings of facial and bodily expressions, all participants were rated by three neutral observers (two male, one female). Observer ratings were collected on the same scales as self-ratings. The intraclass correlations for all cues of the three neutral observers was $r_3 = .93$. Observer ratings were averaged per cue. The internal consistency of the averaged observer ratings amounted to $\alpha = .87$.

Repeated measures

After participants had completed all self-ratings of facial and bodily reactions

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during the Cockroach Task, they were administered the questionnaires for measuring explicit disgust sensitivity (FEE, picture rating). These repeated measures were taken to explore whether or not the self-perception of automatic behavior leads to a re-adaptation of the explicit self-concept. The internal consistency of the FEE and the picture rating amounted to $\alpha = .92$ and $\alpha = .95$ respectively. For observers who had to rate many targets, we employed two marker items of each subscale of the FEE (10 items) and two representative pictures of the picture rating scale. The intraclass correlations of the FEE and the picture rating were $r_3 = .78$ and $r_3 = .83$, respectively. Observer ratings were averaged across the three observers. The internal consistencies of the averaged observer FEE and the averaged picture rating scale were $\alpha = .96$ and $\alpha = .93$, respectively.

5.2. Results

5.2.1. Manipulation check

To ensure successful disgust arousal, it was tested whether participants' disgust state was higher after than before the Cockroach Task. Using the t test for dependent samples, a strong and significant increase in state disgust was observed, $t(116) = 8.40$, $p < .01$, $d = .81$.

5.2.2. Factorial structure of self- and observer ratings

Self-ratings and averaged observer ratings of all facial and bodily cues were submitted simultaneously to a principle axis factor analysis (PAF). Although the eigenvalues suggested two common factors, four factors were extracted and rotated to simple structure using the promax rotation in order to test whether facial cues and bodily cues could be discriminated and whether self-ratings would diverge from observer ratings. The pattern of loadings did not support such a model. Next, only two factors were extracted and rotated to simple structure. This analysis resulted in a clear loading pattern. Self-ratings and observer ratings of facial expression cues loaded on one factor. Self-ratings and observer ratings of bodily cues loaded on the other factor. This pattern means that self-ratings and observer ratings of the same set of cues converge, whereas the two sets of cues diverge. The two-factor solution explained 47% of the total item variance. Factor loadings are presented in Table 3. The correlation between the factors amounted to $r = .44$. Cues of facial expression and cues of bodily reactions were aggregated into separate scales. In order to test the assumed mechanism of the feedback model, separate scales were built for self-perceivers

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and for neutral observers. For self-perceivers, the internal consistencies were $\alpha = .76$ for facial expression cues and $\alpha = .79$ for bodily reaction cues. For observers, the internal consistencies were $\alpha = .89$ for facial expression cues and $\alpha = .75$ for bodily reaction cues.

5.2.3. Descriptive data

Means, standard deviations, and intercorrelations of all measures obtained in Study 2 are presented in Table 4 above the diagonal. The correlations among the variables were largely according to expectations, however, some unexpected results occurred: First, the estimated reliability of the SB-ST-IAT was unexpectedly low ($\alpha = .32$). Second, the SB-ST-IAT was significantly correlated with self-ratings ($r = .23$) and with observer ratings ($r = .23$) of bodily reaction cues but not with self-ratings ($r = .09$) and with observer ratings ($r = -.03$) of facial expression cues. Third, the SB-ST-IAT was significantly correlated with the state disgust measure after the Cockroach Task ($r = .29$). Fourth, the picture rating did not significantly predict controlled behavior ($r = .11$). The unexpected results will be discussed later on.

5.2.4. Cue validity

The predictive validities (cue validity) of the indirect measure of implicit disgust sensitivity (SB-ST-IAT) and the direct measure of explicit disgust sensitivity (FEE, picture rating) were tested via eight path analyses according to the double dissociation model. More specifically, controlled behavior (Cockroach Task) and automatic behavior (facial and bodily reactions) were regressed on the direct and indirect measures of explicit and implicit disgust sensitivity. This was done for self- and observer-rated facial and bodily reaction cues. The path analyses were performed with Mplus (Muthen & Muthen, Ver. 6) on the level of manifest variables with simultaneous parameter estimation. Significant path coefficients are presented in the upper part of Figure 5, separately for self-perceivers and neutral observers and both measures of explicit disgust sensitivity (FEE, picture rating). Of special interest is the unique effect of implicit disgust sensitivity as measured with the SB-ST-IAT on automatic disgust behavior. In line with the correlations in Table 4, no significant unique regression effect of implicit disgust sensitivity on facial expression was found. However, the unique regression effect of implicit disgust sensitivity on bodily reaction cues was significant for both self-perceivers and observers. Also indicated by the correlation in Table 4, no significant cue validity occurred for the explicit specific disgust sensitivity measure (picture rating; see second row of upper part of

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Table 3: Factor Analysis of Automatic Behavioral Cues for Self-Perceivers and Neutral Observers for Study 2 and Study 3

Automatic behavioral cues	Study 2		Study 3	
	Factor 1	Factor 2	Factor 1	Factor 2
Wrinkled forehead (ps)	.34			
Nasolabial fold (ps)	.53		.49	
Dragged down corners of a closed mouth (ps)	.52		.45	
Lifted upper lip and protruded tongue of an open mouth (ps)	.60		.54	
Facial expression of disgust as a whole (ps)	.59		.62	
Hands or body drawn back from stimulus (ps)		.66		.74
Hands put protectively in front of the mouth (ps)		.65		.49
Gaze averted from stimulus (ps)		.75	-.48	.70
Head turned away from stimulus (ps)		.74		.69
Wrinkled forehead (obs)	.57		.90	
Nasolabial fold (obs)	.86		.99	
Dragged down corners of a closed mouth (obs)	.82		.67	
Lifted upper lip and protruded tongue of an open mouth (obs)	.64		.73	
Facial expression of disgust as a whole (obs)	.86		.92	
Hands or body drawn back from stimulus (obs)		.48	.33	.58
Hands put protectively in front of the mouth (obs)		.55		.47
Gaze averted from stimulus (obs)		.73		.52
Head turned away from stimulus (obs)		.68		.58

Note. Study 2: $N = 117$; Study 3: $N = 130$; Factor loadings $> .30$ were reported; ps = scores provided by participants, obs = scores provided by neutral observers.

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Table 4: Correlations, Means, and Standard Deviations for Indirect, Direct, and Behavioral Measures in Study 2 (Above the Diagonal, $N = 117$) and Study 3 (Below the Diagonal, $N = 130$)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. SB-ST-IAT	—	.01	.00	.12	.08	.29**	.09	.23*	-.03	.23*	.00	.13	.04	.06
2. FEE 1 st occ.	.10	—	.20*	-.05	.36**	.41**	.33**	.35**	.37**	.38**	.82**	.60**	.45**	.50**
3. Picture rating 1 st occ.	.13	.33**	—	-.04	.11	.14	.13	-.01	.01	.04	.24**	.25**	.09	.11
4. State disgust 1	.00	.01	.01	—	.15	.51**	.15	.16	.02	.16	-.03	.00	.12	.03
5. Cockroach Task	.02	.30**	.40**	.00	—	.57**	.26**	.41**	.16	.36**	.34**	.56**	.51**	.60**
6. State disgust 2	.05	.23**	.27**	.38**	.24**	—	.42**	.53**	.29**	.54**	.39**	.55**	.44**	.48**
7. Facial expression (ps)	.13	.16	.18*	.01	.03	.31**	—	.37**	.56**	.30**	.36**	.38**	.39**	.45**
8. Bodily reaction cues (ps)	.22*	.17	.28**	.09	.34**	.40**	.33**	—	.33**	.69**	.38**	.41**	.37**	.47**
9. Facial expression (obs)	.15	.09	.03	.02	-.10	.25**	.64**	.27**	—	.51**	.39**	.40**	.52**	.60**
10. Bodily reaction cues (obs)	.18*	.09	.15	-.03	.17	.26**	.42**	.67**	.58**	—	.36**	.45**	.54**	.59**
11. FEE 2 nd occ. (ps)	.09	.82**	.22*	.03	.21*	.24**	.19*	.11	.10	.02	—	.57**	.49**	.56**
12. Picture rating 2 nd occ. (ps)	.19*	.41**	.65**	.03	.46**	.47**	.27**	.38**	.13	.25**	.46**	—	.53**	.59**
13. FEE 2 nd occ. (obs)	.11	.36**	.45**	.05	.53**	.46**	.38**	.52**	.51**	.62**	.27**	.57**	—	.86**
14. Picture rating 2 nd occ. (obs)	.12	.32**	.43**	.03	.57**	.45**	.32**	.50**	.45**	.58**	.24**	.56**	.93**	—
Study 2 <i>M</i>	0.06	3.89	4.28	2.12	2.04	2.81	3.13	3.25	3.40	2.88	3.88	4.81	3.97	4.58
Study 2 <i>SD</i>	0.22	0.67	1.61	0.63	1.16	1.03	1.12	1.38	1.17	0.99	0.67	1.17	0.65	1.00
Study 3 <i>M</i>	0.07	3.77	4.83	2.11	2.02	2.82	2.33	2.22	2.93	2.45	3.94	4.96	4.06	4.23
Study 3 <i>SD</i>	0.19	0.71	1.08	0.70	1.23	1.04	1.05	1.23	1.06	0.91	0.72	1.13	0.56	0.80

Note. Study 2: $N = 117$; Study 3: $N = 130$; SB-ST-IAT = Single Block Single Target IAT; FEE = German Questionnaire for the Assessment of Disgust Sensitivity; ps = scores provided by participants, obs = scores provided by neutral observers.
* $p < .05$. ** $p < .01$.

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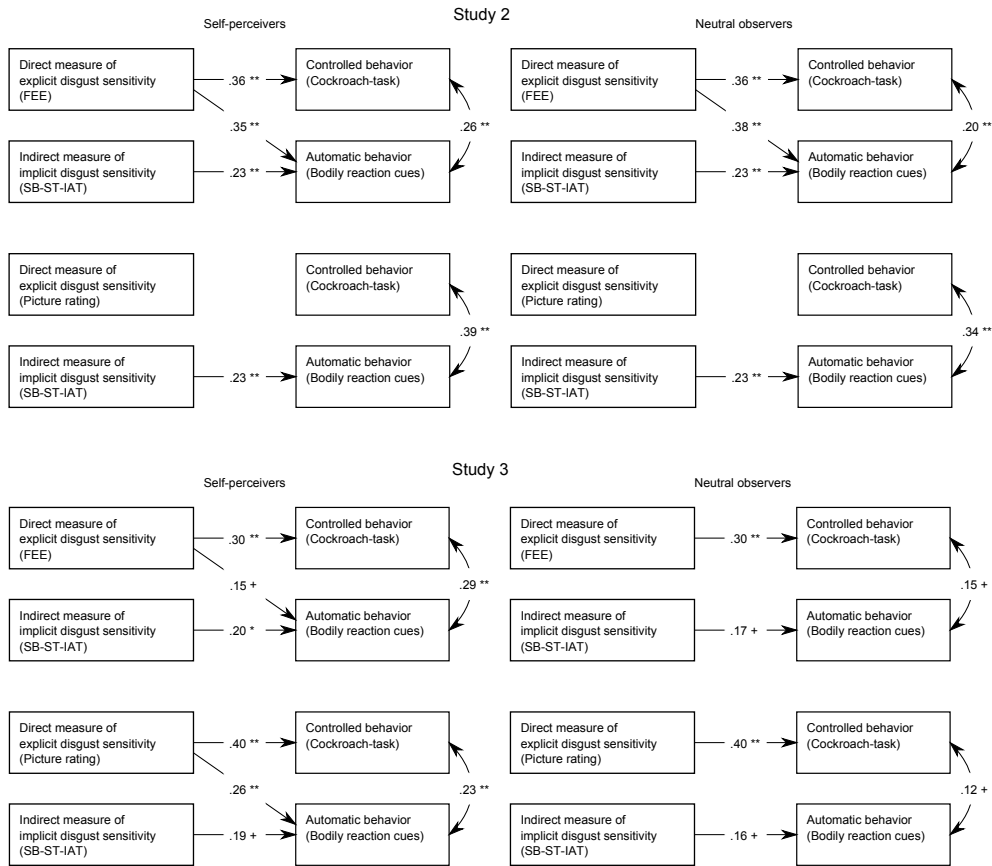


Figure 5: Double dissociation analyses of Study 2 and Study 3: Significant (* $p < .05$, ** $p < .01$) and marginally significant (+ $p < .10$) standardized path coefficients of implicit and explicit disgust sensitivity measures predicting controlled and automatic behavior. The upper part of the figure shows the standardized path coefficients of Study 2, the lower part shows the standardized path coefficients of Study 3.

Figure 5). Subsuming, cue validity for the indirect measure of implicit disgust sensitivity (SB-ST-IAT) was demonstrated for bodily reaction cues but not for facial expression cues.

5.2.5. Cue utility

Cue utility was determined following the procedure employed by Hofmann et al. (2009). Direct measures of self- and observer-rated explicit disgust sensitivity (FEE, picture rating) obtained at Occasion 2 were regressed on the corresponding direct measures obtained at the first measurement occasion. For self-perceivers, the residual variable of this regression reflects measurement error and true differential change from Occasion 1 to Occasion 2. Positive values

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of the residual variable indicate an increase in self-attributed disgust sensitivity, whereas negative values indicate a decrease in explicit disgust sensitivity. Cue utility can be defined as the proportion of variance in the residual variable that is explained by self-ratings of automatic behavior. A positive effect of self-rated automatic behavior indicates that participants with high self-rated automatic disgust behavior display an increase in explicit disgust sensitivity, whereas participants with low self-rated automatic disgust behavior display a decrease in explicit disgust sensitivity. Table 5 shows the relevant correlations for self-perceivers and neutral observers.

As can be seen from the sign of the correlations, for self-perceivers, strong controlled disgust behavior in the Cockroach Task led to an increase in explicit disgust sensitivity as measured via the picture rating. Accordingly, weak controlled disgust behavior in the Cockroach Task led to a decrease in explicit disgust sensitivity according to the picture rating. More importantly for the main research question, both self-rated indicators of automatic behavior (facial and bodily cues) correlated as expected with changes in explicit disgust sensitivity, however, only when the picture ratings were used as a direct measure of cockroach-specific disgust sensitivity. No similar effects were observed for the FEE as a measure of general explicit disgust sensitivity. Not surprisingly, given the convergent and discriminant validity of self-ratings and observer ratings of automatic behavior, the effects of observer ratings paralleled those that were obtained for self-ratings.

For neutral observers, both observer-rated indicators of automatic behavior (facial and bodily cues) correlated strongly with changes in both measures of explicit disgust sensitivity (FEE, picture rating). Again, given the convergent and discriminant validity of self- and observer ratings, the effects of self-ratings paralleled those obtained for observer ratings.

5.2.6. Mediation analyses

Next, the assumed full re-adaptation process (see Figure 1) was tested. This process can be translated into a mediation model with implicit disgust sensitivity at Occasion 1 serving as a predictor variable, automatic behavioral cues (facial expression, bodily reactions) serving as mediator variables, and the residuals of explicit disgust sensitivity serving as the criterion variable. Because the aim of this study was to test the re-adaption process via self-perception, the Cockroach Task was included as a covariate to control for the experiential effects of the Cockroach Task. These effects seem likely given that the Cockroach Task predicted changes in explicit disgust sensitivity (see Table 5). Including

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Explicit Measures

Table 5: Correlation of Behavior Cues With Residuals of Direct Measures in
Study 2 and Study 3 for self-perceivers and neutral observers

	Residuals in Study 2			
	Self-ratings 2nd Occ.		Observer ratings 2nd Occ.	
	FEE	Picture rating	FEE	Picture rating
Facial expression (ps)	.16	.36**	.27**	.44**
Body cues (ps)	.16	.43**	.24**	.47**
Facial expression (obs)	.15	.41**	.40**	.60**
Body cues (obs)	.09	.46**	.41**	.59**
Cockroach Task	.07	.55**	.39**	.59**

	Residuals in Study 3			
	Self-ratings 2nd Occ.		Observer ratings 2nd Occ.	
	FEE	Picture rating	FEE	Picture rating
Facial expression (ps)	.11	.20*	.35**	.27**
Body cues (ps)	-.05	.26**	.49**	.43**
Facial expression (obs)	.04	.14	.51**	.49**
Body cues (obs)	-.08	.20*	.63**	.57**
Cockroach Task	-.06	.26**	.44**	.44**

Note. Study 2: $N = 117$; Study 3: $N = 130$; FEE = German Questionnaire for the Assessment of Disgust Sensitivity; ps = scores provided by participants; obs = scores provided by neutral observers.

* $p < .05$. ** $p < .01$.

5. Study 2: Feedback of Automatic Behavioral Cues and Re-Adaption of Explicit Measures

the Cockroach Task as a control variable made it possible to determine the unique effect of automatic behavioral cues. Separate mediation analyses were performed for both measures of explicit disgust sensitivity (FEE, picture rating). Moreover, all mediation analyses were performed separately for self-ratings and observer ratings as mediators in order to allow for a direct comparison of the present results with the results reported by Hofmann et al. (2009). Results of the present mediation analyses are reported in the upper part of Figure 6. The analyses in Figure 6 were performed employing the bootstrapping procedure recommended by Preacher and Hayes (2004)⁶.

The first row in the upper part of Figure 6 presents the mediation model when the residuals of the general explicit disgust sensitivity measure (FEE) were used as the criterion. Regarding self-perceivers (left), no indirect mediation path was significant. Only cue validity for the path of SB-ST-IAT on bodily reaction cues was significant ($\beta = .21, p = .01$). Regarding neutral observers (right), the indirect effect mediated by bodily reaction cues was significant ($\beta = .046, SE = .035, 95\% CI [.0025 .1521]$) with significant cue validity ($\beta = .21, p = .01$) and significant cue utility ($\beta = .21, p = .02$). The cue utility of facial expression cues was also significant for neutral observers ($\beta = .31, p = .00$). Taken together, a significant mediation effect for neutral observers but not for self-perceivers was found for general explicit disgust sensitivity as measured with the FEE.

The second row in the upper part of Figure 6 depicts the mediation model for the residuals of specific explicit disgust sensitivity (picture rating) as the criterion. For self-perceivers, the indirect effect mediated by bodily reaction cues was significant ($\beta = .031, SE = .023, [.0038 .1102]$) with a significant cue validity path ($\beta = .20, p = .02$) and a significant cue utility path ($\beta = .16, p = .04$). Additionally, a significant cue utility path from facial expression cues to the dependent variable ($\beta = .19, p = .02$) occurred. Similar results were obtained for neutral observers: The path mediated by bodily reaction cues was significant ($\beta = .044, SE = .030, [.0074 .1420]$) with significant cue validity ($\beta = .20, p = .02$) and cue utility ($\beta = .21, p = .00$). Again, cue utility for facial expression was significant ($\beta = .41, p = .00$). Taken together, for the specific disgust sensitivity measure (picture rating), a significant indirect effect via bodily reaction cues occurred for both self-perceivers and neutral observers.

⁶According to current concepts of mediation analysis a significant correlation between independent and dependent variable is not necessary (e.g., Collins, Graham, & Flaherty, 1998; Shrout & Bolger, 2002). Rather important is the proof of the intervening variable effect (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002).

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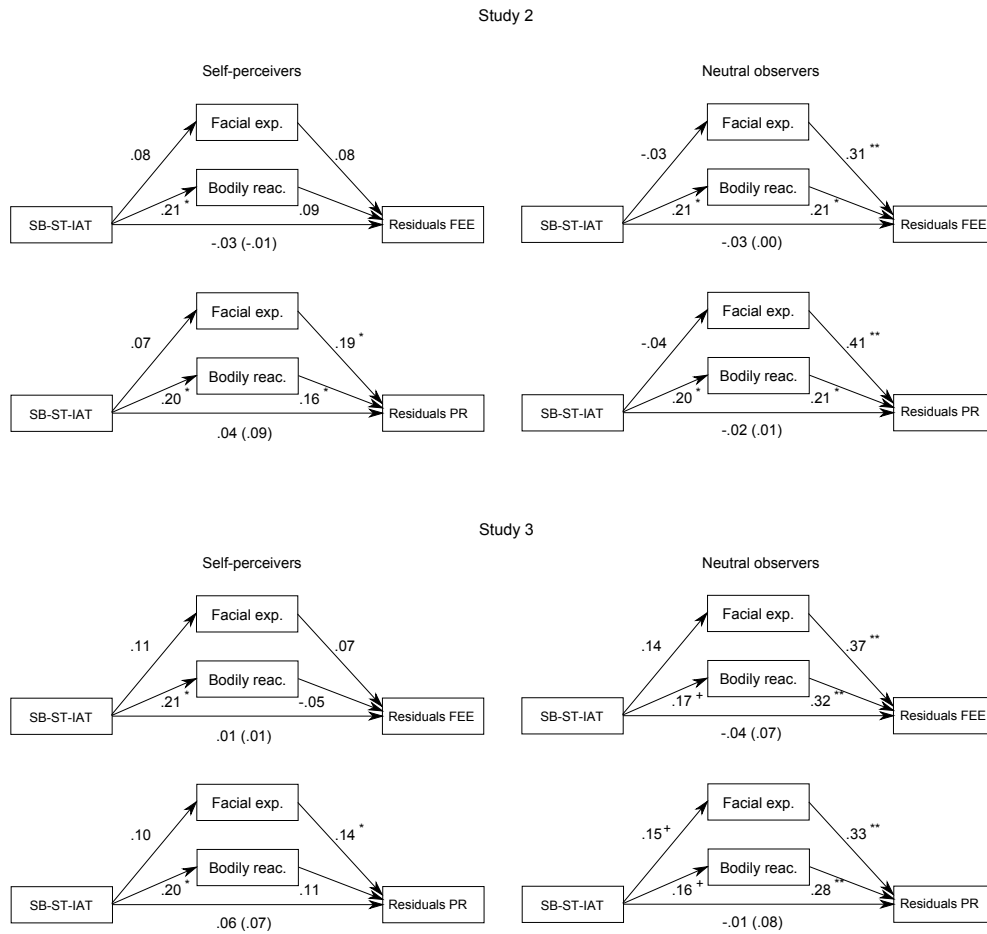


Figure 6: Mediation analyses (first two rows) and state-trait mediation analyses (third row) of Study 2 and Study 3 for the indirect effect of implicit disgust sensitivity on post-test explicit trait inferences for self-perceivers (left column) and observers (right column). PR = picture rating.

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5.2.7. Moderator effects of social desirability

Moderated multiple regression analyses (Aiken & West, 1991) were performed to test whether the cue validity part of the model was moderated by social desirability. The two direct measures of explicit disgust sensitivity (FEE, picture rating) served as predictors, the BIDR total score and its two subscales (Musch et al., 2002; Paulhus, 1994) served as the moderators, and the measures of controlled and automatic behavior as criterion variables. All variables including the dependent variable were standardized before calculating the interaction term (Aiken & West, 1991).

In line with the hypothesis, social desirability moderated the effect of FEE on the Cockroach Task ($R^2 = .17$, $F(3, 113) = 7.48$, $p = .00$; see Table 6, Figure 7). Subjects low in social desirability as measured by the BIDR showed a stronger effect, whereas subjects high in social desirability showed a weaker effect ($\beta = -.20$, $t = -2.12$, $p = .04$, $\Delta R^2 = .04$). Conditional expected values (Cohen & Cohen, 1983) showed a significant effect for subjects low in social desirability ($\beta = .59$, $SE = .14$, 95% CI [.3209 .8760]) and a nonsignificant effect for subjects high in social desirability ($\beta = .19$, $SE = .12$, [-.0323 .4286]).

A similar moderator pattern resulted for the picture rating measure, $R^2 = .04$, $F(3, 113) = 1.47$, $p = .22$, however, the moderator effect was only marginally significant in this case ($\beta = -.13$, $t = -1.70$, $p = .092$, $\Delta R^2 = .03$) with a significant effect for conditional expected values for subjects low in social desirability ($\beta = .25$, $SE = .12$, [.0095 .5020]) but not for subjects high in social desirability ($\beta = -.01$, $SE = .12$, [-.2420 .2246]).

A closer inspection of the moderator effect on the level of social desirability components: self-deception, $R^2 = .14$, $F(3, 113) = 6.09$, $p = .00$; impression management, $R^2 = .16$, $F(3, 113) = 7.07$, $p = .00$, revealed a marginally significant moderator effect of self-deception on cue validity when FEE was used as a predictor of facial expression ($\beta = -.18$, $t = -1.95$, $p = .053$, $\Delta R^2 = .03$), with significant conditional expected values for subjects low ($\beta = .53$, $SE = .14$, [.2601 .8066]), but not for subjects high in self-deception ($\beta = .17$, $SE = .12$, [-.0643 .4061]). Also, a marginally significant moderator effect of impression management occurred when FEE was used as a predictor of the Cockroach Task ($\beta = -.17$, $t = -1.81$, $p = .073$, $\Delta R^2 = .03$). Again, conditional expected values were significant for subjects low ($\beta = .54$, $SE = .13$, [.2807 .8046]), but not for subjects high on impression management ($\beta = .21$, $SE = .12$, [-.0289 .4485]).

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Table 6: Moderated Multiple Regression Analyses Testing Moderator Effects of Social Desirability

Predictor	Cockroach Task		Predictor	Cockroach Task	
	R^2	β		R^2	β
Step 1	.13**		Step 1	.01	
FEE		.36**	Picture rating		.12
BIDR		.01	BIDR		.01
Step 2	.17**		Step 2	.04	
FEE		.40**	Picture rating		.12
BIDR		.04	BIDR		-.02
FEE \times BIDR		-.20*	P. r. \times BIDR		-.13 ⁺

Predictor	Facial expression (ps)		Predictor	Cockroach Task	
	R^2	β		R^2	β
Step 1	.11**		Step 1	.13**	
FEE		.33**	FEE		.36**
BIDR Self-deceptive enhancement		-.03	BIDR Impression management		.03
Step 2	.14**		Step 2	.16**	
FEE		.35**	FEE		.38**
BIDR Self-deceptive enhancement		-.07	BIDR Impression management		.08
FEE \times BIDR S-d.e.		-.18 ⁺	FEE \times BIDR I.m.		-.17 ⁺

Note. $N = 117$; FEE = German Questionnaire for the Assessment of Disgust Sensitivity; BIDR = Balanced Inventory of Desirable Responding.

⁺ $p < .10$. * $p < .05$. ** $p < .01$.

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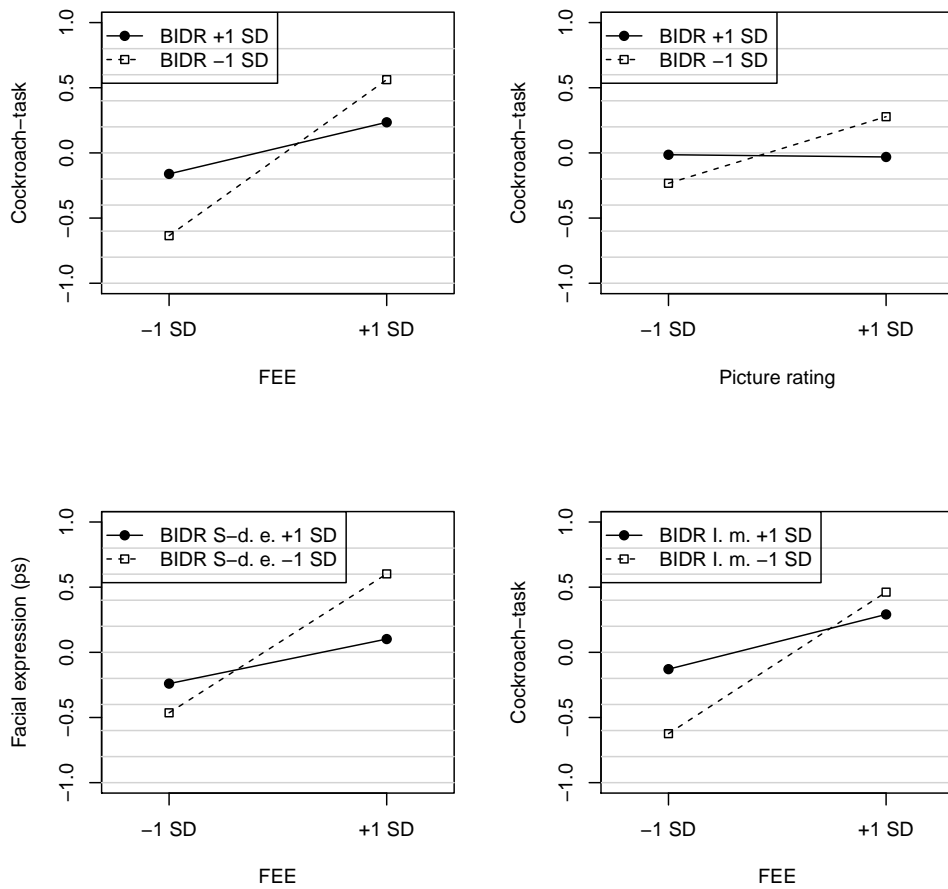


Figure 7: Moderator effects of social desirability. FEE = German Questionnaire for the Assessment of Disgust Sensitivity; BIDR = Balanced Inventory of Desirable Responding; S-d.e. = Self-deceptive enhancement; I.m. = Impression management; ps = scores provided by participants.

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5.3. Discussion

In Study 2, the hypothesis that implicit disgust sensitivity can be integrated into the explicit self-concept of disgust sensitivity via feedback of automatic behavioral cues was tested. This mediation hypothesis was confirmed for the specific explicit disgust sensitivity measure for self-perceivers, indicating that self-perception of automatic behavioral cues can change explicit self-knowledge as predicted by self-perception theory (Bem, 1972). Different from Hofmann et al. (2009), who concluded that there was a “blind spot” for self-perceivers, the employed procedure of self-observation in this study allowed participants insight into their implicit disgust sensitivity. The findings suggest that when using a specific explicit measure and an appropriate self-perception procedure, it is possible to gain access to at least some implicit dispositions. Three procedural elements were implemented that seem to be responsible for the effects that were obtained and that can account for the difference between the present findings and the findings obtained by Hofmann et al. (2009). (a) Automatic behavior was fed back several times with no more than two indicator cues having to be rated at a time. (b) Unequivocal and clearly defined indicators were used in order to reduce interpretational bias in the domain of disgust sensitivity as a domain with clear cues of automatic behavior that are easy to identify and are highly specific. (c) According to the level of specificity of the disgust behavior that was measured, a specific, narrow measure of explicit disgust sensitivity (picture rating) in addition to a measure of general disgust sensitivity (FEE) was used.

5.3.1. Limitations of the indirect and direct measures

The internal consistency of the single target version of the single block IAT (SB-IAT; Teige-Mocigemba et al., 2008) was very low ($\alpha = .32$). In the previous study, an internal consistency of $\alpha = .64$ for a SB-ST-IAT was achieved, however, with pictures of flour worms as target items. There are several possible reasons for the low internal consistency of the SB-ST-IAT that was used here. First, compared to Study 1, in this study, target pictures of cockroaches that were embedded in different settings (cockroaches on skin, cockroaches next to food) were used. This might explain the decrease in homogeneity of the SB-ST-IAT used in this study compared to the measure that was used in Study 1. It is possible that implicit disgust sensitivity toward cockroaches varies across situations in which cockroaches can be observed and have been observed. Thus, cockroaches and disgust may be more closely related in some situations than in others, and this difference probably varies between participants. If this in-

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terpretation is correct, the low internal consistency would not reflect a lack of reliability, but rather some domain specificity and thus multidimensionality of implicit disgust sensitivity. Indirect support for this interpretation comes from our findings. Despite its low internal consistency, the SB-ST-IAT had significant cue validity when used as a predictor of automatic behavior. Second, compared to the SB-IAT (Teige-Mocigemba et al., 2008), the SB-ST-IAT used in this study might have been more difficult to perform because pictures as stimuli were used compared to the word stimuli applied in the SB-IAT. Picture stimuli are more concrete and vivid compared to rather abstract word stimuli. Participants might have focused on different aspects of these pictures while performing the SB-ST-IAT (e.g., the contaminated food vs. the cockroach was salient).

Another unexpected finding was that the picture rating predicted neither automatic nor controlled behavior (see Table 4). Moreover, the correlation between the picture rating at the first and second measurement occasions was fairly low ($r = .25$) compared to the correlation between the FEE at the two measurement occasions ($r = .82$). Given the high internal consistency of the picture rating measure at the two occasions, its low retest correlation indicates differential change. It is possible that participants initially did not have a clear explicit attitude toward the cockroaches, probably because they are rarely encountered in Germany where the study was conducted. Due to infrequent encounters with cockroaches, participants might not have had a well-developed sense of their disgustingness. After the behavior task, participants adapted their explicit evaluation of the disgustingness of cockroaches according to their automatic behavioral reactions during the Cockroach Task. This process is well in line with self-perception theory, the theoretical basis of this study. According to this theory, inferences from self-observed behavior are likely in cases where internal cues are weak or ambiguous and other sources of information are missing or unreliable (Bem, 1972).

5.3.2. Moderator effects of social desirability

According to the hypothesis and the more general proposal that implicit-explicit consistency varies across individuals and situations (Frieze et al., 2008; Hofmann, Gschwendner, Nosek, & Schmitt, 2005; Nosek, 2005), moderator effects of social desirability and its two components as measured by the BIDR were found. Compared to participants high in social desirability, participants low in social desirability displayed a stronger effect of explicit disgust sensitivity on controlled behavior. This pattern suggests that participants high in social desirability were guided more by external social forces such as the instructions of

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the Cockroach Task, whereas participants low in social desirability were guided more by the internal forces of their disgust sensitivity. This interpretation is supported by the more specific finding that the moderator effect was found for the impression management sub scale but not for the self-deception subscale.

The self-deception subscale moderated the effect of explicit disgust sensitivity on self-rated facial expression during the Cockroach Task. Because no moderator effect was found for neutral observer ratings of facial expression as the dependent variable, this effect may mean that people construct self-images of their disgust sensitivity that do not match their real behavior in disgusting situations but are rather biased toward their ideal self. Although by selecting disgust as the domain, the intention was to choose a domain that would provide very little opportunity for a self-perception bias, this effect seems have to occurred nonetheless. Furthermore, if this interpretation is correct, self-rated facial expression cues may not be suitable for self-infering implicit disgust sensitivity because they may be subjected to a self-perception bias.

5.3.3. Automatic behavioral cues

The factor analysis of self-rated and observer-rated facial expression cues and bodily reaction cues clearly shows that the two indicators of disgust converge only moderately. This raises two very important questions: First, whether the sets of cues can be considered to be signs of automatic processes that complement each other or whether one of both indicator sets is more controllable than the other. Second, whether the sets of indicators are subjected to self-presentational concerns. A self-serving bias may affect (a) the actual behavior or (b) the self-perception and self-rating of actual behavior. If the actual behavior is biased, this should affect both self- and observer ratings of behavioral cues and indicate that the behavior is controllable. On the other hand, if the self-perception and self-rating of the actual behavior are biased, the bias should affect only the self-ratings and may mean that the actual behavior is automatic but the self-perception of the behavior is intentionally biased in a self-serving way.

Provided that the SB-ST-IAT used in this study is a valid measure of implicit disgust sensitivity, the findings suggest that the employed facial expression cues are accessible to intentional control because they were not predicted by the indirect but by the general direct measure. Additionally, the results of the moderator effect of self-deception presented earlier suggest that the self-perception and self-rating of facial expression cues are biased. It is possible that people high in self-deception do not rate their own facial expressions as would neutral

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observers whenever an authentic expression of their emotions would contradict their ideal self. Note that this interpretation challenges the widely held assumption of a direct link between emotion and facial expression in biological models of emotion (Izard, 1971; Rosenberg & Ekman, 1994). Rather, it accords with findings of Reisenzein, Bordgen, Holtbernd, and Matz (2006) and Reisenzein and Studtmann (2007), who assume a dissociation between facial expression and the feeling of an emotion. Possibly a more precise facial expression rating according to the FACS (Ekman & Friesen, 1978) or the use of EMG data of disgust-relevant facial muscles (de Jong, Peters, & Vanderhallen, 2002; Vrana, 1993) may reveal facial expression cues to be valid automatic behavior. However, these procedures cannot be combined with the self-rating of facial expression cues that was needed in this research. Therefore, it seems most promising to more specifically investigate moderator effects on facial expressions. If facial expressions are indeed controllable, the differential application of facial display rules (Ekman & Friesen, 1975; Matsumoto et al., 2005) may account for their lack of cue validity. The occurrence of moderator effects for ratings of self-perceivers and neutral observers may also clarify the role of a self-perception bias. These ideas were investigated in Study 3.

In contrast to facial expression cues, bodily reaction cues as indicators of automatic behavior were well-predicted by indirect measures in this study. However, bodily reaction cues were also well-predicted by direct measurement outcomes (FEE, $r = .36$; picture rating, $r = .11$) resulting in a partial dissociation pattern (Perugini et al., 2010; Zinkernagel et al., 2011). This finding may mean two things. First it may mean that bodily reactions during the Cockroach Task were also not fully automatic but were at least partially controlled in a manner similar to facial expressions. The finding may also mean that participants had partially integrated their implicit disgust sensitivity toward cockroaches into their explicit self-knowledge due to previous self-observations of reactions to cockroaches or similar stimuli. This interpretation may account for the small positive correlation between the SB-ST-IAT and the FEE at both occasions of measurement. Last but not least, the finding that bodily reaction cues during the Cockroach Task were predicted both by implicit and explicit disgust sensitivity supports the conjecture that “automatic” and “controlled” are not two mutually exclusive behavioral categories but rather endpoints of a continuum (cf. Friese et al., 2008).

6. *Study 3: Replication of Results and Moderator Effects of Cue Validity and Cue Utility*

5.3.4. **Mediating mechanisms**

According to the studies by Hofmann et al. (2009), the re-adaptation of explicit disgust sensitivity based on the self-perception of automatic behavior was found for neutral observers but not for self-perceivers with the measure of general explicit disgust sensitivity (FEE). However, for the specific explicit disgust sensitivity measure (picture rating), the re-adaptation was found equally for self-perceivers and neutral observers. In all mediation analyses, the indirect effect was mediated by bodily reaction cues.

The difference in significant indirect effects between the general and the specific measure is in accordance with the principle of correspondence (Ajzen & Fishbein, 1977). Self-perceiving indicators of specific disgust sensitivity may not be sufficient for adapting one's general self-concept of being more or less disgust sensitive. For neutral observers however, the behavioral cues of the targets were the only information they had for judging the target's general disgust sensitivity. This can explain the significant indirect effect found for the general explicit measure and the higher cue utility of their ratings compared to the ratings of the self-perceivers.

6. **Study 3: Replication of Results and Moderator Effects of Cue Validity and Cue Utility**

The aims of Study 3 were (a) to replicate the results of Study 2, (b) to strengthen the model assumptions by investigating additional theoretically plausible moderators of both cue validity and cue utility, and (c) to investigate the temporal stability of the implicit disgust sensitivity measure.

The results of Study 2, (a) that cue validity for the facial expression cues as outcomes of implicit disgust sensitivity could not be demonstrated, (b) that a moderator effect of self-deceptive enhancement affecting self-rated facial expression was encountered, and (c) that bodily reaction cues were predicted by both indirect and direct measures, suggest that all three behavioral measures (Cockroach Task, facial expression, and bodily reaction cues) include a controllable part. According to the proposal of Friese et al. (2008) that "automatic" and "controlled" are the endpoints of a continuum, and based on the findings of Study 2, one could say that the Cockroach Task and facial expression are rather controllable behaviors, whereas bodily reaction cues represent a larger part of automatic behavior because the latter is predicted by indirect and direct measures. If a purely automatic behavior would have been found, no moderator effects in the cue validity part of the model would have been expected because

6. *Study 3: Replication of Results and Moderator Effects of Cue Validity and Cue Utility*

the implicit disgust sensitivity should inevitably lead to the disgust-relevant behavior in an automatic, associative way. However, because the behavioral cues, which were previously assumed to be automatic, appeared to be controllable to some extent, moderator effects for the cue validity and the cue utility parts of the model were assumed. The analysis of moderator effects in the cue validity part of the model should help to clarify psychological processes that link behavior with implicit and explicit disgust sensitivity. The analysis of moderators in the cue utility part of the model should also shed light on the psychological processes that shape the re-adaptation of the explicit disgust sensitivity self-concept.

Regarding cue validity, individuals who tend to modify their initial behavior should display lower cue validity compared to individuals who do not modify their behavior. For example, individuals who use display rules will show a facial expression that has less congruence with their disgust sensitivity compared to people who do not use display rules. Self-knowledge of strategies aimed at the modification of behavior should also affect cue utility. For example, individuals who engage in controlling their emotional expressions may not interpret their facial expression and bodily reactions as informative indicators of their personality. For this reason, they might be less likely to adapt their explicit self-concept to self-perceived behavior compared to participants who do not adhere to controlling their facial expressions.

6.1. **Moderators of Cue Validity and Cue Utility in Study 3**

It was argued that facial expressions might be more controllable than has been assumed in biological models of emotion (Izard, 1971; Rosenberg & Ekman, 1994). More specifically, it was assumed that the differential adherence to display rules may account for the lack of validity of facial expression cues (Ekman & Friesen, 1975; Matsumoto et al., 2005). This idea was tested in Study 3 by including the adherence to display rules as a moderator of cue validity. As argued above, adhering to display rules may not moderate only the cue validity part but also the cue utility part of our model. In the cue validity part, a moderator effect of display rules on the link between direct measures of explicit disgust sensitivity (FEE, picture rating) and self-rated as well as observer-rated facial expression was assumed. The adherence to display rules should bias facial expression whereas neglecting display rules should result in an authentic facial expression that matches the explicit disgust sensitivity. Regarding the cue utility part of the model, a moderator effect of display rules on the link between facial expression and the re-adaptation of explicit disgust sensitivity was assumed. Subjects who use display rules were expected to be less likely to adapt

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their self-concept because they know that they did not show authentic behavior.

According to the principle of correspondence (Ajzen & Fishbein, 1977), display rules as a specific moderator is opposed by need for closure as a more general moderator (Webster & Kruglanski, 1994). The need for closure is composed of a preference for order, a preference for structure, and a low tolerance for ambiguity (Webster & Kruglanski, 1994). People with a high need for closure feel uncomfortable if they experience dissonance, inconsistency, and ambivalence. They prefer coherence and predictability. For this reason, people with a high need for closure can be expected to behave in line with their explicit self-concept (cue validity) because any inconsistency between their self-concept and their behavior should make them feel uncomfortable. Therefore, a positive moderator effect of need for closure on the cue validity of explicit disgust sensitivity measures was assumed. In the cue utility part of the model, people with a high need for closure were expected to make no self-inferences because their behavior was consistent with their explicit self-concept to begin with. Therefore, a negative moderator effect of need for closure on cue utility was assumed.

To clarify the role of a self-perception bias, both moderator effects were assumed to occur in the cue validity part of our model for self-perceivers and neutral observers. For example, if display rules moderates the correlation of explicit disgust sensitivity with self- and observer-rated facial expression this finding means that the actual facial expression is biased. However, if this moderator effect occurs only for self-perceivers, it may be interpreted as a self-serving bias. Accordingly, a moderator effect of need for closure for self- and observer-rated behavioral cues indicates that the actual behavior is affected, whereas a moderator effect for self-perceivers may again indicate a self-perceiving bias.

6.2. Method

6.2.1. Participants

One hundred thirty students (age $M = 21.8$, $SD = 3.0$; 81% female) from different disciplines at the University of Koblenz-Landau were recruited and received either course credit or were paid for participation.

6.2.2. Design and procedure

The design and procedure of Study 3 were similar but not identical to Study 2. The first difference was that theoretically plausible moderators of cue validity and cue utility were included at Occasion 1. A second difference was that in a third measurement occasion, the indirect measure was collected again in order

6. Study 3: Replication of Results and Moderator Effects of Cue Validity and Cue Utility

to determine the retest correlation of the indirect measure of implicit disgust sensitivity. This extension was implemented in order to clarify the reliability of the SB-ST-IAT for which a low internal consistency was observed in Study 2. Thus, data collection occurred at three measurement occasions.

At Occasion 1, indirect and direct measures of disgust sensitivity and the moderator variables were obtained. As in Study 2, at the beginning of the experiment, implicit disgust sensitivity was measured with the SB-ST-IAT. Next, the explicit disgust sensitivity measures (FEE, picture rating) were collected. Afterwards, the moderators display rules (Display Rule Assessment Inventory, DRAI; Matsumoto et al., 2005) and need for closure (Webster & Kruglanski, 1994) were collected.

At Occasion 2, two weeks later, controlled and automatic behavior were measured, and direct measures of explicit disgust sensitivity were repeated. First, state disgust, followed by the Cockroach Task with unobtrusive video recording of behavior, and again state disgust were measured. Subsequently, participants performed the video self-rating of their behavioral cues. Finally, the explicit disgust sensitivity measures (FEE, picture rating) were repeated.

Two months later at Occasion 3, the indirect measure of implicit disgust sensitivity was repeated. At this measurement occasion, subjects participated on a voluntary basis. The SB-ST-IAT was performed as an online version at the participant's home.

After completion of data collection, three neutral observer (two female, one male) rated automatic behavior cues, two marker items of the direct measure of general explicit disgust sensitivity (FEE), and two exemplary pictures of the picture rating as a measure of specific disgust sensitivity.

6.2.3. Measures

Indirect, direct, and behavioral measures of disgust sensitivity for self-perceivers and neutral observers. Indirect, direct, and behavioral indicators of disgust sensitivity that were the same as in Study 2 were collected. In addition, at Occasion 3, the SB-ST-IAT was performed ($n = 25$). The internal consistency of the SB-ST-IAT at Occasion 1 was $\alpha = .36$, at Occasion 3, $\alpha = .39$, and the retest reliability between the first and third measurement occasions was $r_{tt} = .45$.

The internal consistencies of the FEE were $\alpha = .92$ and $\alpha = .93$ at the first and second measurement occasions, respectively. The internal consistencies of the picture rating were $\alpha = .93$ and $\alpha = .96$ at the first and the second measurement occasions, respectively. The internal consistencies of the German

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State Disgust Scale were $\alpha = .84$ and $\alpha = .91$ before and after the Cockroach Task, respectively.

For neutral observers, the intraclass correlations were $r_3 = .83$ for the shortened FEE and $r_3 = .80$ for the shortened picture rating. The internal consistencies of the averaged ratings of the neutral observers was $\alpha = .97$ for the shortened FEE and $\alpha = .89$ for the shortened picture rating. As in Study 2, the Cockroach Task was used for measuring controlled behavior. As indicators of automatic behavior, the same facial and bodily reaction cues as in Study 2 were used. A principal axis factor analysis (PAF) with promax rotation was performed as in Study 2 with the self-ratings and observer ratings of these cues (see Table 3). Two factors were extracted and rotated. The two factors explained 46% of the total item variance and their correlation was $r = .36$. Both results closely parallel the results of Study 2. The pattern of factor loadings was also similar to Study 2. For self-perceivers, the internal consistencies were $\alpha = .89$ for facial expression cues and $\alpha = .89$ for bodily reaction cues. For observers, the internal consistencies were $\alpha = .91$ for facial expression cues and $\alpha = .74$ for bodily reaction cues.

Moderators of cue validity and cue utility

The following two moderators of cue validity and cue utility were assessed. Unless specified otherwise, all items had to be responded to on 6-point rating scales ranging from 1 (*do not agree*) to 6 (*fully agree*).

Display Rules. Display rules were measured using an adapted version of the Display Rule Assessment Inventory (DRAI; Matsumoto, 2005). The DRAI consists of 21 social situations with various interaction partners (e.g., alone, with a close relative, with a close friend, with an acquaintance, with a student, with a professor) either in a private (at home) or public (restaurant) setting. Participants are asked to imagine feeling an emotion in each of these situations (anger, contempt, disgust, fear, happiness, sadness, surprise) and to choose among seven display rules (“Show it more than you feel it,” “Express it as you feel it,” “Show it less than you feel it,” “Show it but with another expression,” “Hide your feelings by showing nothing,” “Hide your feelings by showing something else,” “None of the above (please specify)”) the one they would apply in this situation. Only situations describing the person as being “alone” were selected because in the experimental setting a maximum of five participants were placed in separate cubicles. Moreover, the private and public settings were changed to more closely conform to the academic context (empty lecture room, cafeteria). Finally, par-

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Participants had to imagine only the emotion disgust. Display rules were coded as “authentic” (“Express it as you feel it”) or “biased” (“Show it more than you feel it,” “Show it less than you feel it,” “Show it but with another expression,” “Hide your feelings by showing nothing,” “Hide your feelings by showing something else”). The adaptation of the DRAI consists of two items (private and public setting), which were coded “1” for authentic and “0” for biased. The internal consistency for this adaptation was $\alpha = .81$.

Need for Closure. A German version (Hänze, 2002) of the Need for Closure scale (Webster & Kruglanski, 1994) was used. The 11 items measure preference for order, preference for predictability, discomfort with ambiguity, closed mindedness, and decisiveness. Reflecting the multifaceted structure of the construct, the internal consistency of the scale was rather low ($\alpha = .46$).

6.3. Results

6.3.1. Manipulation check

Like the participants of Study 2, the participants of Study 3 felt disgust during the Cockroach Task. The mean difference between state disgust before and after the Cockroach Task was large and significant, $t(129) = 8.03$, $p < .01$, $d = .80$.

6.3.2. Descriptive data

Means, standard deviations, and intercorrelations (below diagonal) of all measures obtained in Study 3 that parallel the measures of Study 2 are presented in Table 4.

6.3.3. Cue validity

The predictive validities of the indirect measure of implicit disgust sensitivity (SB-ST-IAT) and the direct measure of explicit disgust sensitivity (FEE, picture rating) were tested via path analyses in the same manner as in Study 2. Significant and marginally significant paths are presented in the lower part of Figure 5. Although the size of the path coefficients differs between the two studies, the overall pattern is similar. Most importantly, only bodily reaction cues but not facial expression cues could be predicted significantly from the SB-ST-IAT for self-perceivers and with effects of marginal significance for neutral observers. Moreover, like in Study 2, explicit disgust sensitivity predicted not only controlled behavior but also self-ratings of bodily reaction cues during the Cockroach Task, indicating that bodily reactions are partially controllable.

6. Study 3: Replication of Results and Moderator Effects of Cue Validity and Cue Utility

6.3.4. Cue utility

Table 5 presents the correlations of behavior (Cockroach Task), facial expression, and bodily reaction cues with the residuals of explicit disgust sensitivity at Occasion 2 after controlling for explicit disgust sensitivity at Occasion 1. Again, the absolute size of these correlations differs between the two studies. The overall pattern, however, is similar. Most importantly, for self-perceivers, ratings of facial expression and bodily reaction cues correlated only with changes in the specific explicit disgust sensitivity measure (picture rating), but not with the general explicit disgust sensitivity measure (FEE).

6.3.5. Mediation analyses

Mediation analyses were performed in the same way as in Study 2. Results are presented in the lower part of Figure 6. Once more, the absolute sizes of the effects differ between the studies, but the general pattern is similar.

The first row of the lower part of Figure 6 presents the mediation model with the residuals of the general explicit disgust sensitivity measure (FEE) as criterion. Similar to Study 2, for self-perceivers (left), no significant indirect effect, but a significant effect of cue validity for the SB-ST-IAT on bodily reaction cues ($\beta = .21, p = .01$) occurred. For neutral observers (right), the path mediated by bodily reaction cues ($\beta = .051, SE = .023, 95\% CI [.0141 .1084]$) was significant with marginally significant cue validity ($\beta = .17, p = .057$) and significant cue utility ($\beta = .32, p = .00$). Cue utility for facial expression cues was also significant ($\beta = .37, p = .00$). As in Study 2, a significant indirect effect for neutral observers, but not for self-perceivers was found for general explicit disgust sensitivity as measured with the FEE.

The second row of the lower part of Figure 6 depicts the mediation model for the residuals of the specific explicit disgust sensitivity measure (picture rating) as the criterion. For self-perceivers, the indirect effect mediated by bodily reaction cues was significant ($\beta = .019, SE = .011, [.0052 .0538]$) with a significant cue validity ($\beta = .20, p = .02$). However, in the cue utility part of this model, the path from bodily reaction cues to the picture rating residuals was not significant ($\beta = .11, p = .15$). Again, cue utility for facial expression cues reached the level of significance ($\beta = .14, p = .04$). For neutral observers, a significant indirect effect mediated by bodily reaction cues occurred ($\beta = .045, SE = .021, [.0093 .0936]$) with marginally significant cue validity ($\beta = .16, p = .068$) and significant cue utility ($\beta = .28, p = .00$). Again, cue utility for facial expression cues was significant ($\beta = .33, p = .00$). Similar to Study 2, for the specific disgust sensitivity measure (picture rating), a significant indirect effect via bodily

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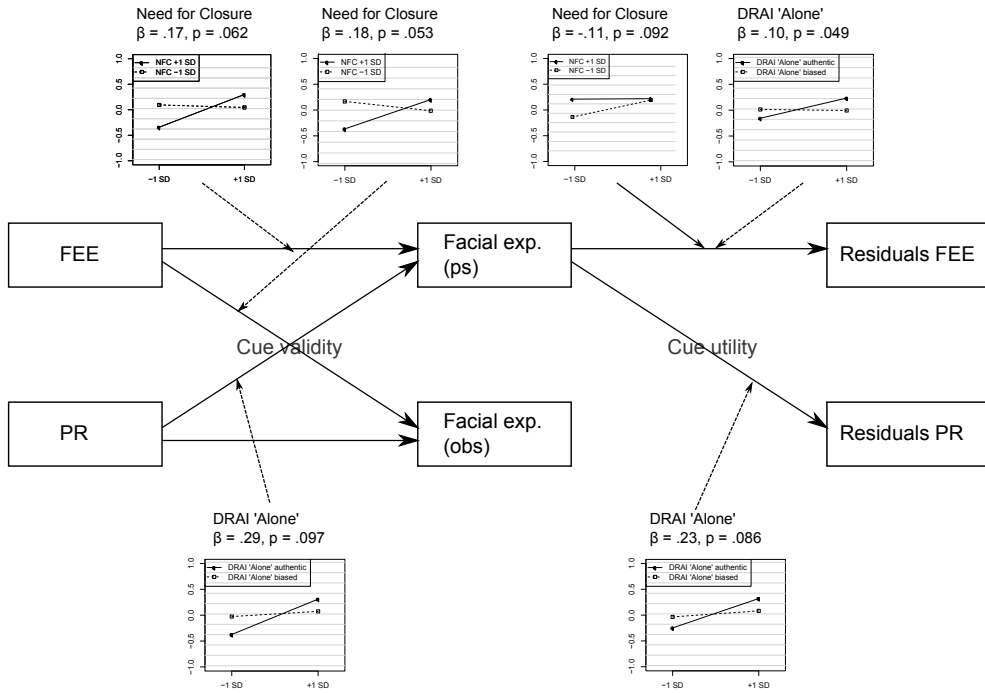


Figure 8: Overview of moderator effects in Study 3. FEE = German Questionnaire for the Assessment of Disgust Sensitivity; PR = picture rating; DRAI = Display Rule Assessment Inventory; ps = scores provided by participants; obs = scores provided by neutral observers.

reaction cues occurred for both self-perceivers and neutral observers.

6.3.6. Moderator analyses

In a first step, separate moderator analyses for each moderator according to the hypothesis regarding the cue validity and the cue utility parts of the model were performed. In a second step, the moderators were simultaneously included in order to test their uniqueness. In the cue validity part, moderator effects with self-rated and observer-rated behavior cues as criterion variables were tested. In the cue utility part, only self-rated behavior cues were used as predictors because it does not make sense to test for self-inferences from observer-rated behavior. As in Study 2, behavior in the Cockroach Task was included as a covariate to control for the experiential effect of behavior that could also lead to a re-adaptation of the explicit disgust sensitivity self-concept. All continuous variables and the dependent variable were standardized before calculating the interaction term (Aiken & West, 1991). As an overview, significant and marginally significant moderator effects for cue validity and cue utility are presented in Table 8.

6. Study 3: Replication of Results and Moderator Effects of Cue Validity and Cue Utility

Moderator Effects of Display Rules. For the regression analyses investigating moderator effects of display rules, the variable DRAI "Alone" was dummy coded (0 = biased; 1 = authentic). In the cue validity part, according to the hypotheses, a marginally significant moderator effect of the private (empty lecture room) setting was found, $R^2 = .05$, $F(3, 126) = 2.36$, $p = .07$. Subjects who did not tend to apply a display rule and who tended to be authentic in their facial expression showed a tendency toward a stronger effect of the picture rating on their self-rated facial expression compared to subjects who tended to bias their facial expression ($\beta = .29$, $t = 1.67$, $p = .097$, $\Delta R^2 = .02$; see Table 7, Figure 9). Conditional expected values (Cohen & Cohen, 1983) showed a significant effect for authentic subjects ($\beta = .19$, $SE = .08$, 95% CI [.0198 .3647]) but not for subjects employing display rules ($\beta = .09$, $SE = .18$, [-.4562 .2706]).

In the cue utility part, display rules in the private setting significantly moderated the effect of self-rated facial expression on the residuals of the direct measures of explicit disgust sensitivity (FEE, picture rating). The cue validity of facial expression cues was also moderated by need for closure (see below). In order to determine the uniqueness of the moderator effect of display rules, need for closure as a second moderator was therefore included (see Table 7). In line with the hypothesis, display rules had a (marginally) significant moderator effect on the path from facial expression to the residuals of the direct measures: FEE, $R^2 = .11$, $F(6, 123) = 2.39$, $p = .03$; picture rating, $R^2 = .13$, $F(4, 125) = 4.51$, $p = .00$. Subjects who did not tend to apply a display rule but who tended to be authentic in their facial expression showed a stronger effect than subjects who tended to apply a display rule and thus bias their facial expression. For the residuals of the FEE as the dependent variable, a significant moderator effect was found ($\beta = .21$, $t = 1.99$, $p = .049$, $\Delta R^2 = .03$) with no significant effect for conditional expected values for subjects showing an authentic ($\beta = .11$, $SE = .06$, [-.0130 .2333]) or biased facial expression ($\beta = -.02$, $SE = .05$, [-.0830 .1179]). For residuals of the picture rating as the criterion, a marginally significant moderator effect was found ($\beta = .23$, $t = 1.73$, $p = .086$, $\Delta R^2 = .02$), with a significant conditional expected value for subjects who were authentic ($\beta = .19$, $SE = .09$, [.0137 .3749]), but not for subjects who employed a display rule ($\beta = .02$, $SE = .02$, [-.0490 .3583]).

Moderator Effect of Need for Closure. In the cue validity part of the model, need for closure had a marginally significant positive moderator effect on the path from FEE to self-rated, $R^2 = .05$, $F(3, 126) = 2.33$, $p = .07$ and observer-rated facial expression, $R^2 = .05$, $F(3, 126) = 2.29$, $p = .082$ (see Table 8, Figure 10). In line with predictions, subjects high in need for closure showed

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Table 7: Moderated Multiple Regression Analyses Testing Moderator Effects of Display Rules

<i>Cue validity</i>				
Predictor			Facial expression (ps)	
			R^2	β
Step 1			.03	
Picture rating				.18*
DRAI “alone”				-.05
Step 2			.05 ⁺	
Picture rating				.05
DRAI “alone”				-.05
Picture Rating × DRAI “Alone”				.29 ⁺
<i>Cue utility</i>				
Predictor	Residuals		Residuals	
	FEE		Picture rating	
	R^2	β	R^2	β
Step 1	.08 ⁺		.11**	
Facial expression (ps)				.15
Need for closure				.10 ⁺
Facial Expression (ps) × Need for Closure				-.11*
DRAI “alone”				.04
Step 2	.11*		.13**	
Facial expression (ps)				-.01
Need for closure				.10 ⁺
Facial Expression (ps) × Need for Closure				-.09 ⁺
DRAI “alone”				.04
Facial Expression (ps) × DRAI “Alone”				.21*

Note. $N = 130$; FEE = German Questionnaire for the Assessment of Disgust Sensitivity; DRAI = Display Rule Assessment Inventory; ps = scores provided by participants.

⁺ $p < .10$. * $p < .05$. ** $p < .01$.

6. Study 3: Replication of Results and Moderator Effects of Cue Validity and Cue Utility

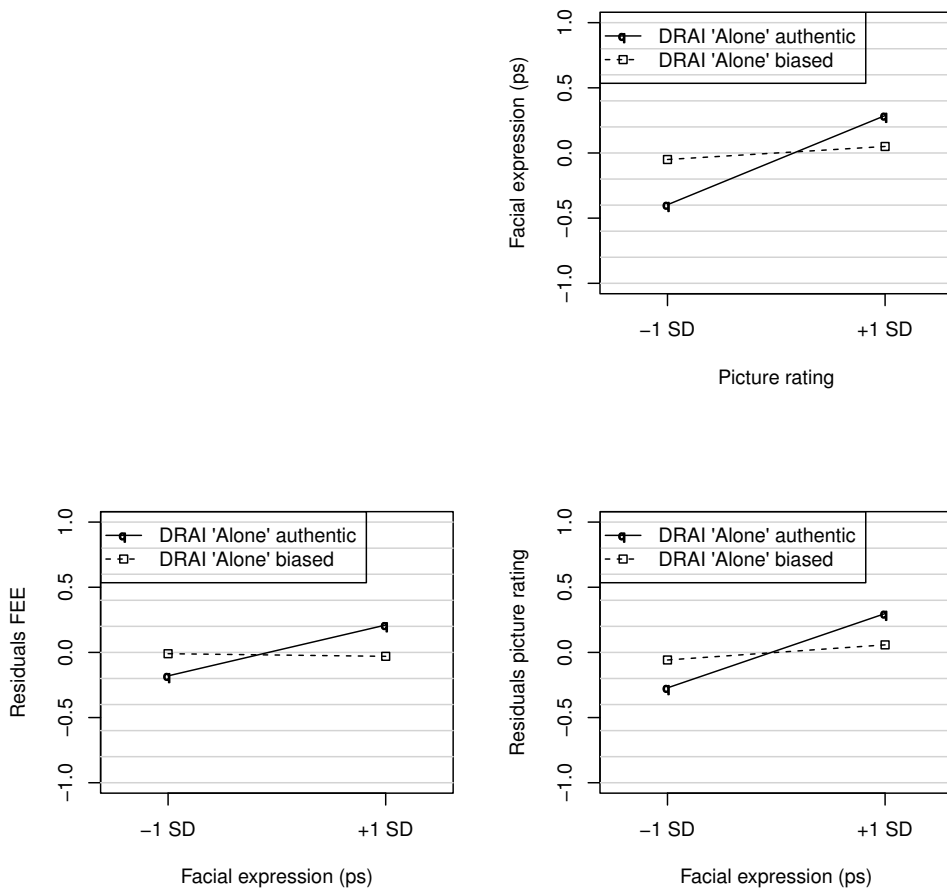


Figure 9: Moderator effects of display rules. FEE = German Questionnaire for the Assessment of Disgust Sensitivity; DRAI = Display Rule Assessment Inventory; ps = scores provided by participants.

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a marginally significantly stronger effect as compared to subjects low in need for closure with self-rated facial expression as the dependent variable ($\beta = .17$, $t = 1.88$, $p = .062$, $\Delta R^2 = .02$). Conditional expected values were significant for subjects high in need for closure ($\beta = .32$, $SE = .12$, [.0781 .5622]), but not for subjects low in need for closure ($\beta = -.02$, $SE = .14$, [-.3001 .2508]). This marginally significant effect occurred also for observer-rated facial expression as the dependent variable ($\beta = .18$, $t = 1.96$, $p = .053$, $\Delta R^2 = .03$). Similar to when self-rated facial expression was the criterion, the conditional expected values were significant for subjects high ($\beta = .27$, $SE = .12$, [.0305 .5177]), but not for subjects low in need for closure ($\beta = -.08$, $SE = .14$, [-.3640 .1902]).

In the cue utility part of the model, need for closure had a negative moderator effect on self-rated facial expression vis à vis FEE. As mentioned before, display rules also moderated this path. This moderator was therefore included as a covariate to investigate the unique moderator effect of need for closure. A marginally significant negative moderator effect of need for closure was found ($\beta = -.11$, $t = -1.69$, $p = .092$) for residuals of FEE as the criterion, $R^2 = .11$, $F(6, 123) = 2.39$, $p = .03$. Conditional expected values were significant for subjects low ($\beta = -.27$, $SE = .11$, [-.5028 -.0354]), but not for subjects high in need for closure ($\beta = .01$, $SE = .01$, [-.0812 .3651]).

6.4. Discussion

The aims of Study 3 were (a) to replicate the findings of Study 2 and (b) to strengthen the model assumptions by investigating theoretically plausible moderators of both cue validity and cue utility. Of special interest was the interpretation of the findings of Study 2 stating that facial expressions are more controllable than automatic.

Limitations of the Indirect and Direct Measures. Again, the internal consistency of the SB-ST-IAT was very low ($\alpha = .36$). However, the retest correlation between the first and the third measurement occasions amounted to $r_{tt} = .45$. This result is in good agreement with retest correlations that have been obtained with IATs of high internal consistency (Gschwendner, Hofmann, & Schmitt, 2008b). Moreover and importantly, given the typical retest correlation that was obtained, the low internal consistency does not mean that the SB-ST-IAT lacks reliability. Rather it seems that it does not measure a one-dimensional construct.

6. Study 3: Replication of Results and Moderator Effects of Cue Validity and Cue Utility

Table 8: Moderated Multiple Regression Analyses Testing Moderator Effects of Need for Closure

<i>Cue validity</i>					
Predictor	Facial expression (ps)		Predictor	Facial expression (obs)	
	R^2	β		R^2	β
Step 1	.03		Step 1	.01	
FEE		.17 ⁺	FEE		.11
NFC		-.04	NFC		-.06
Step 2	.05 ⁺		Step 2	.05 ⁺	
FEE		.15	FEE		.09
NFC		-.05	NFC		-.08
FEE × NFC		-.17 ⁺	FEE × NFC		-.18 ⁺
<i>Cue utility</i>					
Predictor	Residuals FEE				
	R^2	β			
Step 1	.08 ⁺				
Facial exp. (ps)		.06			
DRAI “alone”		.01			
Facial Exp. (ps) × DRAI “Alone”		.12*			
NFC		.10 ⁺			
Step 2	.11*				
Facial exp. (ps)		.07			
DRAI “alone”		.02			
Facial Exp. (ps) × DRAI “Alone”		.10*			
NFC		.10 ⁺			
Facial Exp. (ps) × NFC		-.11 ⁺			

Note. $N = 130$; FEE = German Questionnaire for the Assessment of Disgust Sensitivity; NFC = Need for Closure Scale; ps = scores provided by participants; obs = scores provided by neutral observers.

⁺ $p < .10$. * $p < .05$. ** $p < .01$.

6. Study 3: Replication of Results and Moderator Effects of Cue Validity and Cue Utility

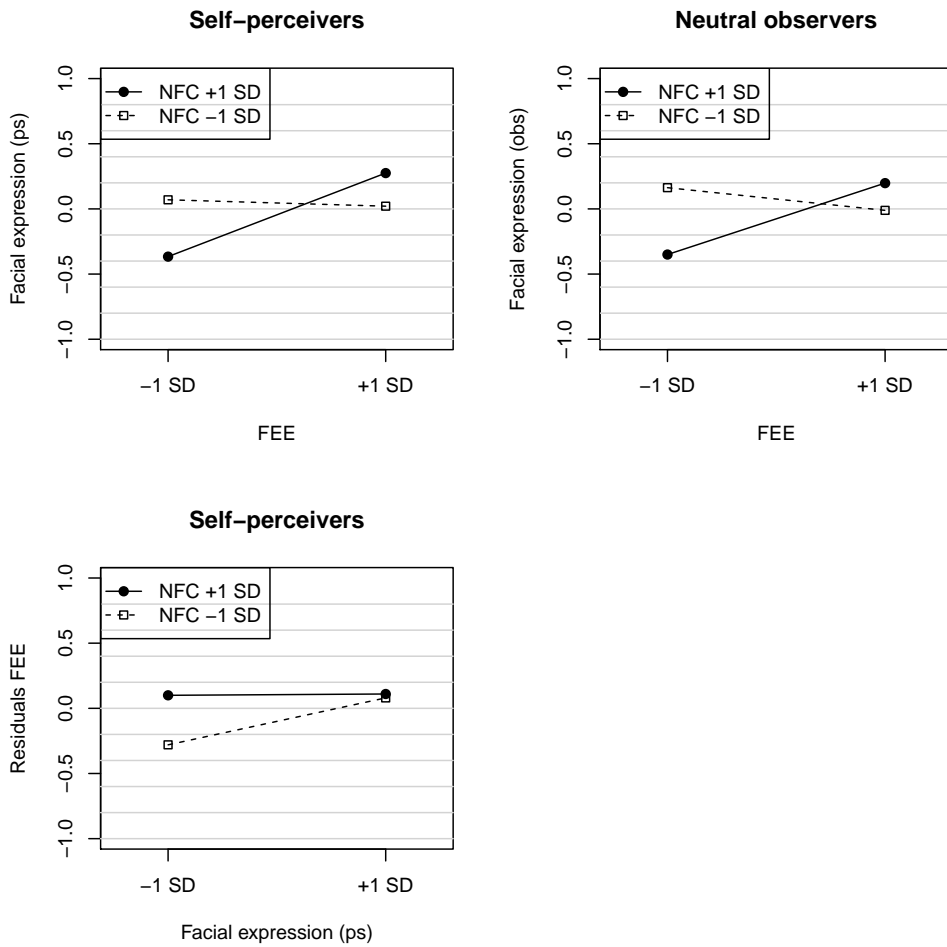


Figure 10: Moderator effects of need for closure. FEE = German Questionnaire for the Assessment of Disgust Sensitivity; NFC = Need for Closure Scale; ps = scores provided by participants, obs = scores provided by neutral observers.

6. Study 3: Replication of Results and Moderator Effects of Cue Validity and Cue Utility

Mediating Mechanisms. The pattern of mediating effects in Study 3 was similar to the pattern in Study 2 (Figure 6). Replicating the pattern from Study 2, no significant mediation (re-adaptation) effect was found for self-perceivers when the FEE as a measure of general explicit disgust sensitivity was used. For neutral observers, however, this mediation effect was significant. As already proposed in the discussion of Study 2, the difference between self-perceivers and neutral observers means that for neutral observers, the behavior of the targets they saw on the video was the only source of information they had about the target and therefore the only basis for making inferences about the targets' disgust sensitivity.

Accordingly to Study 2, for the picture rating as a specific disgust sensitivity measure, a significant indirect effect of bodily reaction cues as a mediator was found for self-perceivers and neutral observers. However, the cue utility path from bodily reaction cues to the residuals of the picture rating was somewhat lower than in Study 2 and did not reach the conventional level of significance in Study 3.

Moderator effects of cue validity. In the cue validity part of the model, moderator effects of display rules and need for closure were found. Subjects employing display rules showed a weaker correlation between picture rating and self-rated facial expression than subjects not applying display rules. This moderator effect of display rules is apparently a weak effect because only a marginally significant effect was found. However, the moderator effect was not observed for neutral observers, which may be interpreted as a self-perception bias for self-perceivers. Interestingly, this moderator effect was observed only for display rules that people employ in a private setting (empty lecture room) and not for display rules that are used in a public setting (cafeteria). This specific finding is quite meaningful because the participants were seated in separate cubicles. The fact that the moderator effect was observed only for the specific disgust sensitivity measure (picture rating) indicates that display rules do not seem to be used in a general manner but are adapted to the specificity of the situation.

For the general moderator, need for closure, subjects with high values showed a stronger consistency between the general disgust sensitivity measure (FEE) with self-rated facial expression than did subjects low in need for closure. However, the fact that this moderator effect was found both for self-perceivers and neutral observers indicates that participants high in need for closure actually showed a facial expression that was in congruence with their general disgust sensitivity. Thus, the moderator effect was not due to a self-perception bias but due to the actual behavior. This can be seen as a hint, that the actual

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facial expression is intentionally biased according to explicit disgust sensitivity for subjects high in need for closure. Additionally, a person's self-perception of their own facial expression is biased for subjects high in applying display rules.

Therefore, there is growing evidence that facial expression, at least as it was operationalized in this research, seems to be an indicator of more controllable behavior because (a) it was not predicted by the indirect measure in two studies, (b) it was intentionally kept congruent with general explicit disgust sensitivity in subjects high in need for closure, and (c) it was subjected to a self-perception bias indicated by the moderator effects only for self-perceivers of self-deception (Study 2) and for subjects high in applying display rules.

Moderator effects of cue utility. In the cue utility part of the model, the moderator effects were largely in accordance with expectations.

Subjects who use display rules (or who believe that they use display rules) tend not to re-adapt their explicit disgust sensitivity to self-observed disgust behavior. By contrast, subjects who do not employ display rules and show an authentic facial expression (or believe that they do so), re-adapt their explicit disgust sensitivity.

In a similar vein, subjects high in need for closure had no reason to re-adapt their explicit disgust sensitivity to their self-perceived behavior because they expressed their disgust sensitivity in a congruent manner. By contrast, subjects low in need for closure showed a less congruent facial expression and this caused them to re-adapt their explicit self-concept after being confronted with their facial expression.

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The main goal of this research was to re-investigate the self-perception hypothesis (Hofmann et al., 2009; Hofmann & Wilson, 2010) in the domain of disgust and with procedural changes for the self-perception of automatic behavior. In Study 1, the proposed implicit disgust sensitivity measure (SB-ST-IAT; Zinkernagel et al., 2011) was validated according to a double dissociation strategy.

In Studies 2 and 3, a mechanism that could potentially explain the mean convergence of the theoretically independent implicit and explicit parts of dispositions was investigated. The mechanism considered in these studies was the "self-perception" of behavioral cues (Bem, 1972) and was initially proposed by Hofmann et al. (2009). Hofmann et al. investigated whether the implicit disposition would be integrated into the explicit disposition if people perceive their own

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automatic behavioral cues that are driven by the implicit disposition and draw inferences based on these cues for a re-adaption of their explicit disposition. However, Hofmann et al. (2009) did not find support for the self-perception of behavioral cues and a re-adaption of explicit measures, but found that neutral observers made appropriate trait inferences. Hofmann et al. concluded therefore that there is a “blind spot” for self-perceivers. This surprising result was re-investigated in these studies with the aim of achieving a higher validity for self-perception by (a) feeding back automatic behavior several times with not more than two indicator cues having to be rated at a time, (b) using unequivocal and clearly defined indicators in order to reduce interpretational bias in the domain of disgust sensitivity with clear cues of automatic behavior that were easy to identify and highly specific, (c) using a specific, narrow measure of explicit disgust sensitivity (picture rating) in addition to a measure of general disgust sensitivity (FEE) according to the level of specificity (Ajzen & Fishbein, 1977).

Studies 2 and 3 showed results similar to the studies of Hofmann et al. (2009) for the general measure of disgust sensitivity. With this broad measure, a significant mediation effect occurred for neutral observers but not for self-perceivers. However, for the specific disgust sensitivity measure, Studies 2 and 3 provided evidence that explicit disgust sensitivity is influenced by implicit disgust sensitivity, mediated by feedback and self-perception of automatic behavioral cues. The implicit measure (SB-ST-IAT; Zinkernagel et al., 2011) significantly predicted automatic behavioral cues of bodily reactions. The feedback and self-perception of these bodily reaction cues led to a significant re-adaption of the explicit specific disgust sensitivity measure (picture rating).

Because the behavior cues used in these studies also contained parts with controllable behavior, this research was also devoted to investigating moderator effects (Study 2: social desirability; Study 3: display rules and need for closure) for the cue validity and cue utility parts of the model. For cue validity, in line with the hypotheses, a moderating effect of social desirability was found in Study 2. Participants high in social desirability showed a behavior that was oriented toward fulfilling experimental demands, whereas subjects low in social desirability followed their internal dispositions. This moderator effect also gave hints that facial expression might be subjected to a self-perception bias.

In Study 3, display rules and need for closure moderated the relation between the explicit general disgust sensitivity measure (FEE) and facial expression. This finding gave additional hints that facial expression—as operationalized in these studies—is a rather controllable behavior and is also subjected to a self-perception bias. Participants, who confessed not to apply display rules,

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self-rated a congruent facial expression according to their directly measured specific disgust sensitivity, whereas subjects, who confessed to use display rules self-rated an incongruent facial expression. Similar results were observed for need for closure. Participants high in need for closure showed a congruent facial expression according to their directly measured general disgust sensitivity (FEE), whereas subjects low in need for closure showed an incongruent facial expression.

Regarding the cue utility part of the model in Study 3, moderator effects of display rules and need for closure were found. The reason for assuming moderator effects in the cue utility part was that these moderator effects also should affect the re-adaption process of explicit measures (e.g., applying a display rule to the facial expression should reduce the validity of the facial expression and therefore the effect of re-adaption because the behavior shown was not authentic). For subjects who were authentic and did not apply display rules, a positive moderator effect of display rules occurred. The (at first sight) counterintuitive moderator effect of need for closure in the cue utility part can be interpreted according to the hypotheses together with the moderator effect in the cue validity part: Subjects high in need for closure showed a congruent facial expression and did not draw information from behavior feedback to re-adapt their explicit measures whereas subjects low in need for closure acted in the opposite manner.

7.1. Limitations

However, these studies also raise questions that cannot be explained by the present data. Although the studies clearly demonstrate the assumed re-adaption process, the exact mechanisms that are responsible for this effect are not yet fully clear. Most importantly, the design does not allow for completely separating the effects of feedback of behavioral cues from experiential effects. It therefore does not distinguish between the visual behavior feedback and the motor feedback with regard to reactions to the disgust-eliciting stimuli. In Studies 2 and 3, experiential influences of self-perception were ruled out by including the Cockroach Task as a covariate. But in order to discriminate clearly between visual behavior feedback and motor feedback, the design of these studies should be replicated without the visual feedback of behavioral cues and just the performance of the Cockroach Task. An emerging indirect effect in this study without behavior feedback would indicate that experiential awareness rather than self-perception mediates the effect of the implicit disgust sensitivity disposition on the re-adaption of the explicit disposition.

In all studies, a single block single target IAT (SB-ST-IAT) for measuring

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implicit disgust sensitivity was used. The IAT was modified for the following reasons: (a) because “disgust” has no natural or semantic antipode, a single target IAT (ST-IAT; Karpinski & Steinman, 2006) was used; (b) to reduce recoding strategies (Mierke & Klauer, 2003; Rothermund & Wentura, 2001, 2004) a combination of the ST-IAT with the single block IAT (SB-IAT; Teige-Mocigemba et al., 2008) was performed; (c) pictorial stimuli were used. Contrary to previous studies (Zinkernagel et al., 2011), the SB-ST-IAT in Studies 2 and 3 had a very low internal consistency, which could be explained by the multidimensionality of the employed pictures and the higher difficulty compared to the SB-IAT (Teige-Mocigemba et al., 2008). Despite the low internal consistency, the size of the unique effect of the SB-ST-IAT on automatic behavior that was obtained corresponded to the size of the classic IAT according to a recent meta-analysis (Greenwald et al., 2009). Also, the retest correlation of the SB-ST-IAT was similar to results that have been reported in the literature (Gschwendner et al., 2008b). However, additional research is needed for a better understanding of the low internal consistency of the SB-ST-IAT using pictures as attribute stimuli. Furthermore, additional disgusting stimuli besides flour worms and cockroaches need to be included in order to determine the structure of implicit disgust sensitivity. Explicit disgust sensitivity as measured by the FEE (DS) consists of several components (death, body products, rotten food, hygiene, oral defense). So far, it is unknown whether implicit disgust sensitivity parallels this structure.

An unexpected finding of Studies 2 and 3 was that facial expression could not be predicted by the indirect measure of implicit disgust sensitivity. This result challenges the assumption that facial expressions occur automatically. Rather, the correlation between the direct measure of specific explicit disgust sensitivity and facial reactions (Table 4) as well as the moderator effects of social desirability (Study 2), display rules, and need for closure (Study 3) that were found indicate that facial expressions are controllable to a larger extent and subjected to a self-serving bias. Therefore, facial expression, at least at it was operationalized in Studies 2 and 3, does not seem to be an adequate indicator for automatic behavior. The findings contradict biological theories of emotion (Izard, 1971; Rosenberg & Ekman, 1994) and are rather in line with recent findings of a dissociation of experiencing an emotion and showing an emotion (Reisenzein et al., 2006; Reisenzein & Studtmann, 2007). However, the measure of facial expression used in these studies might not have been sensible enough to detect automatic cues in a facial disgust expression. Using the FACS (Ekman & Friesen, 1978) or EMG data of facial muscles (de Jong et al., 2002; Vrana, 1993) might reveal automatic components of the facial expression. This

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might be promising because, according to Rinn (1984, 1991), most facial muscles are enervated doubly and can be operated in an automatic and controlled way. Cohn and Schmidt (2004) and Hess and Kleck (1990) found that the timing of different components of a facial expression during an expression period is a valid indicator for distinguishing between genuine and posed faces. According to Hess and Kleck (1990), posed expressions are longer and have more phases and irregularities (number of onsets/offsets, apex phases, pauses, stepwise intensity changes) than genuine expressions. The measurement of the timing differences in distinguishing genuine from posed faces could be done via EMG (de Jong et al., 2002; Vrana, 1993) or via analyzing the facial expression by computer programs (e.g., Littlewort, Bartlett, & Lee, 2009; Valstar, Gunes, & Pantic, 2007).

Unlike facial expressions, in Studies 2 and 3, bodily reaction cues were predicted by the indirect and the direct measures of disgust sensitivity. Thus, bodily reactions seem to consist of a controllable part and an automatic part. However, the absolute size of automatic and controllable parts of this behavior can only be determined imprecisely on a correlational basis. Jacoby (1991) and Jacoby and Kelley (1992) proposed a process dissociation framework and tested it for memory retrieval processes. The idea was to have two experimental conditions, which have either parallel or oppositely aligned effects on the behavior. The controllable and the automatic parts of the behavior can then be estimated arithmetically. The process dissociation framework could also help to classify different behaviors on an automatic–controlled dimension as proposed by Friese et al. (2008).

7.2. Practical Implications

Consistency of implicit and explicit representations seems to be of fundamental interest and may be associated with well-being (Briñol, Petty, & Wheeler, 2006). On the other hand, discrepancy of implicit and explicit representations is associated with several clinical disorders: borderline personality disorder (Vater, Schröder-Abé, Schütz, Lammers, & Roepke, 2010), unhealthy eating behavior (Job, Oertig, Brandstätter, & Allemand, 2010), paranoia and depression (Kesting, Mehl, Rief, Lindenmeyer, & Lincoln, 2011; Valiente et al., 2011), or general psychological health (Schröder-Abé et al., 2007). Although the above-cited studies all refer to discrepancies between implicit and explicit self-esteem, it is conceivable that discrepancies in other domains of implicit and explicit representations may also have disturbing influences on psychological health (e.g., Kazén, 2011).

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Because consistency of implicit and explicit representations is not automatically given, neither from a theoretical (e.g., Vazire, 2010, at least for some domains), nor from an empirical view (Nisbett & Wilson, 1977; Wilson & Dunn, 2004), the self-perception of automatic behavioral cues offers a pathway for generating consistency. Therefore, the self-perception of automatic behavioral cues to infer one's implicit self may be useful in clinical settings. With regard to the emotion disgust it may be useful for therapy for obsessive-compulsive disorder.

7.3. Concluding Remarks

The studies provide evidence that individuals are able to gain insight into their implicit—possibly subconscious—self via the self-perception of automatic behavioral cues. Therefore, these studies contribute a pathway that explains the development of implicit-explicit consistency and may therefore confirm—at least to a small degree—the validity of the trait model.

Explaining the results with a little bit more detail—individuals may gain knowledge about their implicit self if they have the opportunity to self-perceive their behavioral reactions precisely and repeatedly. This is especially true for specific, narrow dispositions. However, this re-adaption process is subject to interindividual boundary conditions: If the self-perception of behavior is biased either by acting in an intended direction, or by self-perceiving in an intended direction the self-perception of behavior loses its informative value and may not be used as a source for inferring an implicit disposition. We are therefore able to gain knowledge about our unconscious selves: if we have the opportunity and if we can trust ourselves.

8. References

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A. Indirect Measurement Procedures

Table 9: List of Indirect Measurement Procedures













Measurement procedure	Abbr.	Literature
Affect Misattribution Paradigm	AMP	Payne, Cheng, Govorun, & Stewart, 2005
Affective Priming Task		Fazio, Jackson, Dunton, & Williams, 1995; Fazio et al., 1986
Analysis of linguistic biases		Franco & Maass, 1999; Hip-pel, Sekaquaptewa, & Vargas, 2008
Approach–avoidance Task	AAT	Chen & Bargh, 1999; Neu-mann, Hülßenbeck, & Seibt, 2004; Rinck & Becker, 2007
Brief Implicit Association Test	BIAT	Sriram & Greenwald, 2009
Dot Probe Task		MacLeod, Mathews, & Tata, 1986
Emotional Stroop Test		Mathews & MacLeod, 1985
Evaluative Movement Assessment	EMA	Brendl, Markman, & Messner, 2005
Extrinsic Affective Simon Task	EAST	De Houwer, 2003a
Go/No-go Association Task	GNAT	Nosek & Banaji, 2001
Identification Extrinsic Affective Si-mon Task	ID-EAST	De Houwer & De Bruycker, 2007
Implicit Association Task	IAT	Greenwald et al., 1998
Implicit Association Procedure	IAP (modi-fied EMA)	Schnabel, Banse, & Asendorpf, 2006b
Implicit Positive and Negative Af-fect Test	IPANAT	Quirin, Kazén, & Kuhl, 2009
Lexical-decision Task	LDT	B. Wittenbrink, Judd, & Park, 1997
Linguistic intergroup bias	LIB	Franco & Maass, 1999
Masked affective Priming		Frings & Wentura, 2003
Name-letter Task	NLT	Koole, Dijksterhuis, & Knip-penberg, 2001; Nuttin, 1985
Semantic Priming		B. Wittenbrink et al., 1997
Single Block IAT	SB-IAT	Teige-Mocigemba et al., 2008
Single Category IAT	SC-IAT	Karpinski & Steinman, 2006
Single Target IAT	ST-IAT	Wigboldus, Holland, & van Knippenberg, 2004
Stroop Test		Stroop, 1935
Word Fragment Completion Task		Dovidio, Kawakami, Johnson, Johnson, & Howard, 1997

B. IAT Stimuli

B. IAT Stimuli

B.1. Study 1

Table 10: SB-ST-IAT Target and Attribute Stimuli in Study 1

Positive stimuli		
		
		
Negative stimuli		
		
		
Target stimuli		
		
		

B. IAT Stimuli

B.2. Studies 2 and 3

Table 11: SB-ST-IAT Target and Attribute Stimuli in Studies 2 and 3

Positive stimuli		
		
		
Negative stimuli		
		
		
Target stimuli		
		
		

Curriculum Vitae

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WS 2008/2009	Seminar „Objektive Persönlichkeitstests“
SS 2008	Seminar „Bewusste und unbewusste Anteile von Persönlichkeit, Motivation und Einstellungen“
WS 2007/2008	Seminar „Leistungsdiagnostik im Unterricht“
SS 2007	Seminar „Computergestützte Diagnostik“
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