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Examining Implicit Aggressiveness in Patients with Obsessive Compulsive Disorder Using the Implicit Relational Assessment Procedure

Dissertation

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Aims and Hypotheses of the Study

Psychodynamic and cognitive theories postulate a prominent role of aggressiveness in the development and maintenance of obsessive compulsive disorder (OCD), especially with regard to checking compulsions. Specifically, Freud's conceptualization suggests that latent aggression lies at the root of OCD. There is robust evidence of higher levels of aggressiveness in patients with OCD than the general population using self-report instruments, which are, however, subject to bias. Implicit measures are designed to yield unintentional, unconscious, or uncontrollable responses. Only two studies have used an implicit measure, the Implicit Association Test (IAT), to assess self-rated aggressiveness in patients with OCD. Both did not show higher self-perceived aggressiveness in patients with OCD. Since the IAT has some methodological limitations, the current study used a different implicit measure, the Implicit Relational Assessment Procedure, to examine the relationship.

The primary hypothesis of this study was that patients with OCD would differ from non-clinical controls in their self-concept of aggressiveness using an implicit and explicit measure, and that this difference would be especially pronounced in patients with checking compulsions. We also assumed there would be an association between scores on the implicit and explicit measures of aggressiveness. Finally, we expected an inflated sense of responsibility would be associated with checking compulsions and levels of anger, respectively.

1 Introduction

Obsessive compulsive disorder (OCD) is a highly complex and multifaceted mental disorder which can be accompanied by an array of difficult emotions. Patients may experience anxiety due to obsessive thoughts and feel disappointed if they are unable to prevent themselves from performing a compulsion. Moreover, they may become frustrated when a dutifully performed compulsion does not cause their tension to drop. Feelings of loneliness and depression are predestinate if the illness' constraints have rendered a person unable to lead a normal life.

An emotion with a unique role in OCD is aggressiveness, because it is considered both a cause and result of the illness. From a Freudian perspective, a person's unconscious aggressiveness may clash with their own high moral standards, leading to a dysfunctional compensation in the shape of obsessions and compulsions (Freud, 1976). A more recent cognitive theory posits that aggressiveness is instead a common emotional reaction when patients with OCD are unsuccessful at reducing their tension or anxiety by performing compulsions (Rachman, 1993). It is integral to gain a deeper understanding of the role of aggressiveness for the development and maintenance of OCD, as it may influence patients' behavior and interaction with others, thereby comprising a possible target of psychotherapy.

However, assessing aggressiveness can be difficult as it is generally viewed as an unfavorable trait to which a person may not want to admit. Additionally, patients with OCD might not even be consciously aware of their own aggressiveness if the Freudian conceptualization holds true. Therefore, we used a computer-based task which measures response latencies to deduce how aggressive or peaceful participants consider themselves to be. This task, the Implicit Relational

Assessment Procedure (IRAP) was conducted with patients with OCD and nonclinical controls to assess their implicit self-concept of aggressiveness.

2 Theoretical Background

2.1 Overview of OCD

2.1.1 Symptomology of OCD. According to the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; DSM-5), OCD is marked by the presence of obsessions and / or compulsions. *Obsessions* are recurring thoughts, images or urges that are experienced as unpleasant and / or intrusive. They often cause anxiety or stress. The affected individual may attempt to ignore, reduce or neutralize obsessions, sometimes by way of compulsions. A typical example of an obsession is worry about contamination of objects and the consequences thereof (e.g., "this subway railing may be contaminated – by touching it, I may contract an illness"). *Compulsions* are repetitive behaviors and mental acts, typically evoked by obsessions, which are performed in order to reduce or neutralize anxiety caused by obsessions or prevent feared outcomes (e.g., excessive and / or repetitive hand-washing after touching certain objects to reduce fear of falling ill). A further hallmark of OCD is *avoidance*, whereby individuals spare themselves compulsions (e.g., avoidance of touching certain objects in the first place so as not to invoke compulsive hand-washing; American Psychiatric Association, 2013).

OCD belongs to the DSM-5's newly introduced group of *Obsessive-Compulsive and Related Disorders* (OCRDs) alongside body dysmorphic disorder, hair-pulling disorder, skin-picking disorder, hoarding disorder, substance / medication-induced OCRDs, OCRDs due to another medical condition as well as other specified and unspecified OCRDs (American Psychiatric Association, 2013). Under DSM-IV, OCD was categorized as an anxiety disorder (American Psychiatric

Association, 2000; for an overview of the changes between editions see Wells, Myers, Simons, & Fisher, 2017, pp 25-27; for a critical discussion of the change in classification see Abramowitz, 2018). The change in classification reflects emerging evidence of overlap, comorbidity, and similar treatment recommendations amongst OCRDs (American Psychiatric Association, 2013; Mataix-Cols et al., 2005).

Nevertheless, the diagnosis of OCD remains extremely heterogeneous (Hirschtritt et al., 2017; Mataix-Cols et al., 2005). This is represented in the 67 distinct obsessions and compulsions listed in the Yale-Brown Obsessive Compulsive Scale, a semi-structured interview considered the gold standard for OCD diagnosis (Hand & Büttner-Westphal, 1991; Hohagen et al., 2015).

Symptoms are commonly grouped into four factors: (a) *symmetry obsessions and compulsions*, (b) *hoarding*, (c) *contamination obsessions and compulsions*, and (d) *repugnant thoughts and checking compulsions* (Bloch, Landeros-Weisenberger, Rosario, Pittenger, & Leckman, 2008; Mataix-Cols et al., 2005; for an alternate factor structure see Schulze, Kathmann, & Reuter, 2018). Notably, obsessions and compulsions are also present in 13-17% of nonclinical samples (Fullana et al., 2009).

2.1.2 Diagnostic criteria of OCD according to DSM-5. For diagnosis of OCD according to the DSM-5, the following four criteria, presented in abbreviated form, must be fulfilled (emphasis added; American Psychiatric Association, 2013, pp. 237–238):

(a) Presence of obsessions *and* / *or* compulsions;

(b) Obsessions or compulsions take up one hour or more per day *or* cause the affected individual clinically significant suffering *or* impairment in social, professional or other areas;

(c) The symptoms displayed are not attributable to the physiological effect of a medication or drug, *or* another medical condition;

(d) The symptoms displayed are not better explained by a different psychiatric diagnosis (e.g., another diagnosis from the OCRDs group).

Furthermore, specification is required regarding:

(1) Insight, that is to which degree the affected individual is convinced their OCD-related beliefs are true;

(2) Tic-relatedness, that is whether the affected individual has a current or past history of a tic disorder.

2.1.3 Epidemiology of OCD. The lifetime prevalence of OCD is estimated at 2.3% (Ruscio et al., 2010) to 3% (Subramaniam et al., 2012) and the 12-month prevalence ranges between 0.7% (Adam et al., 2012) and 1.2% (Ruscio et al., 2010). A large international survey (N = 3711) determined average age of onset at 16.9 years (Brakoulias et al., 2017). Compared to other studies reporting age of onset at ca. 19 years of age (Kang et al., 2017; Ruscio et al., 2010), Brakoulias et al.'s (2017) findings are skewed by the particularly low age of onset in Brazil (M = 12.7 ys, N = 995). During childhood, OCD is more prevalent in males, while in adolescence and adulthood higher rates are found in females (Farrell et al., 2006a; Kang et al., 2017; Ruscio et al., 2010). On average, there is a nine year delay between onset of symptoms and treatment (Voderholzer et al., 2011). Duration of illness varies greatly between sources, with 14 years and 21.8 years at the extremes (Dell'Osso et al., 2013, 2015; Kang et al., 2017). The most common symptoms

among a sample with a lifetime diagnosis of OCD were checking (79.3%) and hoarding (62.3%, Ruscio et al., 2010).

2.1.4 Etiology of OCD. Generally, the etiology of OCD is assumed to involve genetic as well as environmental factors (Pauls et al., 2014). Heritability rates of OCD are high, with 27% to 47% of OC-symptoms attributable to genetics (van Grootheest, Cath, Beekman, & Boomsma, 2005, for findings on genome-wide association in OCD see Mattheisen et al., 2015). Notably, the genetic influence is greater in child-onset OCD than in adult-onset OCD (Pauls et al., 2014). Neuroimaging studies have shown abnormal activity in nodes of the cortico-striato-thalamo-cortical circuit which increases with OC-symptom provocation and decreases with treatment (Milad & Rauch, 2012). There is some evidence that this abnormal brain activity is caused by a dysregulation of glutamate signaling within the circuit (Pittenger et al., 2011; Wu et al., 2012).

Twin studies show that shared environment plays only a minor role in the development of OCD (Taylor, 2011). Hard evidence of environmental risk factors for OCD was not available (Pauls et al., 2014). A meta-analysis by Brander, Pérez-Vigil, Larsson and Mataix-Cols (2016) identified perinatal complications, reproductive cycle events (i.e., menarche, pregnancy, postpartum and menopause) and stressful life events as potential risk factors. Further, diagnosis of OCD correlates with being unmarried and abusing drugs (Fontenelle & Hasler, 2008). Development of a comorbid mental illness is perpetuated by childhood trauma and neuroticism (Klein Hofmeijer-Sevink et al., 2013). For a thorough discussion of biological models as well as an overview of psychological models of OCD, see *The Wiley Handbook of Obsessive Compulsive Disorders* (Wells et al., 2017).

2.1.5 Comorbidity. An estimated 60% (Klein Hofmeijer-Sevink et al., 2013; Torres et al., 2006) to 90% (Ruscio et al., 2010) of patients with OCD have at least one psychiatric comorbidity. The most common concordant diagnoses are mood disorders and anxiety disorders, with 40.7% diagnosed with comorbid major depressive disorder and 43.5% diagnosed with comorbid social phobia (Ruscio et al., 2010). With regard to onset of illness, OCD often succeeds an existing anxiety disorder or precedes a mood disorder (Diniz et al., 2004; Klein Hofmeijer-Sevink et al., 2013). Patients with concordant diagnosis of OCD and generalized anxiety disorder suffer from higher rates of indecisiveness and are more affected by overestimation of responsibility (Abramowitz & Foa, 1998). Findings by Timpano et al. (2012) suggest that comorbid depressive disorder may exacerbate obsessive-compulsive (OC) symptom severity, and that it corresponds with a higher amount of compulsions as well as repugnant obsessions. Finally, patients with two or more comorbidities are at greater risk for chronicity and higher OC symptom severity (Klein Hofmeijer-Sevink et al., 2013; Ruscio et al., 2010).

2.1.6 Burden of disease. OCD can have a detrimental effect on quality of life (QoL; Ruscio et al., 2010). Patients with OCD have lower QoL than healthy controls, even after controlling for comorbid depressive disorder and anxiety disorder (Jahangard et al., 2018). Physical wellbeing may also be decreased (Moritz et al., 2005). Further, QoL decreases with OCD severity (Eisen et al., 2006) number of OC-symptoms (Moritz et al., 2005). In context, the level of impairment in family life and daily activities is comparable to that of schizophrenia (Bobes et al., 2001). Within a twelve-month period, 65.3% of patients with OCD in a large, US-American sample suffered from severe impairment across the domains home management, work, relationships, and social life, with highest impairment of relationships (Ruscio

et al., 2010). Over-responsibility for harm, which often leads to checking compulsions, is significantly associated with impaired health-related QoL (Schwartzman et al., 2017, see also for other associations between other OC-symptomology and dimensions of QoL). At least one suicide attempt occurs in 15% (Dell'Osso et al., 2018) to 25% (American Psychiatric Association, 2013) of persons with OCD.

2.2 Aggressiveness in OCD

2.2.1 Definitions of anger and aggressiveness. Anger is a multifaceted concept, with a longstanding recognition as one of the fundamental emotions experienced by humans (C. D. Spielberger & Reheiser, 2010). Spielberger et al. (2010) define anger as "an emotional state that consists of feelings that vary in intensity, from mild irritation or annoyance to intense fury and rage" (p. 406). This definition is often expanded to include physiological, cognitive, phenomenological and behavioral facets, however most scales assess these elements individually (Eckhardt et al., 2004). Aggression is the behavioral component of anger expression (C. D. Spielberger & Reheiser, 2010), whereas aggressiveness denotes the propensity for aggression. Often, scales differentiate external expression of anger – including verbal and physical aggression, aggression against objects, and passive aggression – from internal expression of anger, which involves suppression and direction of angry feelings towards the self and can also be construed as suppressed hostility (C. D. Spielberger, 1999; C. D. Spielberger & Reheiser, 2010). Finally, the cognitive dimension of anger is usually described in terms of hostility and latent aggression. Hostility is a product of anger involving negative feelings and attitudes towards others which may motivate aggression (A. H. Buss, 1961; C. D. Spielberger & Reheiser, 2010). It has also been suggested that hostile cognitions may in fact

precede anger (Eckhardt et al., 2004). Latent aggression involves cognitions about anger expression, as exemplified in the item “Sometimes I would like to harm strangers on the street” (RIBAQ; Moritz et al., 2011). It somewhat overlaps with the internal expression of anger, in that for instance the STAXI-II subscale *Anger Expression-In* includes items about harboring a grudge without telling anyone and being angry in secret (Rohrmann et al., 2013). In summary, all components of anger are important when examining aggressiveness, because anger is often the cause for aggressiveness, which in turn typically precedes aggression.

2.2.2 Aggressiveness in OCD – theories. *Psychodynamic Theory of Aggressiveness in OCD.* Freud construed aggressiveness as the unconscious cause of what he called obsessional neurosis (Freud, 1976). It is rooted in the oedipal conflict of ambivalent sexual and aggressive impulses towards parents. The aggressive component of these unconscious impulses of the Id stand in disequilibrium to a hypermoral Superego. The resulting reaction formation – defined as behavior in exaggerated opposition to the Id’s impulses (Freud, 1976) – serves as a coping mechanism with the aim of warding off unwanted sexual / hostile impulses. Adolescents with OCD are more prone to utilize reaction formations as behavioral defense mechanisms than their healthy peers (Offer et al., 2000). This is achieved through compulsions: opposing hypermoral behaviors infused with conscientiousness and perfectionism (Fenichel, 1945; Kempke & Luyten, 2007). For example, a person with sexually deviant thoughts may perform an elaborate hand-washing ritual an effort of neutralization or compensation. Since this coping mechanism is dysfunctional, the double-bind between Id and Superego is not resolved, and the Id’s unconscious aggressive impulses prevail in the form of obsessions (Fenichel, 1945; as cited in Kempke & Luyten, 2007). As these

aggressions morph into obsessive thoughts, they are not necessarily consciously available to the subject and therefore considered “latent” (Moritz et al., 2011). Developmentally, psychoanalysts place OCD in the anal-sadistic phase, or a regression thereto in later development (Fenichel, 1945).

Cognitive Theory of Aggressiveness in OCD. In his cognitive theory of OCD, Rachman (*Obsessions, Responsibility and Guilt,* 1993) identifies an inflated sense of responsibility as a central perpetuating factor of the disease. Over-responsibility has since been recognized by the Obsessive Compulsive Cognitions Working Group (OCCWG) as one of the central cognitive distortions inherent to OCD (Obsessive Compulsive Cognitions Working Group, 1997b). It causes patients to hold themselves responsible for preventing the manifestation of their obsessive thoughts. For example, if a person experiences the obsessive fear that their apartment building may burn down, over-responsibility may cause him / her to compulsively check whether their own stove and electrical appliances are off, while disregarding the much higher cumulative probability that a faulty device or one of the other tenants could be responsible for a fire. Moreover, patients with OCD perceive obsessive impulses to harm others or perform devious acts as evidence of their own apparent malevolence. Consequently, they blame themselves for these thoughts resulting in feelings of guilt. When experiencing anger, an inflated sense of responsibility may lead patients with OCD to blame themselves for its cause, constituting an inward, rather than outward expression of anger (i.e. aggressiveness). Observations by Rachman and Hodgson (1980) suggest that patients with checking compulsions may be especially prone to higher levels of anger. They attributed this to the fact that repeated checking is typically not successful in decreasing anxiety. Confronted with unchanged feelings of insecurity

despite the sustained effort of checking, coupled with the fear of negative consequences if checking is not completed, patients become frustrated and angry.

2.2.3 Prior research on anger / aggressiveness in OCD. A literature search on the subject of anger / aggressiveness in patients with OCD or in relationship to subsyndromal OC-symptomology yielded 18 relevant studies which used 14 distinct instruments to assess different facets of anger – 12 self-report measures and two implicit / indirect measures. A qualitative classification of these instruments according to the specific areas of anger they address is given in Table 1. There is an important caveat regarding the comparability of scales assessing anger and aggressiveness. They span 1 to 76 individual items, differ in presentation (interviews, self-report, or observational), aims (assessment of personality vs. behavior in specific provoked situations) and number of different dimensions assessed. Therefore, overlaps and divergences in previous research must be interpreted with caution. For critical discussions of the phenomenology and assessment of anger and aggressiveness, see Eckhardt et al. (2004) and Spielberger and Reheiser (2010). Furthermore, OC-symptomology was assessed in multiple ways, and it is worth noting the most important differences: many studies included patients based on the clinical diagnosis of OCD (e.g., Moscovitch et al., 2008; Radomsky et al., 2007; Whiteside & Abramowitz, 2004), however the method of diagnosis is rarely standardized. The Y-BOCS, widely accepted as the gold standard of OC-diagnostics, yields a global score of OC-severity and a comprehensive picture of an individual's illness, yet specific symptom severity is not comparable between individuals (Goodman, Price, Rasmussen, Mazure, Fleischmann, et al., 1989). For this, the OCI-R and the MOCI are more suitable, as

they ask about specific symptoms, and can be administered to healthy samples as well.

Table 1. Classification of Self-Rating Scales According to Domains of Anger

Questionnaires Assessing Anger/Aggressiveness	Anger	Aggression / Aggressiveness			Anger control (internal and external)	Hostility	Latent aggression
		Anger expression general	Anger expression internal	Anger expression external			
Aggression Questionnaire (AQ)	X			X		X	
Anger Attack Questionnaire (AAQ)	X				X[1]		
Anger Rumination Scale (ARS)	X						X[2]
Revised Freiburg Personality Inventory (FPI-R)				X			X
Inventory of Hostility and Suspiciousness (IHS)						X	
Karolinska Scales of Personality (KSP)				X			
National Survey of Mental Health and Wellbeing (NSMHWB)	X				X		X[3]
Overt Aggression Scale (OAS)			X	X			
Personality Diagnostic Questionnaire (PDQ-R)				X			
Reaction Inventory (RI)	X						
Responsibility and Interpersonal Behaviors and Attitudes Questionnaire (RIBAQ)							X
Symptom Check List-90 (SCL-90)	X	X		X	X		
State-Trait Anger Expression Inventory (STAXI)	X	X	X	X	X		
State-Trait Anger Expression Inventory–2 (STAXI-II)	X		X	X	X		X[4]
Thematic Apperception Test (TAT)							X

Note. [1]The AAQ assesses autonomic, behavioral and psychological symptoms patients may experience during an anger attack, which is interpreted here as indicative of lacking anger control. [2]Thoughts of revenge. [3]The urge to express anger against a person or object. [4]Moosavi, Naziri, and Mohammadi (2014) used a composite score of Trait Anger and Anger Expression-In to assess hidden aggression, which conceptually likens latent aggression.

2.2.1.1 Findings from self-report measures (see Table 2). *Relationship between OCD and aggressiveness.* Several studies have shown that OC-symptoms in members of the general population are associated with elevated rates of anger and aggressiveness. In a study of *N* = 2008 Chinese college students, OC-symptom scores (SCL-90) correlated moderately with the STAXI-II scales *Trait Anger / Temperament, Trait Anger / Response, Anger-In and Anger-Out* (Liu et al., 2017)[1]. Further, multivariate regression analyses showed that OC-symptom scores were predicted by *Anger-In* in females, and *Trait Anger / Response* and *Anger-In* in males. However, these finding are contestable because the Chinese SCL-90 possesses poor discriminant validity with regard to depressive, anxious, and OC-symptomology (Liu et al., 2017; Yu et al., 2018). This means that the observed correlations with STAXI-II subscales cannot be interpreted as strictly OC-symptom specific.

Moritz et al. (2011) compared *n* = 46 in- and outpatients with OCD to *n* = 23 healthy controls and showed higher scores in the OCD group on a measure of both overt aggression and latent aggression in the form of aggressive fantasies (FPI-R subscale), as well as a newly developed scale measuring latent aggression (RIBAQ aggression items). Further, OCI-R scores correlated with RIBAQ scores, indicating that latent aggression increases with OC-symptom severity.

Similarly, Moosavi, Naziri, and Mohammadi (2014) assessed what they termed hidden aggression in a sample of *N* = 60 outpatients diagnosed with OCD. Hidden aggression, conceptually similar to latent aggression, was assessed using a composite score of the STAXI-II's *Trait Anger* and *Anger Expression-In* subscales.

[1] It is unclear which items exactly are subsumed under the scales Anger-In and Anger-Out, as these are not defined for the STAXI-II. I assume they refer to Anger Expression, since this is how the scales are defined in the original STAXI. I contacted the authors to try to resolve this question, yet unfortunately received no reply.

There was a moderate correlation between OC-symptomology, assessed by the Padua Inventory, and hidden aggression. It is unclear however what precisely hidden aggression constitutes, as the STAXI-II is not validated for this purpose, and there are no comparable studies.

Cludius et al. (2020) found higher STAXI-II *Trait Anger, Anger Expression-In and -Out and Anger Control* in a sample of n = 48 patients diagnosed with OCD than in n = 45 non-clinical controls.

Relationship of anger / aggressiveness with checking symptoms. In one of the original studies examining Rachman's theories of heightened anger in patients with checking compulsions, Rachman and Hodgson showed that patients with checking compulsions reported higher anger and tension while performing their respective compulsions than patients with washing compulsions (1980). More recently, Radomsky et al. (2007) compared *n* = 33 patients diagnosed with OCD who were primarily affected by checking compulsions ("checkers") to *n* = 143 healthy undergraduate students. Checkers showed significantly higher *Trait Anger, Anger Expression-Out* and *Anger Control-In* (STAXI-II) than healthy controls. However, a lack of comparison with a non-checking OCD sample renders it unclear whether the findings are specific to checkers. Similarly, in a study by Whiteside and Abramowitz (2004) there were significant correlations between checking (MOCI) and *Anger expression* and *Anger-In*, respectively. Several other studies which examined this relationship found no correlations: neither anger rumination (ARS) nor aggressiveness (STAXI) were correlated with checking symptoms (Jessup et al., 2018; Whiteside & Abramowitz, 2005).

Table 2. Summary of Relevant Studies on Anger / Aggressiveness in OCD which use Self-Rating Measures

Authors (year)	Sample	Instruments	Main Results
Barrett, Mills, & Teesson (2013)	*N* = 8841 participants in a representative household survey in Australia	Questionnaire including: - 30-day DSM-IV mental health disorders - four items assessing anger	OCD, as well as major depressive disorder, bipolar depression, social phobia, panic disorder, generalized anxiety disorder, post-traumatic stress disorder, alcohol use disorders, and drug use disorders were independently correlated with anger, even after controlling for demographics and comorbidity.
Cludius, Mannsfeld, Schmidt and Jelinek (2020)	*N* = 93 *n* = 48 out-patients with OCD *n* = 45 non-clinical controls	- STAXI-II	Patients with OCD showed higher *Trait Anger*, *Anger Expression-In*, *Anger Expression-Out* and *Anger Control* than non-clinical controls.
Jessup, Knowles, Berg, and Olatunji (2018)	*N* = 89 *n* = 30 with primary diagnosis of OCD (Y-BOCS ≥ 16) *n* = 29 with primary diagnosis of generalized anxiety disorder *n* = 30 healthy controls	- OCI–R - ARS - STAI–T	Anger rumination was equally elevated to in both patients with OCD and GAD as opposed to healthy controls. After controlling for trait anxiety, this difference disappeared. Neither checking nor ordering (OCI-R) was significantly associated with anger rumination.
Liu, Liu, and Zhao (2017)	*N* = 2008 college students	- SCL–90 - STAXI–II	OC-symptom scores correlated with *Trait Anger-Trait*, *Trait Anger-Response*, *Anger-In* and *Anger-Out*. The correlations between OC-symptoms and *Trait Anger-Trait* and *Anger-In* remained significant even after controlling for depression and anxiety. In males, *Trait Anger-Response* and *Anger-In* were predictive of OC-symptom scores, while in females *Anger-In* was predictive of OC-symptom scores.
Moosavi, Naziri, and Mohammadi (2014)	*N* = 60 patients with OCD in outpatient treatment	- STAXI-II - Responsibility Attitude Scale - Padua Inventory (OCD symptoms) - Guilt Inventory	OC-symptomology was moderately correlated with hidden aggression (composite score of *Trait Anger* and *Anger Expression-In*) and over responsibility. There was an acceptable fit for the proposed model that that hidden aggression leads to feelings of guilt, which in turn causes excessive responsibility.
Moritz, Kempke, Luyten, Randjbar, and Jelinek (2011)	*N* = 69 adults *n* = 46 in- and outpatients diagnosed with OCD (DSM-IV) *n* = 23 healthy controls	- Y-BOCS - HDRS - OCI-R - RIBAQ latent aggression items	Patients with OCD scored significantly higher on latent aggression (RIBAQ), aggressive fantasies and overt aggression (FPI-R) than healthy controls. Latent aggression correlated with OCI-R scores, but not with Y-

		- FPI-R aggression subscale	BOCS scores. No correlations were found between latent aggression and depression (HDRS) and checking (OCI-R), respectively.
Moscovitch, McCabe, Antony, Rocca, and Swinson (2008)	*N* = 161 *n* = 30 diagnosed with OCD (DSM-IV) *n* = 82 diagnosed with anxiety disorder *n* = 49 healthy controls	- RI - AQ - DASS	Patients with OCD scored significantly higher on the RI than healthy controls, yet the effect disappeared when depression was covaried. Anger expression was not elevated in patients with OCD in comparison to healthy controls.
Painuly, Grover, Mattoo, and Gupta (2011)	*N* = 42 patients of an outpatient clinic diagnosed with OCD (ICD-10) *n* = 21 with anger attacks *n* = 21 without anger attacks	- AAQ - IDA	In the group of patients with OCD who suffered from anger attacks, comorbid depression was significantly more prevalent than in the group without anger attacks. However, depressive symptomology (IDA) did not differ between groups.
Rachman and Hodgson (1980)	*N* = 63 diagnosed with OCD *n = 31 with checking compulsions* *n = 32 with washing compulsions*	Newly developed questionnaire containing the following items, adjusted for specific compulsion: "I feel tense while hand washing / checking." "I feel angry with myself while hand washing / checking."	Patients with checking compulsions reported experiencing more anger and tension while completing their compulsions than patients with washing compulsions.
Radomsky, Ashbaugh, and Gelfand (2007)	*N* = 176 *n* = 33 diagnosed with OCD (DSM-IV) with primarily checking symptoms *n* = 143 healthy undergraduate students	- Y–BOCS - STAXI–II (subscales) - VOCI - OBQ–44 - BDI–II	Patients with checking compulsions had significantly higher Trait Anger, *Anger Expression-Out* and *Anger Control-In* scores than healthy controls, even after controlling for depression. Although overall Anger-Control did not differ between groups, inflated responsibility (*Responsibility/Threat* subscale of OBQ-44) was correlated with *Anger Control-Out* and *-In* in checkers. Surprisingly, greater self-reported checking amongst checkers was correlated with less *Trait Anger*. In healthy controls, *Anger Expression-Out* and *-In* correlated positively, while *Anger Control-Out* and *-In* correlated negatively with depressive symptoms.
Rubenstein, Altemus, Pigott, Hess, & Murphy (1995)	*N* = 147 *n* = 50 females diagnosed with OCD *n* = 69 females diagnosed with bulimia nervosa *n* = 28 female healthy controls	- SCL-90-R - MOCI - HDRS	Patients with OCD and patients with bulimia nervosa both showed elevated levels of anger (SCL-90) compared to healthy controls.

Tallis, Rosen, & Shafran (1996)	*N* = 77 patients with OCD	- PDQ-R - MOCI - BDI - STAI-T	OC-symptomology significantly correlated with passive aggressiveness, even after controlling for symptoms of depression and anxiety.
Tellawi, Williams, and Chasson (2016)	*N* = 161 *n* = 66 diagnosed with OCD (DSM-IV) *n* = 27 with other psychiatric diagnoses *n* = 68 university students	- Y-BOCS–II - OCI–R - IHS - BDI–II - BAI	Patients with OCD scored significantly higher, yet at the same levels as patients with other diagnoses, on hostility and suspicious thinking. Hoarding and ordering (OCI-R) were strongly correlated with hostility and suspicious thinking scores.
Whiteside and Abramowitz (2004)	*N* = 131 undergraduate students *n* = 60 with high OC-symptoms (MOCI: ≥ 14) *n* = 71 with below-average OC-symptoms (MOCI: ≤ 3)	- MOCI - STAXI - BDI	The group with high OC-symptoms scored significantly higher on inward suppression of anger and significantly lower on anger control compared to the low OC-symptoms group as well as the STAXI normative sample. Group differences disappeared after controlling for depressive symptoms (BDI), except for a weak correlation between checking and anger expression and internalization of anger (STAXI).
Whiteside and Abramowitz (2005)	*N* = 142 *n* = 71 adults diagnosed with OCD (DSM-IV) *n* = 71 undergraduate students matched on gender	- Y–BOCS - OCI–R - STAXI - STAI	Anger expression was slightly higher in patients with OCD than healthy controls, yet did no longer differ after controlling for general distress (STAI). Checking symptomology (OCI-R) did not correlate with anger. STAXI Scores correlated with OCI-R scores, yet not with Y-BOCS scores.
Shoval et al. (2006)	*N = 342 adolescents* *n* = 40 inpatients diagnosed with OCD (DSM-IV) *n = 87 healthy adolescents matched for sociodemographic characteristics* *n = 215 inpatients with other mental illnesses*	- OAS (measures aggression against self, objects, others in self report and aggression against self as observed by nursing staff across the timespan of four weeks)	Patients with OCD were more destructive, violent, and aggressive in the past six months and prior than healthy controls, but not patients with other psychiatric diagnoses.

Note. AAQ = Anger Attack Questionnaire (Fava et al., 1991); AQ = Aggression Questionnaire (Arnold H. Buss & Perry, 1992); ARS = Anger Rumination Scale (Sukhodolsky et al., 2001); BAI = Beck Anxiety Inventory (Aaron T. Beck et al., 1988); BDI = Beck Depression Inventory (A. T. Beck et al., 1961); BDI-II = Beck Depression Inventory-II (A. T. Beck et al., 1996); DASS = Depression Anxiety Stress Scales (Lovibond & Lovibond, 1995); FPI-R = Freiburg Personality Inventory (Fahrenberg & Selg, 1970); HDRS = Hamilton Depression Rating Scale (Hamilton, 1960); HARS = Hamilton Anxiety Rating Scale (Hamilton, 1959); HIS = Inventory of Hostility and Suspicious Thinking (Huppert et al., 2002); IDA = Irritability, Depression and Anxiety Scale (Snaith & Taylor, 1985); KSP = Karolinska Scales of Personality (Schalling & Edman, 1987); MOCI = Maudsley Obsessional-Compulsive Inventory (Hodgson & Rachman, 1977); OAS = Overt Aggression Scale (Yudofsky et al., 1986); OBQ-44 = Obsessive Beliefs Questionnaire-44 (Obsessive Compulsive Cognitions Working Group, 2005); OCI-R = Obsessive–Compulsive Inventory-Revised (Foa, Huppert, et al., 2002); PDQ-R = Personality Diagnostic

Questionnaire-R (Hyler & Rieder, 1987); RI = Reaction Inventory (Evans & Stangeland, 1971); RIBAQ = Responsibility and interpersonal behaviors and attitudes questionnaire (Moritz et al., 2009); SCID screen questionnaire (Ekselius et al., 1994); SCL-90 = Symptom Check List-90 (Derogatis et al., 1976); SCL-90-R = Revised Symptom Check List-90 (Franke, 2014); STAI = State–Trait Anxiety Inventory (Charles Donald Spielberger & Gorsuch, 1983); STAI-T = The State Trait Anxiety Inventory-Trait Version (Charles Donald Spielberger & Gorsuch, 1983); STAXI = State–Trait Anger Expression Inventory (C D Spielberger, 1988); STAXI-II = State–Trait Anger Expression Inventory-II (C. D. Spielberger, 1999); VOCI = Vancouver Obsessional Compulsive Inventory (Thordarson et al., 2004); Y-BOCS = Yale–Brown Obsessive Compulsive Scale (Goodman, Price, Rasmussen, Mazure, Fleischmann, et al., 1989); Y-BOCS-II = Yale–Brown Obsessive Compulsive Scale-II (Storch et al., 2010).

Table 3. Summary of Relevant Studies on Anger / Aggressiveness in OCD which use Implicit / Indirect Measures

Authors (year)	Sample	Instruments	Main Results
Cludius, Schmidt, Moritz, Banse, and Jelinek (2017)	*N* = 83 *n* = 58 diagnosed with OCD (DSM-IV) *n* = 25 healthy controls	- Y–BOCS - OCI-R - Agg–IAT - HDRS	Agg-IAT scores, measuring participants' implicit self-concept with regard to aggressiveness, did not differ between groups, with both groups exhibiting a bias towards a peaceful self-concept. The subsample of patients with checking compulsions (OCI-R) had a significantly stronger bias towards a peaceful self-concept than healthy controls. There was no correlation between implicit aggressiveness and depressive symptomology (HDRS).
Cludius, Mannsfeld, Schmidt and Jelinek (2020)	*N* = 93 *n* = 48 out-patients with OCD *n* = 45 non-clinical controls	- Agg-IAT - STAXI-II - OCI-R	Agg-IAT scores did not differ between groups. Exploratory analysis of a subsample of patients with checking compulsions (OCI-R) also showed no group difference on the Agg-IAT.
Cogan et al. (2004)	*N* = 64 male undergraduate students	- OCI–R - TAT	Participants in the high-scoring OCI-R group included significantly more violence in their TAT stories than participants in the low-scoring OCI-R group, demonstrating greater latent aggression.

Note. Agg-IAT = Aggressiveness-Implicit Association Test (Cludius et al., 2017); HDRS = Hamilton Depression Rating Scale (Hamilton, 1960); OCI-R = Obsessive–Compulsive Inventory-Revised (Foa, Huppert, et al., 2002); STAXI-II = State–Trait Anger Expression Inventory-II (C. D. Spielberger, 1999); TAT = Thematic Apperception Test (Murray, 1943); Y-BOCS-II = Yale–Brown Obsessive Compulsive Scale-II (Storch et al., 2010)

The influence of depression and anxiety on anger / aggressiveness. There is strong evidence that anxiety and depressive symptoms have an influence on the higher levels of anger / aggressiveness associated with OC-symptomology and OCD. Comparing healthy undergraduate students with high and below-average levels of OC-symptoms, Whiteside and Abramowitz (2004) found that high levels of OC-symptoms correlated with anger expression, specifically stronger internal expression of anger and more difficulty controlling anger (STAXI)[2]. However, these correlations disappeared after controlling for depression as assessed by the BDI. This finding is limited by the MOCI's response structure: Answers cannot be further discriminated as they are given on a true-false basis. Therefore, information may have been lost, obscuring the examined group difference in anger expression between the high and below-average groups (Radomsky et al., 2007). Further, the differences were not observed in a clinical, help-seeking sample with a formal diagnosis of OCD (Whiteside & Abramowitz, 2004). These shortcomings were addressed in a further study by the same authors that compared students diagnosed with OCD to healthy controls using the Y-BOCS and OCI-R (see chapters 3.3.1 and 3.3.6). Again, anger expression was found to be slightly more frequent in the OCD sample and similarly, this difference disappeared after controlling for general distress as measured by the STAI (Whiteside & Abramowitz, 2005). Factor analysis has shown that the STAI loads on both anxiety and depression, therefore the general distress measured in the latter study may have a conceptual overlap with the depressive symptoms measured in the former (Storch et al., 2004).

[2] The *Anger-Expression* score measures anger expression in relation to the capability for anger control. It is computed as follows: (*Anger-In* + *Anger-Out*) – *Anger-Control* + 16.

Another study found higher anger rumination in patients with OCD, which includes the factors *angry afterthoughts, thoughts of revenge, angry memories,* and *understanding of causes* (Jessup et al., 2018). Again, the STAI score explained this variance. In a study by Moscovitch et al. (2008), patients with OCD reported higher anger, which disappeared when depression was covaried. This was measured using the Reaction Inventory, which presents hypothetical anger-invoking incidents to measure an individual's propensity to experience anger (Fernandez et al., 2015). The Anger Questionnaire, which covers anger, anger expression, and hostility, did not produce elevated scores in patients with OCD compared to healthy controls in the same study (Moscovitch et al., 2008). In summary, four individual studies show that depressive / anxious symptomology contributes higher scores of anger and aggressiveness in patients with OCD. Conversely, some studies contradict the notion that depressive symptomology is related to aggressiveness in OCD. Scores on the Hamilton Depression Rating Scale (HDRS; Hamilton, 1960) were unrelated to latent aggression (RIBAQ latent aggression subscale) as well as implicit aggressiveness (IAT; Cludius et al., 2017; Moritz et al., 2011). Also, patients with OCD who experienced regular anger attacks did not differ from patients with OCD without anger attacks in level of depressive symptomology (IDA; Painuly, Grover, Mattoo, & Gupta, 2011). Finally, two studies showed that the correlation between OC-symptomology and anger / aggressiveness prevailed even after controlling for depression and anxiety (Liu et al., 2017; Tallis et al., 1996).

Two studies examined the relationship of checking and aggressiveness. Radomsky et al. (2007) showed that checkers exhibited significantly higher *Trait Anger, Anger Expression-Out* and *Anger Control-In* (STAXI-II) than healthy controls, even after controlling for depression (BDI-II). Whiteside and Abramowitz (2004), too,

found the correlations between checking (MOCI) and *Anger expression* and *Anger-In*, respectively, remained weakly significant after controlling for depression. This suggests that the interaction between depression and anger / aggressiveness may be different in checkers than in the entirety of patients with OCD, in that depressive symptoms are present independently from anger / aggressiveness, without the former influencing the latter. However, as the correlations were with different STAXI scales in both studies, the data do not point to any specific feature of anger / aggressiveness being unique to patients with checking compulsions.

2.2.1.2 Findings from implicit / indirect measures (see Table 3). The study by Cludius et al. (2017), upon which the current thesis is modelled, examined implicit aggressiveness in *n* = 58 patients with OCD and *n* = 25 healthy controls using an Aggressiveness–Implicit Association Task (Agg-IAT; for a detailed description of the IAT, see chapter 2.3.1.3). Participants were required to categorize the target concept of self (expressed by personal pronouns) as opposed to others (expressed by vocations such as architect, dentist, carpenter, etc.) in conjunction with peaceful and aggressive descriptors. The aim was to measure participants' implicit concept of their own aggressiveness, as opposed to that of others. No significant group difference emerged, with both the OCD sample and healthy controls responding in accordance with a peaceful self-concept. Surprisingly, subgroup analysis of patients with checking compulsions showed a significantly stronger bias towards *self – peaceful* and *others – aggressive* than healthy controls. This cannot be taken to mean that checkers have a more or less peaceful self-concept than controls. Rather, it indicates that checkers discriminate more strongly between themselves and others with regard to aggressiveness / peacefulness than healthy controls. Further, this discrimination does not necessarily pertain to

aggressiveness specifically; it can also be interpreted as checkers placing a stronger claim to a peaceful self-image than healthy controls. Unfortunately, no comparison with an explicit measure of aggressiveness was conducted, therefore it is unclear how large the conceptual overlap between the implicit IAT and explicit questionnaires assessing aggressiveness actually is. A tendency towards less aggressiveness in checkers is supported by Radomsky et al. (2007), who surprisingly found *Trait Anger* to correlate negatively with checking symptoms.

Cludius et al. (2020) conducted a further Agg-IAT study which also assessed explicit aggressiveness using the STAXI-II. No group difference in implicit aggressiveness emerged. The 2017 finding of a more peaceful self-image in patients with checking compulsions was not replicated; as in the overall sample, there was no Agg-IAT group difference.

A study with N = 64 male undergraduate students indirectly assessed aggression using the psychodynamic Thematic Apperception Test (TAT; Cogan et al., 2004). Participants were presented with a picture and asked to write a story, which was scored by clinicians according to the violence of its content (death of a character or physical aggression). The study showed that males with high OC-symptoms (OCI-R) wrote significantly more violent stories than those with low OC-symptoms. This assessment most closely resembles a measure of latent aggression, in that it may reveal whether participants are thinking about aggressive behavior. However, it does not provide any information about the other dimensions of anger and aggressiveness, rendering the findings somewhat inconclusive.

2.2.1.3 Anger / aggressiveness in other mental illnesses. Anger and aggressiveness do not seem to be exclusive to OCD, as higher rates have been measured across different mental illnesses. Patients with OCD showed the same

elevated levels of anger and latent aggression as patients with generalized anxiety disorder (Jessup et al., 2018), the same elevated level of anger as patients with bulimia nervosa (Rubenstein et al., 1995), and the same elevated hostility as patients with a range of other psychiatric diagnoses (Tellawi et al., 2016). In a large cohort study of *N* = 8841 Australians, four questionnaire items screened for anger, external expression of anger and latent aggression (Barrett et al., 2013). Again, there was a correlation between anger / aggressiveness, and 30-day DSM-IV diagnosis of OCD, but also with many of the other mental illnesses in the screening. These findings challenge the notion that anger / aggressiveness is a distinct characteristic of OCD, instead indicating that it may be an emotion more generally associated with psychopathology. In contrast, adolescents diagnosed with OCD were more destructive and violent than adolescents with eating disorders and more aggressive than patients with psychotic disorders (Shoval et al., 2006). However, these data do not per se contradict other findings, as they pertain to adolescents, whose presentation of OCD can differ quite significantly from adults (Farrell et al., 2006b).

2.2.1.4 Summary of findings on anger / aggressiveness in OCD. Overall, the prior research strongly suggests that anger and aggressiveness are inherent to the emotional landscape of patients with OCD. Several studies show a stronger propensity for anger and its inward expression (Cogan et al., 2004; Liu et al., 2017; Moritz et al., 2011), especially in patients with checking compulsions (Radomsky et al., 2007; Whiteside & Abramowitz, 2004), as suggested by Rachman (1993). Moreover, a moderating effect of depression was repeatedly examined, and several studies of different mental illnesses suggest that anger / aggressiveness may not be exclusive to OCD. In support of psychodynamic theories, there is also strong

evidence of latent aggression in patients with OCD (Cogan et al., 2004; Moritz et al., 2011). However, questionnaires and interviews are structurally unsuitable for assessing truly latent emotions, since these are experienced unconsciously (Freud, 1976). Therefore, this study attempts bridge this gap in the research by capturing latent aggressive tendencies using an implicit measure that improves upon some of the shortcomings of the IAT used by Cludius et al. (2017) to measure the same construct.

2.3 Theoretical Introduction to the IRAP

2.3.1 Implicit and explicit measures

***2.3.1.1 Dual process theories*.** The distinction between implicit and explicit attitudes is rooted in dual process theories, an array of cognitive models that posit the division of mental processes into automatic and controlled (for a comprehensive overview, see Chaiken & Ledgerwood, 2013). Some theories are domain specific, seeking to explain only specific types of behavior such as prejudice or stereotyping (Devine, 1989), while more recent theories suggest that all mental processes are attributable to one of two domain-independent operating principles (e.g., Kahneman, 2003). Moors and De Houwer (2006) propose that a process be labeled automatic if it is unintentional, efficient, uncontrollable, or unconscious. These characteristics are tangible in the research that applies dual processing theory to attitudes.

***2.3.1.2 Implicit and explicit attitudes*.** The distinction between implicit and explicit attitudes was popularized by Greenwald and Banaji (1995), who define implicit attitudes as “introspectively unidentified (or inaccurately identified) traces of past experience that mediate favorable or unfavorable feeling, thought, or action toward social objects” (1995, p. 8). For example, a person may harbor aggression towards a certain group, without being able to introspectively identify where this

animosity comes from. As the person is aware of his / her aggression, the implicit and explicit dimensions of this attitude overlap – the distinction becomes more relevant when implicit and explicit attitudes diverge.

For example, a Caucasian woman may have the explicit attitude that all races are equal. Her implicit attitude however may contain a negative bias towards people of color. This dissociation of attitudes demonstrates the necessity for measures that may distinguish between explicit and implicit attitudes (Greenwald & Banaji, 1995). A self-report measure would be unsuited to reveal the woman's racial bias, because she would answer in line with her explicit attitude. Moreover, even if she was explicitly racist, social desirability or imprecise reporting might mask this bias (Greenwald et al., 2000). Implicit measures have the ability to circumvent these cognitive and social barriers and allow comparison with self-report attitudes, revealing implicit-explicit dissociations (Nosek, 2007). Researchers emphasize different aspects of implicit attitudes, with some focusing on their unconscious nature (Greenwald & Banaji, 1995) and others highlighting their habit-like nature (Wilson & Schoolar, 2000).

2.3.1.3 Implicit measures. There are different ideas on what constitutes an implicit measure (Gawronski & De Houwer, 2011). This thesis follows Gawronski and De Houwer's (2011) definition whereby a measurement is implicit if the impact of the measured attribute on the given response is unintentional, resource-independent, unconscious, or uncontrollable, and is explicit if the impact of the measured attribute on the given response is intentional, resource-dependent, conscious, or controllable. A widely used implicit measure is the Implicit Association

Task (IAT; Greenwald et al., 1998)[3]. It measures the strength of association between two different categories: a target concept (e.g., in a hypothetical example used henceforth to explain different implicit measures, race) and an associated attribute (e.g., pleasantness / unpleasantness). In the computer-assisted task, participants are first asked to categorize words or images according to the target concept discrimination (e.g., images of white and black persons as *black* or *white*), and the associated attribute dimension (e.g. words such as "good", "worthy", "healthy" as *positive* and "bad", "dirty", "ugly" as *negative*) by pressing one of two computer keys. Subsequently, the target concept and associated attribute are both assigned to one key, for example *black – negative word* and *white – positive word*. Then, the key assignments switch to *black – positive word* and *white – negative word*. Participants are instructed to answer as quickly and accurately as possible, receiving feed-back when they make an error. If participants have an implicit bias towards either combination of key assignment, they will find it considerably easier to answer in this fashion, therefore their responses will be faster. The difference in response latency between the *white – pleasant* and *black – unpleasant* versus *white – unpleasant* and *black –pleasant* key assignments is used as a measure of bias (Greenwald et al., 1998). A meta-analysis showed acceptable predictive validity (r = .274) of the IAT for various behavioral, judgement, and physiological measures (Greenwald et al., 2009). Expectedly, the IAT's predictive validity for socially sensitive topics such as Black-White interracial behavior was impaired (Greenwald et al., 2009). In these

[3] Implicit measures may be categorized into: (1) evaluative priming methods, (2) the IAT, and (3) the Affect Misattribution Procedure. For an overview of their various mechanisms, underlying theories, psychometric properties, and limitations, see Goodall (2011).

types of studies, the IAT significantly exceeded the predictive validity of self-report measures, exemplifying the implicit-explicit dissociation discussed above[4].

The IAT's ability to reveal implicit attitudes is commonly modelled on association-activation theories (De Houwer, 2014). Fazio and colleagues (1986) theorized association-activation as the mechanism of automatic processes in dual process theory. They argue the key feature of automatic processes is inescapability, meaning the activation of a process without reflection. They deduce that for this activation to be automatic, it requires a set of well-learned associations, which equate to a person's implicit attitude. Other implicit measures have been derived from the IAT, such as the Go / No-Go Association Task (Nosek & Banaji, 2001) and the Extrinsic Affective Simon Task (Houwer, 2003). They all share the limitation of measuring only the relative ease of an association, but not its nature or directionality (De Houwer, 2002). If the hypothetical IAT described above revealed a bias towards *white – pleasant* and *black – unpleasant,* one might be tempted to infer that this demonstrated anti-black racism. However, it merely shows that the association of *white – pleasant* and *black – unpleasant* is stronger than *white – unpleasant* and *black – pleasant*, or in other words, that the former association is more deeply engrained in a person's automatic processes. It does not however show the associations between the concepts in absolute terms, that is as how independently pleasant Caucasians and people of color are evaluated, nor whether pleasantness is perceived as an element of whiteness, or vice versa. In short, it is unable to show the relationship between these constructs (Barnes-Holmes et al., 2006). This limitation is circumvented in the IRAP (Barnes-Holmes et al., 2006).

[4] For a discussion of possible explanations for implicit-explicit dissociations, see Hofmann, Gwaronski, Gschwendner, Le and Schmitt (2005, p. 1370)

A common critique of the IAT pertains to its scoring. In the *D*-score, constructed as the difference in latency between consistent (i.e. *white* – *pleasant* and *black* – *unpleasant*) and inconsistent (i.e. *white* – *unpleasant* and *black* – *pleasant*) trials, all four of these associations receive the same weight. This is down to the single factor structure of the *D*-score which places the associated attributes (*pleasant* and *unpleasant*) on a linear continuum (Blanton et al., 2006). In fact, however, correlations between consistent and inconsistent latencies (i.e., *white* – *pleasant* and *white* – *unpleasant*) have been found to range between 0.4 – 0.6, somewhat undermining this linear conceptualization (Blanton et al., 2006).

A further issue has been raised about the valence of target stimuli. These may be loaded with associations and appraisals which are individual to the participant, thereby tainting associations (Fiedler et al., 2006). For example, in the study upon which the current study's IRAP is modeled, the target to be associated with the related concept (*aggressiveness* / *peacefulness*) is self (i.e., *me*, *my*) versus others (represented by different vocations, i.e., *accountant*, *farmer*). It is likely that participants have different attitudes about vocations along the dimension of aggressiveness, shaped by stereotypes as well as experiences. In turn, any interpretation of the target concept is subject to a "stimulus selection effect" (Fiedler et al., 2006, p. 90). A further critical aspect of stimulus selection is the assumption of the type of attitude an association represents. For example, the association *others* – *aggressiveness,* represented by the stimulus combination *accountant* – *attack,* could be interpreted as negative for the attitude object (i.e., the accountant is being attacked), or negative for the attitude holder (i.e., the accountant is attacking someone; Fiedler et al., 2006). This too can be disentangled by the IRAP's

construction which allows differentiation of the strength of positive and negative appraisals.

2.3.2 The Implicit Relational Assessment Procedure. The IRAP was developed by Dermot Barnes-Holmes in 2006. For reasons of comprehensibility, a description of the IRAP will proceed its theory. In this computer-assisted task, participants evaluate pairs of presented stimuli, labeled sample and target stimuli, according to predefined responding contingencies. Each presentation of stimulus pair is called a trial, and trials are grouped into blocks. Between blocks, the instructed responding contingency switches. Typically, there are two sample stimuli, for example the words *white* and *black*, and an equal number of target stimuli of two opposing categories, for example words deemed either *pleasant* (e.g., *kind*, *lovely*, *likeable*) or *unpleasant* (e.g., *hostile*, *rude*, *mean*). The response options are opposing relational terms, for example *true* and *false*, or *similar* and *opposite* (Barnes-Holmes et al., 2006). The resulting responding contingencies are designed to be consistent or inconsistent with participants' explicit attitudes or a hypothesized bias; in the given example this bias is anti-black racism. The two sample stimuli and two types of target stimuli yield four different trial types displayed in Figure 1: *white – pleasant*, *white – unpleasant*, *black – pleasant*, and *black – unpleasant*. In a consistent block, participants are required to respond: *white – pleasant → true*, *white – unpleasant → false*, *black – pleasant → false*, and *black – unpleasant →* true. If the participant responds correctly, that is in line with the responding contingency of that block, the screen is cleared for 400 ms and the next trial commences. If a participant responds incorrectly, choosing the inconsistent response on a consistent block or vice-versa, a red X appears on the screen until the correct response is chosen. In analogy to the IAT's switching key assignment combinations, which

produce slower responses when two opposing concepts are assigned to the same key, responses are theorized to be slower in inconsistent blocks than consistent ones. The IRAP's primary datum is therefore response latency until the participant clicks the correct key. The difference in response latency between blocks of opposing responding contingency, for example between the response latency of *white – pleasant → true* and *white – pleasant → false*, is construed as an effect size of the relative ease of one responding contingency over the other. This effect may be considered an implicit measure of attitudes because it applies accuracy and latency pressure, rendering the variability in response latency an effect of the participants' history of relating stimuli in a certain way (Hussey & Barnes-Holmes, 2012). A person with a strong pro-white racial bias would show a greater difference in latency (i.e. large effect size) in the aforementioned example than a person without any such bias (for this person, response latencies would be similar during either block, resulting in no effect).

Figure 1. Trial Types of an Example IRAP

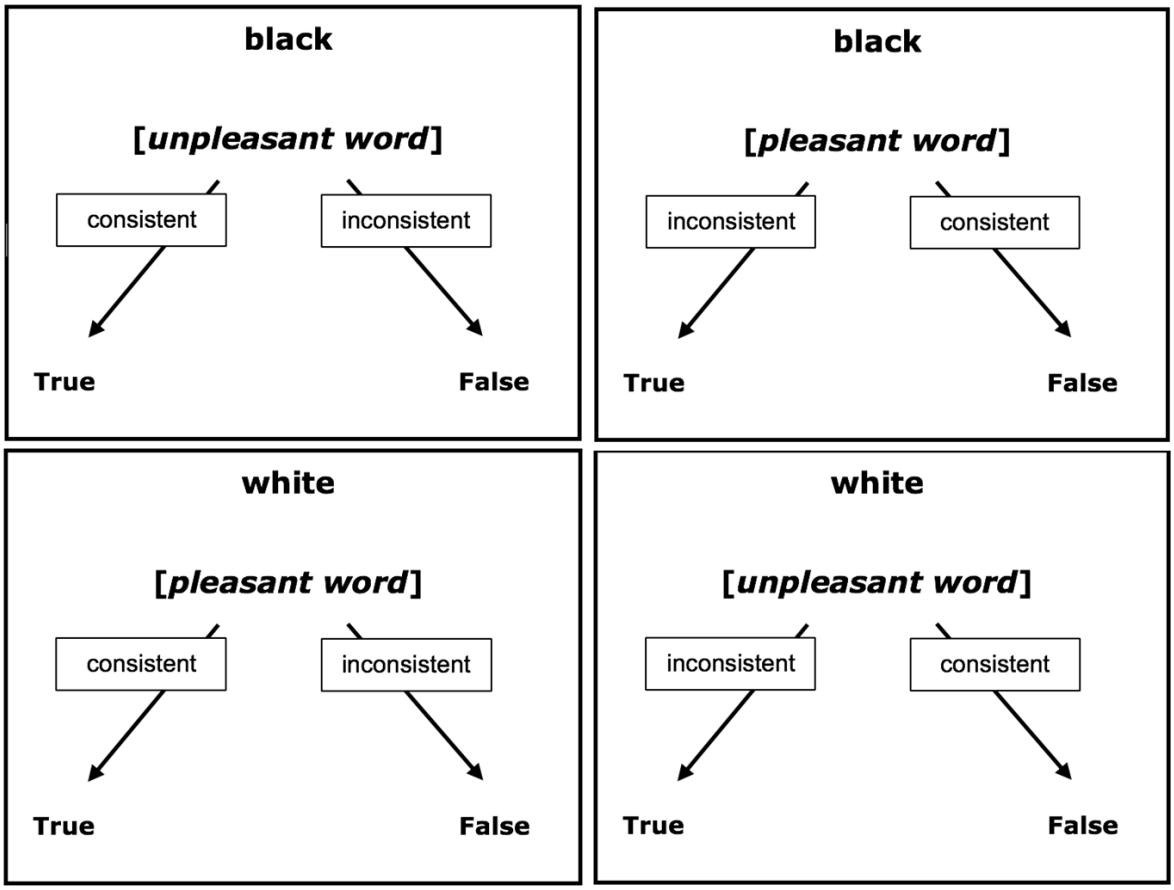

Figure 1. Trial types of an example IRAP assessing racial bias. Sample stimuli, (*black*, *white*), target stimuli ([*unpleasant word*], [*pleasant word*]), and response options (*true*, *false*) are presented simultaneously on the screen. The superimposed arrows and text-boxes indicate which response is required per the responding contingency of a block (arrows and text-boxes not shown in the task). Responses are chosen by pressing a computer key located on the left of the keyboard for *true*, and the right of the keyboard for *false.* If the participant answers correctly, that is in line with the responding contingency, the screen is cleared for 400 ms and the next trial commences. If a participant chooses the inconsistent response on a consistent block or vice-versa, a red X appears on the screen until the correct response is chosen. Participants are instructed to respond as quickly and accurately as possible.

2.3.2.1 Relational frame theory. The Implicit Relational Assessment Procedure is conceptionally based on relational frame theory (RFT; Hayes et al., 2001). RFT is built around the assumption that the building block of higher human cognition and language is the ability to create bi-directional links between concepts and evaluate events and situations accordingly (Hayes et al., 2001). This skill is described as ‘arbitrarily applicable relational responding’ (AARR; Hughes, 2016).

For example, a coin and a button are similar in that they are both round and flat and differ in that the former is made of metal and used for payment, and the latter may be made from various materials and is used for fastening. The terms ‘similar’ and ‘differ’ specify the type of relations between a coin and a button, while shape, material, and use are the dimensions along which these are made. RFT argues that the type of relational responding applied is arbitrary (Hayes et al., 2001), as a person may relate coin and a metal button as “same” along the dimension of material, yet “different” along the dimension of monetary worth if it were a gold coin and a copper button (Hughes, 2016). The IRAP measures the individual strength of specific relations between sample stimuli according to their characteristics. In the aforementioned example, the words *black* and *white* (as linguistic representations of race) are compared along the dimension of pleasantness, with the response options (*true* or *false*) specifying the type of relation.

2.3.2.2 Relational elaboration and coherence model. RFT explains the IRAP effect of diverging response latencies using the relational elaboration and coherence (REC) model in analogy to the explanation of the IAT effect through association-activation. The REC model posits that the IRAP is capable of producing brief and immediate relational responses (BIRRs), even before the participant has presses a response key. The probability of this immediate response is determined by the way a subject has most frequently related the presented sample and target stimuli in the past (Barnes-Holmes, Barnes-Holmes, et al., 2010). For example, a person may have been raised to fear people of color, therefore immediately relating *black* and *unpleasant*. If the instructed responding contingency of a trial aligns with the person’s BIRR, the response will be quicker than if the person must first remember the responding contingency instruction and then respond in dissonance

to their BIRR. Averaged across several trials and under latency and accuracy pressure, the IRAP effect thus emerges (Barnes-Holmes, Barnes-Holmes, et al., 2010). Through a dual processing theory lens, RFT's BIRRs are automatic cognitions, while so-called extended and elaborated relational responses (EERRs; Barnes-Holmes, Barnes-Holmes, et al., 2010) are their controlled counterparts. EERRs are produced without latency pressure and incorporate more relations than only the most probable; they are the types of answers produced on questionnaires (Barnes-Holmes, Barnes-Holmes, et al., 2010). If asked on a questionnaire to evaluate the pleasantness of the word *black* (applied to race), the subject's BIRR may be overshadowed by other relations: former positive interactions with people of color, ethical considerations of equality, or social desirability. When BIRRs and EERRs cohere, the implicit (e.g., IRAP) and explicit (e.g., questionnaire) measures of a concept will typically converge, and when they do not cohere, a response given on an explicit measure will often diverge from the implicit response (Barnes-Holmes, Barnes-Holmes, et al., 2010).

2.3.2 Prior research using the IRAP. Since its development by Dermot Barnes-Holmes and his team in 2006, the IRAP has been used in various domains (for a comprehensive table of IRAP studies up to 2013, see Golijani-Moghaddam, Hart, & Dawson, 2013) A large share of IRAP studies has assessed psychopathology, ranging self-esteem (Remue et al., 2013), spider phobia (Nicholson & Barnes-Holmes, 2012), and pedophilia (Dawson et al., 2009), to name just a few. Other researchers have used the IRAP to measure personal preference, for instance for a specific soccer club (Barnes-Holmes, Barnes-Holmes, et al., 2010), or participants' attitudes towards work versus leisure time. Still others assessed stereotyping and stigmatization in domains such as race (Barnes-Holmes,

Murphy, et al., 2010), gender (Drake et al., 2010), and body type (Nolan et al., 2013). Finally, the IRAP has also been implemented as purely logical exercise, requiring participants to identify words as pleasant or unpleasant (Barnes-Holmes et al., 2006) or categorize shapes and colors (Finn et al., 2016). Several studies showed that IRAP *D*-scores were changeable, for example by mood-induction (Hussey & Barnes-Holmes, 2012) or a mindfulness intervention (Hooper et al., 2010).

Golijani-Moghaddam, Hart and Dawson (2013) reviewed 31 articles reporting on the validity and / or reliability of the IRAP. Discriminant validity, in terms of correlation with explicit responses, varied substantially (Golijani-Moghaddam et al., 2013). At the same time, implicit-explicit dissociations, expected predominantly in socially sensitive target concepts, were not always present (Kelly & Barnes-Holmes, 2013). Concurrent validity, that is the IRAP's ability to differentiate between groups which are expected to score differently, was relatively strong, with effects in all ten according studies (Golijani-Moghaddam et al., 2013). In a slightly different approach, Vahey, Nicholson, and Barnes-Holmes (2015) conducted a meta-analysis of the clinical relevance of IRAP effects in terms of their correspondence with criterion variables, such as known group differences and self-report measures. Fifteen studies with data from 494 participants were included in the analysis, yielding a meta-effect of $\bar{r}$ = .45 (95%-CI: .23, .67), which can be interpreted as the average correlation between IRAP *D*-scores and their designated criterion variables. This effect is superior to those of other implicit measures, namely the IAT and evaluative priming methods such as the AMP (Vahey et al., 2015). In summary, the IRAP has a number of positive characteristics such as thematic versatility and solid psychometric properties, however its ability to provide information about attitudes above and beyond explicit measures requires further confirmation.

The current study's IRAP uses sample and target stimuli which together constitute self-referential statements. It acts as a measure of self-image with regard to aggressiveness because it asks participants to agree / disagree to statements about themselves (e.g., "I am brutal"). Several other IRAP studies have assessed the way participants personally relate with target concepts.

Three studies assessed participants' own body image in clinical and non-clinical samples. Parling, Cernvall, Stewart, Barnes-Holmes, and Ghaderi (2012) compared *n* = 17 patients with anorexia nervosa to *n* = 17 age- and gender-matched controls. Both groups showed a similar, significant bias towards *good – me thin* → *same*, indicating an endorsement of the thin ideal. The group with anorexia nervosa also showed a significantly stronger bias towards *bad – self fat* → *same*, reflective of the fear of gaining weight inherent to the diagnosis (American Psychiatric Association, 2013). However, the IRAP score did not correlate with explicit measures (a visual analog scale and the BSQ). The two other studies on body image were conducted using healthy undergraduate students. One found a bias towards body satisfaction (Timko et al., 2010a) and the other showed more mixed results, with evidence of fat as well as thin self-images, albeit in different participants (Juarascio et al., 2011). Both studies showed significant correlations between IRAP and explicit measures. This raises the question whether the lacking correlations in the anorexia nervosa sample constitute an explicit-implicit dissociation caused by socially desirable responding on the explicit measures in the anorexia nervosa sample (Vandereycken, 2006).

Another theme repeatedly examined by self-referential IRAPs was self-esteem. In a sample of *N* = 93 undergraduate students, Timko et al. (2010b) showed an IRAP bias towards self-esteem as well as two predictable correlations: scores on

the *I am* [*positive word*] trial type weakly positively correlated with quality of life and weakly negatively correlated with a measure of overall psychopathology. A further study used the individualized response options [participant's first name] / Not [participant's first name] to measure self-esteem in a sample of *n* = 24 undergraduate students, *n* = 6 open area prisoners and *n* = 13 main block prisoners (these have less freedoms than the open area prisoners). Undergraduate students and open area prisoners exhibited a positive self-esteem bias, while the more isolated main block prisoners had a negative self-esteem bias – they confirmed positive self-esteem yet did not deny negative traits. Further, overall IRAP *D*-scores significantly positively correlated with an explicit measure of self-esteem. A third study compared *n* = 27 undergraduate students with low levels of dysphoria to *n* = 29 with high levels (Remue et al., 2013). IRAP *D*-scores scores indicated significantly lower *actual* and higher *ideal* self-esteem in the high-dysphoric group.

Another self-referential statements IRAP examined self-forgiveness for success and failure (Bast & Barnes-Holmes, 2015). As expected, there was a bias towards positive feelings as a result of success, and negative feelings as a result of failure. However, only one out of 60 possible correlations with explicit measures was significant.

In summary, there is solid evidence that IRAPs using self-referential statements are able to produce biases that align with hypotheses as well as discriminate between groups. This indicates at least some face validity. However, discriminant validity greatly varied. This may be down to methodological issues such as a lacking conceptual concordance between the IRAP and explicit measures. Overall, general statements about the IRAP's psychometric properties are

somewhat problematic at the current stage, because of the diverse mastery criteria, stimulus types and explicit measure comparisons applied.

In this study, the IRAP is used to assess aggressiveness because it is capable of circumventing potential response biases that may arise with sensitive target concepts (Barnes-Holmes et al., 2006). Further, it is designed to captures brief and immediate relational responses and may therefore be able to expose unconscious aggressiveness as theorized by Freud (1976). It is also an improvement upon the IAT because it measures attitudes about opposing concepts independently from each other, potentially decreasing stimulus selection bias. Contrary to the IAT in which stimuli are related by their assignment to the same key, the IRAP allows for sample and target stimuli to be combined into syntactically correct, self-referential statements, allowing a more focused assessment of participants' attitudes about their *own* aggressiveness. Finally, the scoring modality derived from Cohen's *d* (Jacob Cohen, 1988) is appropriate for use in a clinical sample as it reduces the impact of interindividual differences in cognitive processing speed on scoring. To my best knowledge, the IRAP has not yet been used to assess aggressiveness, making this an innovative study in the young field of IRAP research.

2.4 Aims of the Current Study

Overwhelmingly, prior research has shown that patients with OCD show higher levels of explicit aggressiveness than the general population (Cogan et al., 2004; Liu et al., 2017; Moritz et al., 2011), and there is also some evidence for latent aggression in this sample (Cogan et al., 2004; Moritz et al., 2011). However, no study has shown elevated aggressiveness using an implicit measure – the only study (at the time this research was conceived, a further study using the same implicit measure has since been published by Cludius et al., 2020) using an implicit

measure by Cludius et al. (2017) found no difference between patients with OCD and healthy controls. Due to several limitations of the IAT, this study assesses aggressiveness using the IRAP. Since the research from explicit assessment and implicit assessment of aggressiveness is contradictory – Cludius et al. (2017) even found lower levels of aggressiveness in patients with checking compulsions compared to healthy controls – the directionality of the hypothesized group difference in implicit aggressiveness (H1a) is left open here. As Rachman (1993) theorized that the concept of aggressiveness may be particularly relevant to patients with checking compulsions, I expect an especially pronounced group difference between patients with checking compulsions and healthy controls (H1c). Further, a group difference is also assumed in the explicit self-report assessment of aggressiveness (H1b) using the well-established State-Trait Anger Expression Inventory-II (C. D. Spielberger, 1999). The hypothesized convergent validity of the IRAP as a measure of aggressiveness will be tested by correlating IRAP scores with STAXI-II scores (H2). In an attempt to provide evidence for Rachman's (1993) supposition of the role of an inflated sense of responsibility in the development of checking compulsions and anger / aggressiveness in patients with OCD, the relationship of these constructs will also be analyzed (H3).

2.5 Hypotheses

H1) Patients with OCD and healthy controls differ in their self-concept of aggressiveness;

a) as measured by an implicit measure of aggressiveness (IRAP)
b) as measured by an explicit measure of aggressiveness (STAXI-II).
c) This difference is particularly pronounced in patients who perform checking compulsions.

H2) There is an association between the implicit and explicit measure of aggressiveness.

H3) In patients with OCD, an inflated sense of responsibility (OBQ *Responsibility / Threat*) is associated with:

a) checking compulsions (OCI-R *Checking*) and

b) increased anger (STAXI-II *Trait Anger*).

3 Methods

3.1 Study Design

The current study uses data from a randomized controlled trial (RCT) assessing the metacognitive group training for patients with OCD (Miegel et al., 2021). The RCT was registered at the German Clinical Trials Register (DRKS00013539) and was approved by the Ethics Committee of the German Psychological Society (Deutsche Gesellschaft für Psychologie; LJ112017). The current study has a cross-sectional design comparing patients with OCD to healthy controls.

3.2 Participants

3.2.1 Patients with OCD. Eighty-two patients with OCD were included (*M* = 39.23 years, *SD* = 11.82). They were recruited from December 2017 to November 2018 through the specialized outpatient clinic for anxiety and OCD at the University Medical Center Hamburg-Eppendorf (UKE); other outpatient psychiatric clinics; outpatient psychotherapists; and in-patient psychiatric wards in Hamburg, Germany. Further, we launched a Google AdWords search campaign and approached eligible patients from the working group's internal database of patients who consented to

being contacted for future studies. The inclusion criteria were diagnosis of OCD according to DSM-5, as confirmed by the Mini International Neuropsychiatric Interview (MINI, Sheehan et al., 1998); age between 18 and 70 years; written informed consent; willingness to participate in the Z-MKT; and group ability as assessed by the Z-MKT therapist. The exclusion criteria were lifetime diagnosis schizophrenic or schizoaffective symptoms (i.e., mania), as assessed by the MINI; patient reported current or lifetime neurological disorders; and moderate or severe substance abuse in the past 12 months as assessed by the MINI.

3.2.2 Healthy controls. Forty-eight healthy controls participated in the study (*M* = 43.29 years, *SD* = 15.02). The sample was recruited from February 2018 to August 2018 through word of mouth, leaflets, and the aforementioned internal database. The inclusion criteria were age between 18 and 70 years and written informed consent. The exclusion criteria were any current or lifetime diagnosis according to DSM-5 as assessed by the MINI (except for mild alcohol abuse) and patient reported current or lifetime neurological disorders.

3.2 Procedures

All proceedings took place at the clinical neuropsychology unit of the University Medical Center Hamburg-Eppendorf, with only those relevant to this study reported here. Patients with OCD who were interested in participating contacted the study team by telephone. After receiving basic information about the trial, they underwent a screening interview, and, if eligible for inclusion, they were invited to an interview. Ahead of the appointment, patients were asked to complete a battery of questionnaires that they received by mail. The 2–3 hr interview consisted of (a) an interview assessing demographic information; (b) two structured psychopathological interviews focused on OCD and depression; (c)

neuropsychological assessment including the Trail Making Tests A and B (TMT-A, TMT-B; Battery, 1944) which measure processing speed, sequencing, mental flexibility, and visual-motor skills (Bowie & Harvey, 2006); and (d) computer-assisted tasks. Individual outcome measures are detailed in section 3.4.

3.3 Psychopathology

3.3.1 Yale-Brown Obsessive Compulsive Scale. The Yale-Brown Obsessive Compulsive Scale (Y-BOCS; Goodman, Price, Rasmussen, Mazure, Delgado, et al., 1989; Goodman, Price, Rasmussen, Mazure, Fleischmann, et al., 1989; German version: Hand & Büttner-Westphal, 1991) is a semi-structured interview that measures obsessive-compulsive symptom severity in patients with OCD. It consists of (a) a comprehensive inventory of obsessions and compulsions read out by the clinician, who prompts the patient to enumerate his or her current (past seven days) and past symptoms; (b) the patient's ranking of his or her three most severe obsessions and compulsions, respectively; (c) 10 clinician-rated items which comprise the total score, five each pertaining to overall severity of obsessions (items 1–5) and compulsions (items 6–10), respectively, rated on a five-point scale from 0 *none* to 4 *extreme*; (d) six additional items assessing further dimensions of OCD, which are not included in the total score and, (e) three items that rate overall severity, symptom improvement, and the patient's reliability, also excluded from the total score (Goodman, Price, Rasmussen, Mazure, Fleischmann, et al., 1989). The 10-item scale assessing overall severity of obsessive-compulsive (OC) symptoms possesses excellent reliability and validity (Goodman, Price, Rasmussen, Mazure, Delgado, et al., 1989) with a three factor model distinguishing *Severity of obsessions* (items 1, 2, 3, and 5), *Severity of compulsions* (items 6, 7, 8, and 10), and *Resistance to symptoms* (items 4 and 9; Moritz et al., 2002). It is scored from 0–40

into subclinical (0–7), mild (8–15), moderate (16–23), and severe OCD (32–40; Jänsch et al., 2007). The German language version of the Y-BOCS, which possesses high inter-rater reliability for the 10-item scale (*r* = .90; Jacobsen, Kloss, Fricke, Hand, & Moritz, 2003), is used in the current study to measure OCD symptom severity in patients.

3.3.2 State-Trait Anger Expression Inventory-II. The State-Trait Anger Expression Inventory-II (STAXI-II; Spielberger, 1999; German version: Rohrmann et al., 2013) is the revised version of the original questionnaire (C. D. Spielberger, 1988). It assesses how a patient experiences, expresses, and controls anger (Hilsenroth & Segal, 2004). Comprised of 51 total items scored on 4-point Likert scales, the STAXI-II includes the following scales: (a) *State Anger*, that is how angry the person feels while completing the questionnaire and to which extent the person feels like expressing this anger verbally or physically (subscales *State Anger-Feeling*, *State Anger-Verbal,* and *State Anger-Physical*); (b) *Trait Anger*, that is how often the person feels angry in general, and how prone the person is to experience anger in frustrating situations, after negative evaluation, and without provocation (subscales *Trait Anger-Temperament* and *Trait Anger-Reaction*; (c) *Anger Expression-Out*, that is the person's propensity to express anger towards persons or objects either verbally or physically; (d) *Anger Expression-In*, that is the person's propensity to feel angry and suppress, retain or internalize this feeling; (e) *Anger Control-Out*; that is the person's propensity to control outward expression of anger; and (f) *Anger Control-In*, that is the person's propensity to control anger by calming themselves (Lievaart et al., 2016). The validated German language version possesses good internal consistency (*α* = .73–.92) and test-retest reliability (α = .63–.81 Rohrmann et al., 2013) for the *Trait Anger*, *Anger Expression,* and *Anger Control*

scales. In accordance with the manual, raw values of the subscales are converted into standardized *T*-scores (*M* = 50, *SD* = 10) according to age groups, with scores 30–39 considered below average, 40–60 average, and 71–70 above average anger / aggressiveness (Rohrmann et al., 2013). In this study, the STAXI-II serves as an explicit, self-rated measure of anger and aggressiveness to be compared with IRAP *D*-scores.

3.3.3 Mini International Neuropsychiatric Interview. The Mini International Neuropsychiatric Interview (MINI; Sheehan et al., 1998)**,** used here in the German version 7.0.2 is a structured diagnostic interview that screens for the major psychiatric disorders in DSM-5 (Diagnostic and Statistical Manual of Mental Disorders, Fifth edition; American Psychiatric Association, 2013). It possesses high concordance rates with other diagnostic interviews such as the Composite International Diagnostic Interview (CIDI) at a considerably shorter administration time (Lecrubier et al., 1997). The MINI has good sensitivity (.79), specificity (.72–.97), and inter-rater reliability (κ = .88–1; Lecrubier et al., 1997; Sheehan et al., 1997). In this study, it was used to diagnose OCD, identify comorbid psychiatric disorders, and detect exclusion criteria.

3.3.4 Hamilton Depression Rating Scale. The Hamilton Depression Rating Scale (HDRS; Hamilton, 1960) is a widely used instrument for assessing severity of depression. Here, the 17-item version is used. Items are rated on either three-point or five-point Likert scales with a maximum of 52 total point. They pertain to the intensity and frequency of depressive symptoms that the patient experienced in the past seven days. A score of seven points or less is commonly defined as *no depressive symptoms,* while the thresholds for grades of illness vary (Kriston & von Wolff, 2011). A meta-analysis revealed satisfactory levels of internal consistency (α

= .79), inter-rater reliability (*r* = .94), and test-retest reliability (r = .87; Trajković et al., 2011). For a further meta-analysis addressing the psychometric flaws of the HDRS see Bagby, Ryder, Schuller, and Marshall (2004). The scale is used here to quantify depressive symptoms in participants.

3.3.5 Beck Depression Inventory-II. The Beck Depression Inventory-II (Beck, Steer, & Brown, 1996; German version: Hautzinger, Keller, & Kühner, 2006) is the revised version of the original questionnaire from 1961 (A. T. Beck et al., 1961). Its 21 items cover the clinical features and behaviors of persons with depression. In self-rating form, the patient is asked to choose their answers on 19 four-, and two six-point scales, with reference to the past two weeks. Internal consistency of the German language version in psychiatric and non-psychiatric patients is good ($\alpha \geq .75$) and content validity is high (Kühner et al., 2007), however the BDI-II is not without psychometric shortcomings (see Richter et al., 1998). In this study the BDI-II serves as a self-rated measure of depressive symptoms.

3.3.6 Revised Obsessive-Compulsive Inventory. The revised Obsessive-Compulsive Inventory (OCI-R; Foa et al., 2002; German version: Gönner, Leonhart, & Ecker, 2007) is a self-rating scale of common symptoms found in OCD. It is a shortened, 18-item version of the original 42-item Obsessive-Compulsive Inventory (Foa et al., 1998). On a five-point Likert scale, the patient rates how much distress or bother he or she experienced in the past month due to the symptoms listed. The subcategories of the OCI-R are *Checking*, *Ordering*, *Obsessing*, *Hoarding*, and *Mental Neutralizing*. It displays good to excellent test-retest reliability (*r* = .74–.91; Foa et al., 2002). The validated German language version used here possesses high total internal consistency (α = .85), with exception of the *Mental Neutralizing*

subscale displaying only adequate internal consistency in a sample of patients with OCD (α = .76; Gönner, Leonhart, & Ecker, 2008).

3.3.7 Obsessive Belief Questionnaire-44. The Obsessive Belief Questionnaire-44 (OBQ-44; Obsessive Compulsive Cognitions Working Group, 2005; German version: Ertle et al., 2008) is a shortened, 44-item version of the original scale (Obsessive Compulsive Cognitions Working Group, 1997b). It is used to assess common beliefs and appraisals that may be present in patients with OCD. The 44-item version loads on 3 factors that each show good internal consistency with α = .93 for *Responsibility / Threat Estimation* and *Perfectionism / Certainty* and α = .89 for *Importance / Control of Thoughts*. The questionnaire is used here to detect obsessive beliefs and analyze their relationship to aggressiveness as assessed by the IRAP.

3.4 Computer-assisted tasks

3.4.1 Implicit Relational Assessment Procedure. We developed an IRAP as an indirect measure of aggressiveness, modified from the original IRAP (Barnes-Holmes et al., 2006). In the task, the subject evaluates combinations of phrases labeled sample and target stimuli, based on a rule defined for each block. It was programmed on Inquisit 3 (Millisecond Software, 2003) and presented on a 14 inch laptop set to a resolution of 1366 x 768.

Selection of target stimuli. Target stimuli were selected through a survey of psychologists and psychiatrists with expertise in OCD. Via an email invitation, experts were invited to participate in the survey conducted through the online survey tool Unipark (Questback GmbH, 2017). Ten experts rated 32 clinician selected, potential target stimuli — 16 aggressive and 16 peaceful adjectives — on five-point

Likert scales with regard to (a) valence (1 *very negative* to 5 *very positive*); (b) aggressiveness (1 *very aggressive* to 5 *very peaceful*); (c) comprehensibility (1 *very incomprehensible* to 5 *very easily comprehensible*); and (d) to which extent they expressed an action (1 *not at all active* to 5 *extremely active*). The six aggressive and peaceful adjectives with the most favorable rating were selected for the IRAP. Mean ratings of the chosen stimuli are detailed in Table 4, the stimuli are listed in Table 5. The overall sum of letters in the six peaceful and aggressive adjectives was compared and did not differ.

Table 1. Mean Clinician Rating of IRAP Target Stimuli

Rating Criteria	**Aggressive words** (mean rating)	**Peaceful words** (mean rating)
Valence (1 *very negative* to 5 *very positive*)	≤ 1.50	≥ 4.40
Aggressiveness / peacefulness (1 *very aggressive* to 5 *very peaceful*)	≤ 1.60	≥ 4.40
Comprehensibility (1 *very incomprehensible* to 5 *very easily comprehensible*)	≥ 4.20	≥ 4.00
Activeness (1 *not at all active* to 5 *extremely active*)	≥ 4.60	≤ 3.30

Table 2. Target Stimuli Used in IRAP

Aggressive Words		**Peaceful words**	
8	Aggressive (*aggressiv*)	9	Peaceful (*friedlich*)
6	Ready to use violence (*gewaltbereit*)	9	Pacific (*friedfertig*)
8	Violent (*gewalttätig*)	8	Placid (*friedvoll*)
7	Forcible (*gewaltsam*)	9	Benign (*gutartig*)
10	Brutal (*brutal*)	5	Forgiving (*versöhnlich*)
8	Physically violent (*handgreiflich*)	9	Peace-loving (*friedliebend*)

Note. Original German words in parentheses. Numbers before target stimuli indicate how many times they were presented overall in the trials included in the final

analysis. The amounts are not equal because the first two blocks were excluded after target stimuli had been randomized across all blocks.

Procedure. The task consisted of six blocks, with each block consisting of a pre-block instruction page and 24 trials (2 sample stimuli x 12 target stimuli). Each trial consisted of a sample stimulus at the top of the screen and a target stimulus below it. The sample stimulus consisted of the phrases *I am* (*ich bin*) or *I am not* (*ich bin nicht*), and the target stimulus was an aggressive or peaceful adjective (see Table 5). In the upper left-hand and right-hand corners, the response options *correct* (*richtig*) and *incorrect* (*falsch*), respectively, were displayed. Participants were asked to respond by clicking the x-key to choose *correct* and the m-key to choose *incorrect*, in accordance with the block instructions. Key assignments were not required to be memorized, as the word *correct* appeared on the same side of the screen (left) as the corresponding response-key on the keyboard.

There were four possible trial types constituting self-referential statements, as defined by the combination of sample (*I am* / *I am not*) and target stimuli (aggressive / peaceful adjective): *I am* – [aggressive adjective], *I am* – [peaceful adjective], *I am not* – [aggressive adjective] and *I am not* – [peaceful adjective]. At the beginning of each block, participants were instructed to choose their answer according to a responding contingency that was either consistent or inconsistent with a peaceful self-image. For example, in a consistent block, participants were instructed to respond by choosing *correct* when presented with the statement *I am* [peaceful word] or *I am not* [aggressive word] and choosing *incorrect* when presented with *I am* [aggressive word] or *I am not* [peaceful word]. If a participant responded correctly, that is according to the designated responding contingency of the block, the screen was cleared for 400 ms before the next trial appeared. If a participant responded incorrectly, that is consistent with a peaceful self-image in an

inconsistent trial or vice versa, a red cross appeared in the center of the screen until the participant pressed the correct key, upon which the next trial was presented. Participants were instructed to respond as accurately and as quickly as possible. Consistent and inconsistent blocks were presented in alternation, starting with an inconsistent block. Aggressive and peaceful adjectives were randomized across all six blocks. Examples of a consistent block are shown in Figure 2.

Figure 2. Example of an Inconsistent IRAP Block

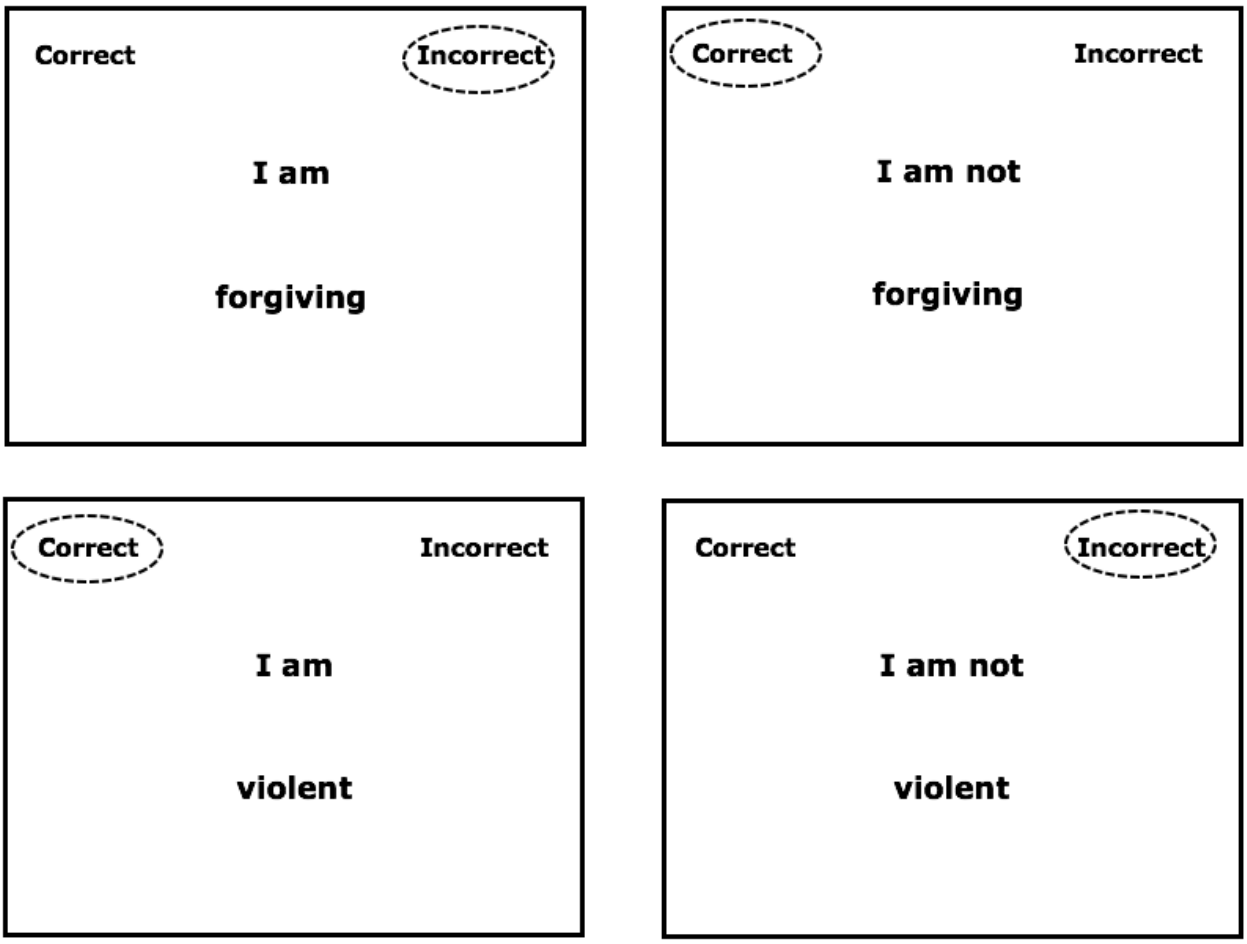

Figure 2. Example of the four different trial types in an inconsistent block. The correct answer for each trial is circled.

Data processing. Raw IRAP data was imported to IBM SPSS 24.0, then transposed into a long format using R version 3.5.0 (R Core Team, 2018) in RStudio Version 1.1.453 (RStudio Team, 2015), and then further processed in IBM SPSS

24.0 according to current guidelines (Hussey et al., 2015). Primarily, the IRAP measures reaction time latency, analyzed by comparing the latencies of consistent and inconsistent blocks. Reaction time latency is defined as “the time from stimulus presentation to first *correct* response” (Hussey et al., 2015, p. 9). In the commonly used *D*-score analysis, IRAP reaction time latencies are construed as effect sizes in adaptation of Cohen’s *d* (Cohen, 1988). *D*-scores were calculated by following the recommended steps (for all steps except for 4: Hussey et al., 2015): (1) all IRAP data of participants whose reaction time latencies were less than 300 ms in more than 10% of trials was excluded; (2) all reaction time latencies greater than 10,000 ms were treated as missing; (3) the first two blocks were treated as practice blocks and excluded from further analysis (see Barnes-Holmes, Barnes-Holmes, et al., 2010); (4) reaction time latencies for each of the four trial types in each of the four blocks were averaged, yielding 16 mean reaction time latencies; (5) for each pair of an inconsistent and a consistent block, that is 3+4 and 5+6, *M* (latencies inconsistent block) - *M* (latencies consistent block) was calculated, yielding twelve difference scores; (6) standard deviations of reaction time latencies for each of the four trial types in the two block pairs (blocks 3+4 and 5+6) were calculated, yielding eight standard deviations; (7) the difference scores from step #5 were divided by the corresponding standard deviations from step #6 yielding eight *D*-scores, one for each trial type in each block pair; (8) IRAP data that did not adhere to mastery criteria as detailed below was excluded; (9) *D*-scores of each of the four trial types were averaged across the two block pairs, yielding four trial type *D*-scores; and (10) we averaged the *D*-scores from step #8 to yield one overall *D*-score.

Following guidelines adapted from Nicholson and Barnes-Holmes (2012), we excluded block pairs that did not adhere to mastery criteria from analysis. These

mastery criteria served the purpose of increasing the validity of IRAP data. In each individual block, participants were required to choose the correct answer in 75% of trials or more and achieve a median answer-time latency of 2,500 ms or less. If a participant failed to meet these criteria in either block in a block pair, the entire pair was excluded, and only the remaining of the two block pairs was analyzed. While Nicholson and Barnes-Holmes (2012) include only blocks with a median answer-time latency of 2,000 ms or less, we have loosened the latency criterion to 2,500 ms or less because our study includes a clinical population of persons with OCD, who may have slower thinking processes due to psychiatric drugs (Benkert & Hippius, 2012) or comorbid depression (Lam et al., 2014), to name just two. The vast majority of IRAP studies include healthy populations, and some of them use an even more lenient latency criterion of ≤ 3,000 ms (Barnes-Holmes, Murtagh, et al., 2010; Murphy et al., 2014). We chose the cutoff ≤ 2,500 ms in accordance with two comparable IRAP trial samples: a sample of students with extremes of normative levels of depression and a subgroup of voice-hearing participants (Hussey & Barnes-Holmes, 2012; McEnteggart et al., 2017). Unlike McEnteggart et al. (2017) who applied the stricter, more common latency criterion of ≤ 2,000 ms for their non-voice-hearing participants, we decided to apply the same criteria to our clinical and health samples for the purpose of comparability. *D*-scores above zero are interpreted as a bias towards a peaceful self-image, while those below zero point towards an aggressive self-image.

3.4.2 Explicit rating of IRAP target stimuli. Participants rated the 20 target stimuli (see Table 5) on a 5-point scale choosing between 1 *negative and personally meaningful*, 2 *negative*, 3 *neither*, 4 *positive*, or 5 *positive and personally meaningful*. This rating was conducted to check whether peaceful and aggressive

words were in fact rated by both groups as positive and negative, respectively, as this is the condition for the IRAP results being comparable. Moreover, it served the purpose of confirming whether the clinician-selected aggressive adjectives were in fact relevant to OCD.

3.5 Data Analysis

All analyses were performed using IBM SPSS 24.0. Blind to results on the primary measure (i.e., IRAP *D*-scores), the samples were iteratively reduced to homogenize them in terms of age, sex ratio, and years of pre-university education. Sociodemographic and descriptive data of the questionnaires were compared using independent sample *t*-tests and Chi^2-tests. Per questionnaire, between 0 and 0.70% of values were missing. They were replaced with the mean score of all items on any given subscale.

To determine internal reliability of the IRAP used in this study, split-half reliability was calculated by computing two overall IRAP *D*-scores (as described in section 3.5.1), one for even and one for odd trials, and applying a Spearman-Brown correction (Bast & Barnes-Holmes, 2015; Campbell et al., 2011; Drake et al., 2010). To assess suitability of the clinician-chosen target stimuli, mean explicit ratings of IRAP target stimuli were calculated and deemed acceptable if it was greater or equal to 4 (*positive*) for positive, and smaller or equal to 2 (*negative*) for negative words. Further, as aggressive stimuli had been selected based on their relevance to OCD, the mean number of stimuli rated as negative and personally meaningful was calculated and compared between groups using independent sample *t*-tests.

Data analysis of the individual hypotheses was conducted as follows:

H1a: To compare IRAP *D*-scores (implicit measure of aggressiveness), a 2 x 4 mixed analysis of variance (ANOVA) was conducted with group (OCD / healthy controls) as the between-subject factor and the four IRAP *D*-scores of the different trial types as the within-subject factor. If the main effect for trial type was significant, subsequent independent sample *t*-tests were used to compare the four individual trial type *D*-scores between the OCD and healthy control groups. Eight one-sample *t*-tests were used to determine whether mean trial type *D*-scores differed significantly from zero, thus producing a significant bias (Barnes-Holmes, Murphy, et al., 2010; Bast & Barnes-Holmes, 2015; Remue et al., 2013).

H1b: STAXI-II (explicit measure of aggressiveness) scores of individual scales were converted into standardized *T*-values according to the manual (Rohrmann et al., 2013), and subsequently compared between groups using independent sample *t*-tests.

H1c: Analyses conducted to examine H1a and H1b were repeated to compare the subsample of persons with OCD who scored above the cutoff for *checking* (≥ 4) on the OCI-R with healthy controls.

H2: Pearson's correlation coefficients (Pearson, 1896) were computed between the *T*-values of the STAXI-II scales (explicit measure of aggressiveness) and the overall IRAP *D*-score (implicit measure of aggressiveness).

H3: Simple linear regression analyses were calculated with the OBQ-44 *Responsibility / Threat* subscale as the outcome variable and

(a) the OCI-R *checking* subscale score as the predictor variable

(b) the STAXI-II *Trait anger* score as the predictor variable.

Effect sizes of *t*-tests were calculated using Cohen's *d* (Cohen, 1988), with effect sizes of .2, .5, and .8 or higher interpreted as small, medium, and large, respectively, and effect sizes of ANOVA were calculated using partial eta squared, with effect sizes of .01-.06 considered as small, .06-.14 considered as medium and above .14 as large (Cohen, 1988). Pearson's *r* values of ± .1, ± .3, and ± .5 were interpreted as weak, moderate and strong correlations, respectively. To guard against Type 1 errors, Bonferroni corrected alpha levels were applied for multiple tests. Unless otherwise indicated, *P*-values smaller than .05 were considered statistically significant.

4 Results

4.1 Participants

After excluding participants from the analyses due to exclusion criteria; withdrawal of informed consent; confounding influences on, or non-completion of the IRAP; and non-fulfillment of the IRAP mastery criteria, the final sample size was *N* = 90 (*n* = 59 patients with OCD and *n* = 31 healthy controls). For 11 patients with OCD and nine healthy controls, only one IRAP block pair was analyzed, because mastery criteria were not met on the other block pair.

4.2 Descriptive Data (see Table 6)

4.2.1 Group comparison of descriptive data. There were no significant between-group differences in age or years of pre-university education, and gender distribution was balanced and equal. The mean overall OCI-R score was higher in the OCD sample, however there were no group differences in the organizing and hoarding subscales. The OCD sample also scored significantly higher on the OBQ-44 and the BDI-II.

4.2.2 Descriptive data of the OCD sample. In the OCD sample, mean age of onset was 17.51 years (*SD* = 10.48), with years of illness averaging at 21.6 (*SD* = 12.11). Average OCD severity according to Y-BOCS cutoffs was moderate (*M* = 20.29, *SD* = 5.92; see chapter 3.3.1 for cutoffs). According to the MINI, one comorbidity was present in 37.3% of the OCD sample, and 37.3% suffered from two or more comorbidities. The most common comorbidity was major depression; 17% of the OCD sample met criteria for a current episode of major depression and 44.1% met criteria for at least one past episode of major depression. Suicidal ideations were reported by 6.8% of the OCD sample. Other current comorbidities present in the sample were generalized anxiety disorder (16.9%), panic disorder (10.2%), agoraphobia (10.2%), alcohol abuse (mild or moderate; 5.1%), social phobia (3.4%), bulimia (3.4%), post-traumatic stress disorder (3.4%) anorexia (1.7%), and affective disorder with psychotic features (1.7%).

Table 3. Descriptive Statistics

Variable	OCD Sample [a] (*n* = 59)		Healthy Controls [a] (*n* = 31)		Statistics[b]
	n / M	*SD*	*n / M*	*SD*	
Gender (f. / m.)	29 / 30		16 / 15		χ^2 (1) = 0.01, *p* = .824
Age in years	39.24	12.13	43.68	14.01	*t* (88) = 1.56, *p* = .121
Years of pre-university education	12.20	1.27	11.69	1.56	*t* (51.32) = 1.54, *p* = .130
TMT-A in seconds	31.04	13.56	23.40	8.76	*t* (88) = 2.840, *p* = .006, *d* = 0.67
Illness onset (age in years)	17.51	10.48	-		
Years of illness	21.60	12.11	-		
Y-BOCS Total	20.29	5.92	-		
Obsessions	9.56	3.47	-		
Compulsions	10.73	3.68	-		
Aggressive Obsessions (yes / no) [c]	30 / 29				
Checking Compulsions (yes / no) [d]	41 / 18				
OCI-R Total	27.24	10.13	8.90	6.43	*t* (84.74) = 10.46,

					$p < .001$, $d = 2.16$
Checking	6.14 {41}	3.69	1.48	1.63	t (86.11) = 8.26, $p < .001$, $d = 1.63$
Obsessions	6.69 {46}	3.37	1.26	1.21	t (80.56) = 11.08, $p < .001$, $d = 2.14$
Washing	4.73 {25}	4.50	.48	.89	t (66.26) = 7.00, $p < .001$, $d = 1.31$
Organizing	4.03 {31}	3.39	2.61	2.49	t (78.48) = 2.26, $p = .026$, $d = 0.48$
Hoarding	2.92 {23}	3.17	2.45	1.93	t (85.98) = 0.80, $p = .392$, $d = 0.18$
Neutralizing	2.75 {18}	3.18	.61	1.23	t (82.73) = 4.54, $p < .001$, $d = 0.89$
OBQ-44	183.22	49.29	107.66	34.59	t (80.67) = 8.46, $p < .001$, $d = 1.77$
Perfectionism / Certainty	74.65	21.21	42.40	15.90	t (88) = 7.43, $p < .001$, $d = 1.72$
Importance / Control	40.64	16.26	24.62	9.40	t (87.11) = 5.92, $p < .001$, $d = 1.21$
Responsibility / Threat	67.97	22.93	40.63	14.01	t (85.88) = 7.01, $p < .001$, $d = 1.44$
HDRS	8.27	7.21			
BDI-II	22.25	12.12	3.84	3.98	t (77.88) = 10.64, $p < .001$, $d = 2.04$

Note. [a]Number of participants above the cutoff for each OCI-R subscale given in curved parentheses. [b]Degrees of freedom given in round parentheses. [c]All items categorized as *Aggressive Obsessions* as well as the items *Concerned will get others ill by spreading contaminant (Aggressive)* and *Sexual behavior towards others (Aggressive).* [d]Checking amongst three main compulsions as ranked by participant in Y-BOCS.

4.3 Assessment of IRAP Methodology

To assess internal reliability of the IRAP, a split-half reliability score was calculated. For this purpose, two overall *D*-scores, one for odd trials and one for even trials, were computed. Applying a Spearman-Brown correction, the split-half correlation between odd and even *D-s*cores was moderate and significant, $r = .559$ $n = 90$, $p < .001$.

Valence of the aggressive and peaceful words chosen as target stimuli was confirmed by the explicit rating by participants: the mean ratings of aggressive adjectives were smaller or equal to 1.90 (2 = *negative*), and ratings of positive adjectives were greater or equal to 4.16 (4 = *positive*). To verify whether the selected aggressive target stimuli were indeed relevant to patients with OCD (as rated by

clinicians, see chapter 3.4.1), the frequency with which aggressive words were rated as personally meaningful was computed and compared. The mean number of aggressive words rated as personally meaningful was significantly higher in patients with OCD (M = 1.15, SD = 1.78) than healthy controls (M = 0.29, SD = 0.65), t(80.59) = 3.32, p = .001, d = 0.64.

4.4 Results Analogous to Hypotheses

4.5.1 Hypothesis 1a. *Implicit measure of aggressiveness.* A 2 x 4 mixed ANOVA was conducted to analyze the interaction between group (between subject factor, independent variable) and trial type (within subject factor, dependent variable). The main effect for group was not significant F(1, 88) = 0.231, p = .632, $\eta^2_{partial}$ = .003, showing that group membership did not account for the variance in *D-s*cores, and disproving the hypothesis that groups would differ with regard to their overall implicit aggressiveness. *D-s*cores greater than zero correspond to faster responding during trials consistent with a peaceful self-image, while negative *D*-scores indicate a bias towards an aggressive self-image. Both the OCD sample and (M = 0.22, SD = 0.29) and healthy controls (M = 0.25, SD = 0.24) exhibited a bias towards a peaceful self-image. The main effect for trial type was significant, F(3, 264) = 11.558, p < .001, at a moderate effect size, $\eta^2_{partial}$ = .116, as was the interaction between group and trial type, F(3, 264) = 4.170, p = .007, at a small effect size, $\eta^2_{partial}$ = .045. This indicates that individual trial type *D-s*cores differed from each other, and that trial type *D-s*cores differed between groups. Subsequent independent-sample t-tests of individual trial type *D*-scores revealed a significantly higher score for the *I am – aggressive* trial type in healthy controls (M = 0.49, SD = 0.44) than patients with OCD (M = 0.15, SD = 0.48), t(88) = 3.23, p = .002, d = 0.73. This shows that healthy controls denied their aggressiveness more

strongly than patients with OCD. In terms of the raw latency data, this translates to both groups on average responding faster to *I am – aggressive → incorrect* than *I am – aggressive → correct,* with the difference in average latency between consistent and inconsistent blocks being larger in healthy controls than patients with OCD. There were no group differences regarding the other trial types, *p*s ≥ .156.

Eight one-sample *t*-tests, one for each trial type in both groups, were conducted to examine whether trial types even produced a significant bias. All individual trial types differed significantly from zero, $2.47 \leq t \leq 6.21$, *p*s ≤ .016, aside from the *I am not – peaceful* trial type (OCD sample: $t(58) = 0.86$, $p = .395$; healthy controls: $t(30) = 1.22$, $p = .233$). This shows that neither group displayed any significant bias towards either *I am not – peaceful → correct* or *I am not – peaceful → incorrect*, in that latencies during both responding contingencies were similar.

Fisher's LSD was calculated for pairwise comparison of the trial type *D-s*cores. All three other trial types differed significantly from the *I am not – peaceful* trial type, ps ≤ .002, yet did not differ from each other, $.130 \leq p \leq .419$.

Figure 3. Mean Overall and Trial Type *D*-scores of Patients with OCD and Healthy Controls

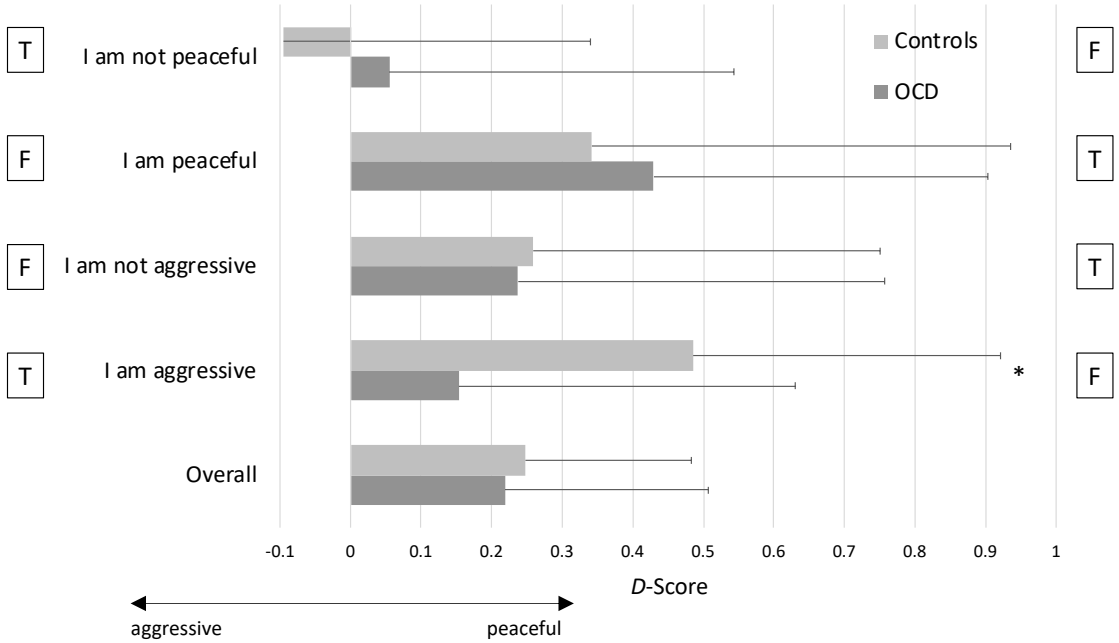

Figure 3. IRAP results: overall and individual trial types. OCD = Patients with OCD; Controls = healthy controls. Error bars are standard deviations. Letters T = true and F = false represent the direction of the response biases that were recorded by the measures. * p<.05.

Exploratory Analyses. To address the supposition that the trial types using negation (*I am not*) perhaps produced systematically different responses because they were more difficult to comprehend under latency pressure, the raw latencies produced by the two different sample stimuli were compared. On consistent as well as inconsistent blocks, trials using *I am* (*M* = 1,515.59 ms, *SD* = 387.72 ms) elicited faster responses than those using *I am not* (*M* = 2,204.97 ms, *SD* = 619.11 ms), *t*(89) = 16.56, *p* = < .001. This finding implies that cognitive processing speed may be related to IRAP latencies. However, a correlation analysis of TMT-A score in seconds with mean IRAP latencies of *I am* and *I am not* sample stimulus trial types yielded no significant results (*p*s > .202)

4.5.2 Hypothesis 1b. *Explicit measure of aggressiveness.* STAXI-II scores are displayed in Table 7. Raw values were converted to standardized *T*-values according to three age groups. Patients with OCD scored significantly higher on the *Trait Anger* scale, as well as its two subscales, demonstrating a stronger propensity for having an angry temperament and reacting to situations with anger. Also, their scores were higher on the *Anger Expression-Out* scale and the *Anger Expression-In* scale, though the latter difference only approached significance. On the anger control subscales, groups did not differ, although OCD-patients' scores were slightly lower. Mean *T*-values of both groups were within the average ranges, as defined in the STAXI-II manual, on all scales.

Table 4. Mean STAXI-II Scores and Group Comparisons

STAXI-II Scale	**OCD (*n* = 59)**		**OCD Checkers (*n* = 41)**		**Healthy Controls (*n* = 31)**		**Group Differences**	
	M	***SD***	***M***	***SD***	***M***	***SD***	**OCD / Controls**	**Checkers / Controls**
T-Ang	55.61	11.93	56.05	11.47	46.52	8.14	$t(81.90) = \mathbf{4.26}$, $p < .001$	$t(70) = 3.93$, $p < .001$
T-Ang / T	54.86	11.26	55.22	10.85	47.19	7.41	$t(83.42) = \mathbf{3.88}$, $p < .001$	$t(69.37) = 3.73$, $p < .001$
T-Ang / R	55.47	11.73	55.95	11.24	48.06	8.64	$t(88) = \mathbf{3.10}$, $p = .003$	$t(70) = 3.25$, $p = .002$
AX-O	53.15	10.45	53.76	10.39	46.90	6.71	$t(84.30) = \mathbf{3.44}$, $p = .001$	$t(68.52) = 3.39$, $p = .001$
AX-I	52.93	14.60	52.54	14.16	47.13	10.89	$t(88) = 1.95$, $p = .055$	$t(70) = 1.77$, $p = .082$
AC	48.86	9.46	48.54	9.73	52.52	10.46	$t(88) = 1.68$, $p = .097$	$t(70) = 1.66$, $p = .101$
AC-O	49.64	10.26	48.76	10.93	52.97	9.32	$t(88) = 1.51$, $p = .136$	$t(70) = 1.72$, $p = .089$
AC-I	47.83	10.23	48.10	10.33	50.77	10.98	$t(88) = 1.27$, $p = .209$	$t(70) = 1.06$, $p = .293$

Note. T-Ang = *Trait Anger*; T-Ang / T = *Trait Anger – Temperament;* T-Ang / R = *Trait Anger – Reaction;* AX-O = *Anger Expression – Out;* AX-I = *Anger Expression – In,* AC = *Anger Control,* AC-O = *Anger Control – Out;* AC-I = *Anger Control – In.*

Exploratory Analyses. Several studies found that OCI-R scores, but not Y-BOCS scores, correlated with measures of anger / aggressiveness (Moritz et al.,

2011; Whiteside & Abramowitz, 2005). To add further evidence to this matter, correlations of the STAXI-II scales and the IRAP overall and trial type scores with the Y-BOCS and OCI-R scores, respectively, were computed (see Table 8). Since only patients with OCD completed the Y-BOCS, likewise only the OCI-R scores of the OCD sample were used for better comparability. At a Bonferroni adjusted alpha level of .005 (.05 / 10), there were moderate correlations between the OCI-R score and the *Trait Anger* scale and its subscale *Trait Anger – Temperament*, respectively. There was also a small significant correlation between the *I am aggressive* trial type *D-s*core and the OCI-R score, however this did not withstand Bonferroni correction. Y-BOCS scores did not correlate with any measure of anger / aggressiveness (*p*s > .328). To further investigate the reason for this finding, the correlation between Y-BOCS and OCI-R scores was calculated and found to be significant, but small, r = .288, p = .027.

Table 5. Correlations between Measures of Anger / Aggressiveness and Y-BOCS and OCI-R Scores, Respectively, in Patients with OCD (n = 59)

	Y-BOCS	**OCI-R**
T-Ang	.046, p = .728	**.373**, p = .004
T-Ang / T	.044, p = .743	**.377**, p = .003
T-Ang / R	.039, p = .771	.255, p = .051
AX-O	-.081, p = .541	.290, p = .026
AX-I	.033, p = .804	.069, p = .703
AC	-.018, p = .892	-.045, p = .078
AC-O	-.001, p = .995	-.086, p = .519
AC-I	-.019, p = .889	.036, p = .789

Note. T-Ang = Trait Anger; T-Ang / T = *Trait Anger – Temperament;* T-Ang / R = *Trait Anger – Reaction;* AX-O = *Anger Expression – Out;* AX-I = *Anger Expression – In,* AC = *Anger Control,* AC-O = *Anger Control – Out;* AC-I = *Anger Control – In.* Significant correlations which withstood Bonferroni correction are typed in boldface.

4.5.3 Hypothesis 1c. *Separate analysis of patients with checking compulsions.* To compare IRAP *D*-scores between patients with checking compulsions (n = 41) and healthy controls, analyses from H1a were repeated. The results mimicked those in H1a. A 2 x 4 mixed ANOVA showed a significant main effect of trial type, $F(3, 210) = 8.848$, $p < .001$, $\eta^2_{partial} = .112$, and no significant main effect of group, $F(1,70) = 0.039$, $p = .844$, $\eta^2_{partial} = .001$. The interaction effect between group and trial type was significant, $F(3, 210) = 4.135$, $p = .007$, $\eta^2_{partial} = .056$. Subsequent independent sample *t*-tests showed that, as in the overall sample, the only significant group difference was in the *I am – aggressive* trial type, $t(70) = 3.15$, $p = .004$, $d = 0.75$, other *p*s ≥.081, with healthy controls (M = 0.49; SD = 0.49) disagreeing with the statement more fervently than patients with checking compulsions (M = 0.16, SD = 0.53; see Figure 4).

Four one-sample *t*-tests revealed that as in the overall OCD sample, all individual trial type *D*-scores of patients with checking compulsions differed significantly from zero, 2.30 ≤ t ≤ 6.21, *p*s ≤ .027, except for the *I am not – peaceful* trial type, $t(49) = 1.29$, $p = .205$.

STAXI-II scores of patients with checking compulsions are displayed in Table 7. Group comparison with healthy control yielded the same results as in the overall sample of patients with OCD.

Figure 4. Mean Overall and Trial Type D-scores of Patients with Checking Compulsions and Healthy Controls

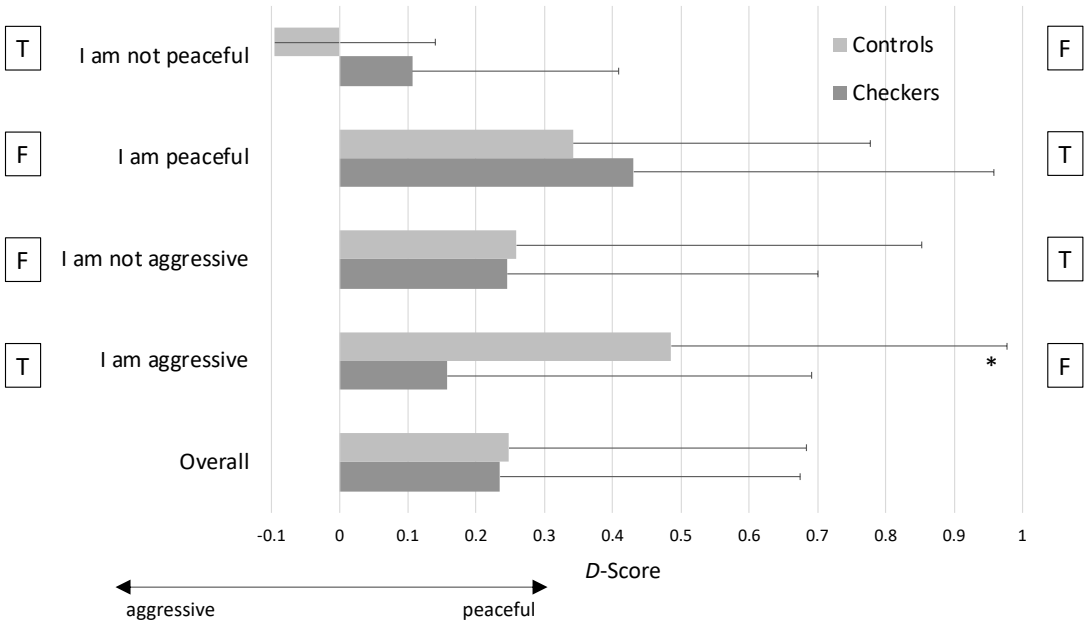

Figure 4. IRAP results: overall and individual trial types. Checkers = Patients with OCD who scored above the cutoff for "checking" on the OCI-R; Controls = healthy controls. Error bars are standard deviations. Letters T = true and F = false represent the direction of the response biases that were recorded by the measures.

* p<.05.

Exploratory analyses. Independent-sample *t*-tests comparing IRAP *D*-scores and STAXI-II scores of patients with and without checking compulsions showed no significant differences (*p*s ≥ .223 on IRAP *D*-scores, *p*s ≥ .320), confirming that patients with checking compulsions did not differ from the rest of the OCD sample in terms of implicit aggressiveness.

To assess whether any other domain of OC-symptomology was more closely associated with anger or aggressiveness, correlation analyses between all OCI-R subscales and the STAXI-II subscales were computed. At the Bonferroni adjusted alpha level of .004 (.05 / 15), there were several moderate correlations with STAXI-II scales and the OCI-R subscales *washing*, *obsessing*, *ordering*, and *neutralizing* (see Table 9).

Table 6. Correlations between STAXI-II Scales and OCI-R Subscales

	T-Ang	T-Ang / T	T-Ang / R	AX-O	AX-I	AC	AC-O	AC-I
Washing	**.301**, p = .004	.285, p = .006	.222, p = .036	.204, p = .054	.155, p = .144	-.082, p = .442	-.108, p = .313	-.026, p = .811
Obsessing	**.367**, p < .001	**.363**, p < .001	.253, p = .016	**.320**, p = .002	.054, p = .614	-.072, p = .502	-.101, p = .345	-.021, p = .846
Hoarding	.170, p = .108	.112, p = .293	.164, p = .122	.051, p = .636	.180, p = .090	-.097, p = .362	.012, p = .910	-.163, p = .125
Ordering	**.360**, p < .001	**.400**, p < .001	.239, p = .023	**.305**, p = .003	.112, p = .294	-.202, p = .056	-.197, p = .063	-.154, p = .147
Checking	.240, p = .023	.198, p = .062	.224, p = .034	.219, p = .038	.074, p = .489	-.091, p = .392	-.136, p = .200	-.012, p = .912
Neutralizing	**.308**, p = .003	**.298**, p = .004	.233, p = .027	.257, p = .015	.129, p = .227	-.166, p = .119	-.119, p = .264	-.165, p = .120

Note. T-Ang = Trait Anger; T-Ang / T = *Trait anger – Temperament;* T-Ang / R = *Trait anger – Reaction;* AX-O = *Anger Expression – Out;* AX-I = *Anger Expression – In,* AC = *Anger Control,* AC-O = *Anger Control – Out;* AC-I = *Anger Control – In.* Correlations which withstood Bonferroni correction are typed in boldface.

4.5.4 Hypothesis 2. Correlations between IRAP *D-s*cores and STAXI-II scores are displayed in Table 10. Contrary to the hypothesis, the overall *D-S*core did not correlate with the any of the STAXI-II scales. For exploratory purposes, correlations between individual trial type *D-s*cores and all STAXI-II scales were computed. At the Bonferroni corrected alpha level of .004 (.04 / 15), the *I am – aggressive D-s*core was moderately negatively correlated with the overall *Trait anger* scale (r = -.33, p = .001). This adheres to the predicted direction: a smaller *I am – aggressive D*-score indicates a weaker disagreement with this statement, in line with a stronger predisposition to experience anger (*Trait anger*).

A further moderate negative correlation was found between the *I am – aggressive D-s*core and the *Anger expression – In* scale (r = -.31, p = .003), that is the tendency to experience intense anger, yet suppress this feeling. When an open

expression of anger might cause psychological discomfort, high scorers may experience guilt instead of anger, which can generate anxiety and depression (C. D. Spielberger, 1999). This correlation shows that weaker rejection of the statement *I am aggressive* – in other words stronger ambivalence towards this statement – is associated with anger suppression.

Table 7. Correlations of Overall and Trial Type IRAP D-scores with STAXI-II Scales in the Overall Sample (N = 90)

	STAXI-II Scales							
IRAP *D*-score	**T-Ang**	**T-Ang / T**	**T-Ang / R**	**AX-O**	**AX-I**	**AC**	**AC-O**	**AC-I**
Overall	-.068, p = .527	.032, p = .764	-.123, p = .246	-.002, p = .985	-.183, p = .084	-.029, p = .789	-.094, p = .378	.032, p = .762
I am aggressive	**-.330**, p = .001	-.270, p = .010	-.279, p = .008	-.159, p = .135	**-.306**, p = .003	-.074, p = .485	-.065, p = .543	-.082, p = .442
I am peaceful	.108, p = .310	.102, p = .339	.103, p = .334	.097, p = .363	-.159, p = .135	-.213, p = .044	-.254, p = .016	-.146, p = .170
I am not aggressive	.061, p = .565	.124, p = .245	.008, p = .941	-.001, p = .991	.064, p = .551	.077, p = .471	-.004, p = .967	.150, p = .160
I am not peaceful	.002, p = .986	.106, p = .318	-.115, p = .280	.054, p = .611	.002, p = .984	.161, p = .129	.134, p = .209	.157, p = .140

Note. T-Ang = Trait Anger; T-Ang / T = *Trait Anger – Temperament;* T-Ang / R = *Trait Anger – Reaction;* AX-O = *Anger Expression – Out;* AX-I = *Anger Expression – In,* AC = *Anger Control,* AC-O = *Anger Control – Out;* AC-I = *Anger Control – In.* Correlations which withstood Bonferroni correction are typed in boldface.

4.5.5 Hypothesis 3a. A simple linear regression was calculated to predict checking symptoms in patients with OCD based on an inflated sense of responsibility. Scores on the OBQ-44 subscale *Responsibility / Threat* significantly predicted OCI-R *checking* subscale scores, β = .38, t(57) = 3.09, p = .003.

Responsibility / Threat also explained a significant proportion of variance in *checking* scores, R^2 = .143, $F(1, 57) = 9.52$, p = .003.

4.5.6 Hypothesis 3b. A further simple linear regression was computed to assess the influence of inflated responsibility on anger in patients with OCD. *Responsibility / Threat* significantly predicted scores on the STAXI-II scale *Trait Anger*, β = .31, $t(57) = 2.44$, p = .018. *Responsibility / Threat* also explained a significant proportion of variance in *Trait Anger*, R^2 = .095, $F(1, 57) = 5.95$, p = .018.

4.5.7 Further exploratory analyses. Several studies found that higher levels of anger / aggressiveness in patients with OCD could be explained by depressive symptoms (see chapter 2.2.1.1). To assess this relationship in the current sample, correlations were first computed between BDI scores and overall and trial type *D*-scores and the overall raw score of all STAXI-II subscales, respectively. The *I am aggressive* trial type *D*-score correlated moderately (.309, p = .003), and the STAXI-II score correlated strongly (.504, $p < .001$) with the BDI score. As all prior group comparisons on the STAXI-II pertained to its individual scales, an independent *t*-test of the overall raw STAXI-II score[5] was calculated, which confirmed the group difference ($t(88) = 2.86$, p = .005). ANCOVA was computed with group as the independent variable, the STAXI-II score as the dependent variable, and the BDI score as a covariate, and showed that the group difference in STAXI-II score was no longer significant, $F(1, 87) = .334$, p = .565. The same ANCOVA was calculated with the *I am aggressive* trial type *D*-score as the dependent variable, and this too no longer differed between groups after depression as covaried, $F(1,87) = 2.612$, p = .110.

[5] Excluding the *State Anger* scale

5 Discussion

5.1 Summary of Aims and Results of the Study

The aim of this study was to show a difference in implicit aggressiveness between patients with OCD and healthy controls using the IRAP. An according group difference was also expected on an explicit, self-report measure of aggressiveness, the STAXI-II. Moreover, IRAP and STAXI-II scores were assumed to positively correlate. A particularly large group difference in implicit aggressiveness was expected between the subgroup of patients with checking compulsions and healthy controls. Finally, an influence of perceived over-responsibility on levels of anger as well as checking symptoms was assumed.

In summary, results showed:

1) No overall IRAP group difference, yet a difference on the *I am aggressive* trial type, with healthy controls denying this statement faster than patients with OCD, whose latency times for denial and affirmation were more similar;
2) Significantly higher trait anger and outwards expression of anger in patients with OCD on the explicit measure of anger / aggressiveness (STAXI-II);
3) No difference in aggressiveness of patients with checking compulsions compared to other patients;
4) Several correlations between implicit and explicit aggressiveness subscales;
5) Over-responsibility accounted for a significant share of the variance in anger and checking.

In exploratory analysis, a significant covarying influence of comorbid depression was shown to cancel out the group differences in overall STAXI-II score and the *I am aggressive* IRAP trial type score.

5.2 Implicit Aggressiveness

The overall IRAP *D*-score did not differ between groups, disproving the first hypothesis. Both groups showed a significant bias towards a peaceful self-concept, expressed through faster average responding during those blocks. This finding is in line with the studies by Cludius et al. (2017, 2020), which also found no group differences in implicit aggressiveness using the IAT.

Groups did however differ on the *I am aggressive* trial type, with a significantly larger bias towards denial of the statement in healthy controls than patients with OCD, inferred by significantly faster responding to *I am aggressive* → *false* than *I am aggressive* → *true*. A useful analogy for understanding this finding is a hypothetical questionnaire that asks participants to explicitly rate the statements "I am aggressive", "I am brutal" etc. on a Likert-scale between *strongly disagree* and *strongly agree*; the IRAP latency-based results might translate to healthy controls responding with *strongly disagree* while OCD-patients' responses might average closer to *slightly disagree*. In terms of relational frame theory, this was therefore the only trial type which elicited a between-group difference in brief and immediate relational responding behavior. This finding is somewhat difficult to interpret. For one, it could be taken to imply a relative indifference to the concept of being aggressive in the OCD sample: The smaller the absolute value of a *D*-score, the smaller the difference in strength of relationship between the two responding contingencies. The standard deviation of 0.48 for the mean *I am aggressive D*-score of 0.15 in the OCD sample further implies that several patients responded faster

during at least some aggressiveness-affirming trials, as the standard deviation spans negative values. Therefore, this result suggests that at least some patients with OCD possess implicit aggressive tendencies, and that on average the sample was less biased towards rejecting an aggressive self-image than healthy controls. This is an important addition to the existing research in that it provides first evidence for the presence of aggressiveness in patients with OCD using an implicit measure. As my finding contradicts the other two studies which assessed aggressiveness in OCD using an implicit measure (Cludius et al., 2017, 2020), it must be viewed only as a first indication and requires replication.

In the trial types *I am peaceful* and *I am not aggressive*, affirmative responses were faster across both groups, amounting to peaceful biases. The bias towards *I am peaceful* in patients with OCD does not contradict the *I am aggressive D*-score. Both can coexist as well-learned relations because they are highly situational: A person with OCD might relate to peacefulness because they are generally a pacifist, while they may relate to aggressiveness in specific, illness-related overwhelming situations, such as severe frustration due to a time-consuming compulsion. In other words: The *I am peaceful* trial type does not appear to have any discriminant validity, presumably because it was not relevant to OCD. It is more difficult to understand why *I am not aggressive* did not yield a between-group difference, while *I am aggressive* did. There was a significant bias towards appraisal of the statement in both groups, which shows that the statement was primarily capable of eliciting a brief and immediate relational response (BIRR). This seemingly contradictory responding pattern resembles Freud's (1976) theory of aggressiveness in OCD: Patients with OCD responded ambivalently to *I am aggressive*, potentially reflective of latent (unconscious) aggression. At the same time, their hypermoral superego may have caused them to readily agree with the statement "I am not aggressive",

while simultaneously being the driving force behind the development of OC symptoms. It is important to note that although it might intuitively seem so, the difference between a BIRR and an extended and elaborated relational response (EERR), as construed by the relational elaboration and coherence model (Barnes-Holmes, Barnes-Holmes, et al., 2010), is not a distinction between unconscious and conscious; therefore, it is theoretically possible for BIRRs to reflect unconscious as well as conscious relations. Consequently, the current results do not necessarily imply that patients with OCD possess latent aggression – this would have been more probable if the explicit rating of aggressiveness had *not* shown elevated levels. In this constellation, the IRAP result primarily suggests that patients' immediate, unreflected response – be it conscious or unconscious – points towards an ambivalent appraisal of their own aggressiveness.

5.3 Explicit Aggressiveness

Patients with OCD showed higher trait anger and higher outward expression of anger than healthy controls. This finding is generally in line with prior research (Liu et al., 2017; Radomsky et al., 2007; Whiteside & Abramowitz, 2004, 2005). However, it contradicts part of Rachman's (1993) theory by which patients with OCD have difficulty expressing their anger outwardly because their exaggerated sense of responsibility causes them to blame themselves when things go wrong. While the current OCD sample did show highly elevated over-responsibility compared to controls, it did not translate to placing blame internally – most closely captured by the STAXI-II's *Anger Expression-In* scale. Moreover, there is no consistency in the research as to which specific type of anger expression according to the STAXI and STAXI-II may be elevated in patients with OCD, as there are findings of elevated *Anger Expression-In* (Whiteside & Abramowitz, 2004), -*Out* (Radomsky et al., 2007), or both (Liu et al., 2017; Whiteside & Abramowitz, 2005). Perhaps the mode of anger

expression is influenced by factors other than OCD-diagnosis, such as the more general burden of being mentally ill or circumstantial factors. Essentially however, patients with OCD consistently experience more anger than healthy controls and acknowledge this in questionnaires.

Since results showed group differences in the implicit and explicit measure of anger / aggressiveness, I further assumed that OC-symptomology as assessed by the OCI-R and overall severity of OCD as assessed by the Y-BOCS would correlate with *I am aggressive D*-scores and STAXI-II scores. Exploratory analysis showed, however, that only the OCI-R, but not the Y-BOCS score was related to STAXI-II scores (the *I am aggressive D*-score also correlated with the OCI-R score, but this did not withstand Bonferroni correction). To my knowledge, this is the third study to make the aforementioned observation (aside Moritz, Kempke, Luyten, Randjbar, & Jelinek, 2011 and Whiteside & Abramowitz, 2005). Notably, the correlation between OCI-R and Y-BOCS scores was small. This may be attributed to the fact that the former is a self-report questionnaire focusing on distress caused by OCD symptoms, while the latter is a semi-structured interview describing the overall severity of OCD. This suggests that levels of anger / aggressiveness are more closely related to the subjective suffering from OCD than an objective degree of illness.

5.4 Aggressiveness in Patients with Checking Compulsions

The effects observed in the subsample of patients with checking compulsions resembled those of the overall sample of patients with OCD. This was corroborated by comparison of IRAP and STAXI-II scores of patients with and without checking compulsions, which yielded no significant differences. Cludius et al.'s (2017) finding

of a more peaceful self-image in patients with checking compulsions could not be confirmed. However, IAT and IRAP results are principally not fully comparable (see chapter 2.3.1.3), since the IAT weighs participants' response latencies assessing their own aggressiveness *against* that of *others*, whereas the current IRAP implicitly targets participants' assertion and denial of their *own* aggressiveness. Therefore, the current results do not contradict Cludius et al.'s (2017) IAT findings, they rather highlight a different facet of aggressiveness.

There is further evidence that patients with checking compulsions may not differ from other patients with OCD in terms of anger / aggressiveness. Exploratory correlational analysis of STAXI-II scores with all OCI-R subscales showed no relationship with the checking subscale after Bonferroni correction. Other OCD symptom dimensions however, namely washing, ordering, obsessing, and neutralizing, correlated moderately with trait anger, and obsessing and ordering additionally correlated moderately with the outward expression of anger. This confirms findings by Whiteside and Abramowitz (2004), who found only the OCI-R subscales washing, ordering, and obsessing to be related to STAXI scores in a sample of OCD patients, and Tellawi et al. (2016), who found that only hoarding and ordering correlated with hostility.

In summary, the current findings do not support Rachman's (1993) theory that patients with checking compulsions might be especially affected by anger or aggressiveness. Given the mounting evidence to the contrary using explicit and implicit measures, it seems appropriate to dismiss the idea of anger being specifically related to checking compulsions.

5.5 Relationship between Implicit and Explicit Aggressiveness

There were moderate negative correlations between the *I am aggressive* trial type and the STAXI-II subscales *Trait Anger* and *Anger Expression-In*, respectively, indicating that an implicit aggressiveness bias was associated with higher self-reported propensity for anger and stronger internalized expression of anger. While not in the expected scope, this shows at least some overlap between the implicit and explicit measures of aggressiveness used in this study. Further, it is not uncommon for implicit and explicit measures to diverge, especially when they pertain to "psychologically sensitive issues" (Barnes-Holmes, Murtagh, et al., 2010, p. 303). However, the correlation with *Anger Expression-In* is somewhat inconclusive. For one, the aggressive target stimuli were specifically chosen for their activeness, therefore they are conceptually more closely related to the *Anger Expression-Out* scale. However, the target stimuli are all adjectives to some degree synonymous with "aggressive", while the items of the *Anger Expression-Out* describe situational reactions, often verbal, to a feeling of anger. For another, *Anger Expression-Out* scale, but not *Anger Expression-In*, was elevated in patients with OCD compared to healthy controls, therefore the correlation of the *I am aggressive* trial type with *Anger Expression-In* does not appear to describe levels of elevated aggressiveness. Perhaps instead, the opposite side of the observed relationship – that is strong denial of the statement *I am aggressive* correlates with low scores on the *Anger Expression-In* score – is more coherent. Low scores on *Anger Expression-In* point towards a healthy relationship with anger and its expression (C. D. Spielberger, 1999), in line with a generally peaceful self-image.

5.6 The Role of Over-responsibility

This hypothesis followed Rachman's (1993) theses on the impact of perceived over-responsibility on checking compulsions and anger. The fact that over-responsibility accounts for a significant proportion of checking symptomology is well studied, and my results support these findings (Foa, Sacks, et al., 2002; Williams et al., 2013). Rachman's other proposal – that over-responsibility may in turn also lead to anger – is less studied. For this too my findings provide some evidence, in that over-responsibility significantly predicted scores on the STAXI-II *Trait Anger* scale. In the STAXI-II manual, Spielberger (1999) offers some insight towards the possible pathomechanism of the relationship: Elevated trait anger alongside a tendency to internalize anger (towards which the OCD sample showed a trend) may lead patients to suppress their feelings, experience guilt, and ultimately blame themselves for the cause of their anger, that is take on (over-)responsibility for the cause of their distress. This model was adopted by Moosavi et al. (2014), who found that hidden aggression predicted over-responsibility via a mediating influence of feelings of guilt.

Overall however, the coefficients of determination were not particularly high: I found that over-responsibility explained 14.3% and 9.5% of the variances in checking and anger, respectively. This confirms that over-responsibility is only one of several cognitive distortions that underly OCD and should not be over-estimated in its ability to explain the emotional landscape and behaviors of patients (Obsessive Compulsive Cognitions Working Group, 1997a). For example, overestimation of threat and intolerance of uncertainty are two cognitive distortions that presumably contribute to development and maintenance of checking compulsions, with the latter

conceivably being a potential source of frustration and perhaps aggressiveness as well.

5.7 IRAP Methodology

As an important requisite for the interpretability of these results, the technicalities of the IRAP require closer analysis. The present IRAP's internal reliability was moderate, yet comparable to other IRAP studies (Barnes-Holmes et al., 2009; Drake et al., 2010). As to the size of the IRAP effects, *D*-scores did not exceed a value of 0.5, although the IRAP has a theoretical range of -2 to +2 (Hussey et al., 2015). These biases are fairly modest, yet their magnitude likens that of the other IRAP studies which used self-referential statements, though some reported overall *D*-scores and some reported individual trial type *D*-scores (Bast & Barnes-Holmes, 2015; Remue et al., 2013; Timko et al., 2010b; Vahey et al., 2009). In this context, the methodology of the IRAP used in this study appears solid, rendering observed group differences interpretable as actual effects.

Unlike the other three trial types and the overall *D*-score, the trial type *I am not peaceful* did not differ significantly from zero in either group, which means that there was no difference in latency between the two responding contingencies. This is most probably due to the fact that the trial type was not capable of eliciting a brief and immediate relational response, in that participants did not have a strong verbal or nonverbal history of relating "I am not" with any of the peaceful adjectives used in this study (Bast & Barnes-Holmes, 2015), and therefore had no automatic evaluation of this sentence (Barnes-Holmes, Barnes-Holmes, et al., 2010). Further, the trial type likely required too much cognitive effort to understand. When asked to reply in accordance with a peaceful self-image, participants were required to think something along the lines of: *"I am not peaceful" – that implies that I'm aggressive,*

but because I'm supposed to answer as if I were peaceful, that would be wrong!", all before pressing the response key. This type of logical thinking requires the multiple cognitive steps inherent to relational frame theory's extended and elaborate relational responses, equivalent to explicit attitudes. Analysis of the raw response latencies further showed that regardless of responding contingency, participants responded slower during trials that negated a statement, namely *I am not aggressive* and *I am not peaceful*. This was corroborated by a correlational analysis of the negation trial type response latencies with the Trail-Making-Test-A, which showed no relationship between response latency and cognitive processing speed. These findings indicate that affirmative and negation statements cannot be used as two sides of the same coin in IRAP designs, because they produce systematically different responses.

Further, double-negation thinking required in the *I am not peaceful* trial type contradicts the established maxims of conversation, by which people expect communication to be clear, brief, and as simple as possible (Grice, 1975). Other studies also found that verbally improbable trial types did not produce significant biases. In an IRAP asking participants to relate failure and success to positive and negative emotions, the *failure – positive feelings* trial type did not differ significantly from zero (Bast & Barnes-Holmes, 2015). In the assessment of pro-thin and anti-fat attitudes, trial types *bad – others fat* and *good – others thin* (with the other two trial types referring to the self) failed to produce significant effects (Parling et al., 2012).

5.8 Further Exploratory Analyses

As several previous studies found that depression accounted for higher levels of anger / aggressiveness in patients with OCD (see chapter 2.2.1.1), the analysis

was repeated here and the relationship was confirmed: Depressive symptomology accounted for the variance in both STAXI-II overall scores and *I am aggressive* trial type *D*-scores. As these as well as prior findings of a covarying influence of depression stem from exploratory analyses however, they must be interpreted with caution and serve primarily as a prompt for future research designed specifically to target this concept. Nonetheless, a body of research which shows elevated levels of anger and aggressiveness in patients with depression lends way to the notion that anger is independently related to depression (for a summary, see Busch, 2009) or more generally, negative affect (Moscovitch et al., 2008), instead of the comorbidity of depression and OCD influencing anger in some way. Moreover, Spielberger (1999) suggests that depression may in fact be a result of elevated levels of anger in conjunction with a tendency to internalize anger, via the suppression of angry feelings causing guilt and anxiety. At first glance, the strong impact of depressive symptomology undermines the premise of this thesis. Due to the large share of patients with OCD affected by comorbid depression, however, feelings of anger and aggression warrant clinical attention if the cognitions and behavior of patients with OCD are to be understood. Therefore, future research should assess anger and aggressiveness within the frame of depressive symptomology and general psychopathology, rather than assigning it to specific symptoms of OCD such as checking.

5.9 Strengths

The current study has a number of methodological strengths. In accordance with CONSORT guidelines (Schulz et al., 2010), the RCT into which the current trial is embedded was pre-registered, establishing accountability and transparency regarding the reported outcome measures. Participants in the OCD sample were

assessed for eligibility using the standardized MINI interview (see chapter 3.3.3), ensuring a clinician-rated, reliably pathological sample. The demographic similarity with the sample of healthy controls lends this study's results further weight.

The IRAP was carefully constructed and adhered to current standards. The selected target stimuli were rated by clinical experts and were all relevant to OCD, as shown by the fact that they were rated as personally meaningful more often by patients with OCD than healthy controls. The mastery criteria applied to the raw data adhere to current recommendations (Hussey et al., 2015), and the IRAP's internal reliability was comparable to other IRAP studies. Further, the sample size was sufficient according to current recommendations on IRAP analysis, which most conservatively suggest a sample size of $N = 37$ per group (the current overall sample size was $N = 90$; Vahey, Nicholson, & Barnes-Holmes, 2015). Therefore, it is safe to assume that the observed group difference in *I am aggressive* IRAP *D*-scores is attributable to true differences in response latencies. Moreover, the IRAP constructed for this study effectively captures the target concept of aggressiveness as shown by its concordance with STAXI-II scores. It also proves its merit as an implicit measure, as it showed differences in aggressiveness that the IAT was unable to capture (Cludius et al., 2017). Overall, this study is a constructive addition to the current body of IRAP research, especially because it is one of the first studies to successfully utilize the IRAP in a clinical sample.

5.10 Limitations

While the current study showed a group difference in aggressiveness using the IRAP, this effect was only found in one of the four trial types. Possible reasons for this have already been discussed at length, yet failure of the *I am not peaceful* trial type to produce any bias demonstrates how difficult it is to choose sample

stimulus / target stimulus combinations capable of eliciting relevant and meaningful responses within the confines of the IRAP formula. In addition, the moderate strength of the correlation between the *I am aggressive D*-score and some STAXI-II scales cannot be unambiguously attributed to their conceptual likeness or difference since the items are constructed quite differently.

Since the IRAP is still a relatively new instrument, the exploration of its manifold applications is only just beginning and current recommendations continue to shift. The current study falls short on some of the technicalities that may improve the quality of IRAP data. First, the contingency (i.e., consistent or inconsistent) of the first block was not randomized. This may have produced an undetectable bias in all participants as it has been show that the initially presented contingency can dramatically moderate effects (Finn et al., 2016). However, this is unlikely to have distorted any group differences, since all participants started with the same contingency. Second, the IRAP lacked further practice blocks. Four or six practice blocks would have improved performance during the test blocks, necessitating fewer participants' exclusion from the IRAP analyses. Ideally, only those participants who reached mastery criteria during practice blocks would continue to the test block, resulting in a more efficient data collection. A further possible source of bias pertains to the IRAP instructions. Many participants required additional oral explanation of the IRAP task, aside from the on-screen instructions. Due to the fact that four different staff members (doctorate students and research assistants) administered the IRAP and supplementary oral instructions were not manualized, each individual may have explained the IRAP slightly differently. Another non-standardized aspect of the data-collection emerged due to logistical reasons: Participants received a package of questionnaires via post to complete ahead of the in-clinic appointment

so as to limit its length to 3 hours. Therefore, the STAXI-II was completed under non-standardized conditions, which may have influenced its correlation with the IRAP between the different participants. Finally, the sample size of patients with OCD was roughly double that of the non-clinical controls which may have led to over-estimation of group differences, thus warranting replication of results with a larger control sample.

5.11 Clinical Implications, Fields for Future Research and Conclusion

Elevated levels of aggressiveness ostensibly add to the emotional burden of suffering from OCD. As shown clearly in the explicit rating, patients are aware of their own aggressiveness. It should be acknowledged as a typical emotion in psychotherapeutic settings, not least to reduce self-stigmatization and self-blame. Moreover, addressing difficulties in dealing with anger and aggressive feelings in psychotherapy may allow patients to develop coping mechanisms and in turn improve their relationships with others.

This study used a newly designed IRAP in a highly burdened, clinical population, which was therefore subject to the typical shortcomings that become evident in hindsight. Additionally, however, there is a certain degree of guesswork that goes into designing a measure that targets BIRRs, and in the relatively young body of IRAP research, laboratories continue to iron out which IRAP trial types work, and which do not. For future IRAP studies, I would like to share a few recommendations as well as ideas for IRAP construction:

1) Participants should complete several practice trials and only continue to the actual task if they reach mastery and latency criteria;
2) Response contingency of the first IRAP block should be randomized across participants;

3) Participants should complete an explicit rating of the IRAP trial types (e.g., "On a scale of 1-10, how strongly do you agree to the following statements: *I am aggressive*, *I am not aggressive*, *I am peaceful*, *I am not peaceful*, etc. with every combination of sample and target stimulus used in the IRAP) in order to shed more light on possible explicit-implicit dissociations;
4) To create an IRAP which is more affectively relevant to a participant, it could include only target stimuli which the participant explicitly rated as "personally meaningful";
5) To capture different domains of aggressiveness, trials could be formulated as actions (i.e., *I lash out* or *I raise my voice*) or feelings (*I feel aggressive*), thereby acknowledging that aggression can be a transient emotion with which patients do not necessarily associate (as opposed to *I am aggressive*).
6) Trial types should be designed with special attention to their linguistic plausibility, since a BIRR can only be emitted if the content of the trial type in conjunction with its required response is easy to understand.

In exploratory analysis, I found that depressive symptomology accounted for elevated levels of aggressiveness in patients with OCD. This raises follow-up questions: Is aggressiveness as a feature of depression especially common in patients with OCD? That is, do patients with OCD and comorbid depression experience aggressiveness more often than patients with a sole diagnosis of depression? And if so, what is the pathomechanism of aggressiveness at the intersection of depression and OCD, and how might a deeper understanding thereof be used for psychotherapy? A comparison of patients with OCD and depression on

measures of aggressiveness could also be helpful for disentangling this construct and its pathomechanism. Further, the current analyses were conducted using the self-report BDI as a measure of depression; this warrants replication using a clinician rating such as the HDRS.

The assumed singularity with regard to the aggressive self-image of patients with checking compulsions was not confirmed, therefore future research may dismiss this strand of thinking.

Overall, this study showed that the IRAP task can be applied in a clinical population. It is therefore a promising instrument for assessing implicit attitudes, with myriad potential applications. Specifically, the group difference in latency suggests that patients with OCD were more ambivalent about confirming or denying their aggressiveness, whereas healthy controls more firmly denied it. This finding correlated with explicit self-report. Moreover, results of my exploratory analyses suggest that aggressiveness should be examined in conjunction with comorbid depression. Acknowledging this will hopefully lead to an even more focused examination of aggressiveness in patients with OCD.

6 Summary

Psychodynamic and cognitive theories suggest a prominent role of aggressiveness in the development and maintenance of obsessive-compulsive disorder (OCD). Elevated aggressiveness in patients with OCD has been demonstrated using various self-rating scales. Contrarily, two studies utilizing an implicit measure, the Implicit Association Test, found no difference in self-perceived aggressiveness between OCD-patients and nonclinical controls (NCs) (Cludius et al., 2017, 2020). The present study aimed to overcome methodological limitations of this prior research by using the Implicit Relational Assessment Procedure (IRAP) to assess self-perceived aggressiveness in patients with OCD as compared to NCs.

Patients with OCD (n = 59) were compared to NCs (n = 31) using an IRAP which required them to respond as quickly and accurately (correct / incorrect) to self-referential statements (i.e., “I am” / ”I am not” + *aggressive adjective* / *peaceful adjective*) according to predetermined rules. Groups were also compared on an explicit measure of aggressiveness, the STAXI-II questionnaire.

There was no group difference in overall D_{IRAP}-Score, yet patients with OCD scored significantly lower on the *I am – aggressive* trial type compared to NCs (d = 0.73), implying a weaker disagreement with the statement. On the STAXI-II scales *Trait Anger* and *Anger-Expression-Out*, patients with OCD scored significantly higher. The *I am – aggressive* D_{IRAP}-Score correlated with the overall *Trait Anger* scale (r = -.33, p = .001) and with the *Anger Expression – In* scale (r = -.31, p = .003).

Patients with OCD were more ambivalent about their own implicit aggressiveness than NCs. This was in line with patients’ explicit aggressiveness. Our results contribute to establishment of the IRAP in clinical assessment and the understanding of aggressive tendencies in patients with OCD.

Zusammenfassung

Psychodynamische und kognitive Theorien postulieren die wichtige Rolle von Aggressivität in der Entwicklung und Aufrechterhaltung der Zwangsstörung. Mittels verschiedener Selbstbewertungsverfahren wurde erhöhte Aggressivität bei Patienten mit Zwangsstörung nachgewiesen. Im Gegensatz dazu zeigten zwei Studien unter Verwendung eines impliziten Maßes, dem Implicit Association Test, keinen Gruppenunterschied zwischen Patienten mit Zwangsstörung und gesunden Kontrollprobanden hinsichtlich Aggressivität (Cludius et al., 2017, 2020). Ziel der vorliegenden Studie war es, methodische Limitationen der Vorbefunde zu umgehen. Hierfür wurde das Selbstbild hinsichtlich Aggressivität von Patienten mit Zwangsstörung und gesunden Kontrollprobanden mittels des Implicit Relational Assessment Procedure (IRAP) untersucht.

Patienten mit Zwangsstörung (n = 59) und Kontrollprobanden (n = 31) absolvierten einen IRAP bei dem sie nach vorgegebenen Regeln so schnell und akkurat wie möglich auf die Kombination verschiedener Stimuli („Ich bin“ / „Ich bin nicht“ + *aggressives* / *friedliches Adjektiv*) antworten sollten. Ebenfalls vorgegeben wurde der STAXI-II Fragebogen, ein explizites Maß zur Erfassung von Aggressivität.

Es zeigte sich kein Gruppenunterschied im Gesamt-D_{IRAP}-Score, allerdings war der durchschnittliche *Ich bin – aggressiv* D_{IRAP}-Score bei Patienten mit Zwangsstörung signifikant niedriger als bei Kontrollprobanden (d = 0.73), wodurch eine geringere Zustimmung mit der Aussage impliziert wird. In den STAXI-II Subskalen *Trait Anger* und *Anger-Expression-Out* zeigte sich eine stärkere Ausprägung bei Patienten mit Zwangsstörung als Kontrollprobanden. Der *Ich bin* –

aggressiv D_{IRAP}-Score korrelierte positiv mit den *Trait Anger* (r = -.33, p = .001) und *Anger Expression – In* Subskalen (r = -.31, p = .003).

Patienten mit einer Zwangsstörung waren im impliziten Assessment hinsichtlich ihrer eigenen Aggressivität ambivalenter als Kontrollprobanden. Dieser Befund stimmte mit den expliziten Ergebnissen überein. Diese Ergebnisse demonstrieren die Anwendbarkeit des IRAPs in einer klinischen Stichprobe und tragen zum Verständnis aggressiver Tendenzen in Patienten mit einer Zwangsstörung bei.

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Eidesstattliche Erklärung

Ich versichere ausdrücklich, dass ich die Arbeit selbständig und ohne fremde Hilfe verfasst, andere als die von mir angegebenen Quellen und Hilfsmittel nicht benutzt und die aus den benutzten Werken wörtlich oder inhaltlich entnommenen Stellen einzeln nach Ausgabe (Auflage und Jahr des Erscheinens), Band und Seite des benutzten Werkes kenntlich gemacht habe. Ferner versichere ich, dass ich die Dissertation bisher nicht einem Fachvertreter an einer anderen Hochschule zur Überprüfung vorgelegt oder mich anderweitig um Zulassung zur Promotion beworben habe. Ich erkläre mich einverstanden, dass meine Dissertation vom Dekanat der Medizinischen Fakultät mit einer gängigen Software zur Erkennung von Plagiaten überprüft werden kann.

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Empirical Research

Aggressiveness in patients with obsessive-compulsive disorder as assessed by the Implicit Relational Assessment Procedure

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ABSTRACT

Objective: Psychodynamic and cognitive theories postulate a prominent role of aggressiveness in patients with obsessive-compulsive disorder (OCD). Explicit assessment of aggressiveness in OCD has yielded diverging results. The present study aimed to investigate aggressiveness in OCD using the Implicit Relational Assessment Procedure (IRAP).

Method: Patients with OCD ($n = 59$) were compared to non-clinical controls (NCs; $n = 31$) on an IRAP using self-referential statements and the explicit State-Trait Anger Expression Inventory-II (STAXI-II). During the computer-based IRAP, participants were required to respond as quickly and accurately ("correct" or "incorrect") to the relation of two presented stimuli (e.g., "I am" + "aggressive").

Results: D_{IRAP}-Scores for the *I am aggressive* trial type were significantly higher in NCs compared to the OCD sample ($d = 0.73$). Patients with OCD scored significantly higher on the *Trait Anger* scales and the *Anger Expression-Out* scale of the STAXI-II. The *I am aggressive* D_{IRAP}-Score correlated with the overall *Trait Anger* scale ($r = -.33$, $p = .001$) and with the *Anger Expression-In* scale ($r = -0.31$, $p = .003$).

Conclusions: Patients with OCD were more ambivalent about their own aggressiveness than NCs. These findings were in line with patients' explicit aggressiveness.

1. Introduction

Obsessive-compulsive disorder (OCD) puts considerable strain on affected individuals' daily lives (Moritz et al., 2005; Ruscio, Stein, Chiu, & Kessler, 2010). A recent meta-analysis showed that patients with OCD have a severely impaired quality of life in the domains of work, social life, emotions and family (Coluccia et al., 2016). A likely contributor thereto are aggressive feelings, which are increased in patients with OCD compared to the general population (e.g., Moritz, Kempke, Luyten, Randjbar, & Jelinek, 2011; Radomsky, Ashbaugh, & Gelfand, 2007).

Two theories underlie much of the research conducted on aggressiveness in patients with OCD. For one, Freud's psychodynamic theory (1976) construes the cause of OCD as the oedipal conflict between ambivalent sexual and aggressive impulses towards a subject's parents. According to the theory, these aggressive impulses are unconscious, yet they clash with the subject's hypermoral superego. As a dysfunctional coping mechanism for aggressive impulses, which may in turn surface as sexual or hostile obsessions, patients may develop compulsions characterized by perfectionism and conscientiousness (Fenichel, 1945; Kempke & Luyten, 2007). In current research, Freud's conceptualization of aggression is often called 'latent aggression', highlighting its inaccessibility to the conscious mind (Moritz et al., 2011).

In contrast to Freud, Rachman (1993) identified cognitive factors at the root of OCD. Particularly, an inflated sense of responsibility (Mitchell, Hanna, & Dyer, 2019; Obsessive Compulsive Cognitions Working Group, 1997) may cause patients with OCD to hold themselves accountable for preventing the manifestation of their obsessive thoughts. For example, a person who obsessively fears a fire in their apartment building might feel overly responsible for this eventuality, causing them to compulsively check their own electrical appliances. According to Rachman (1993), the ways in which this pathological mechanism may lead to aggressiveness are twofold: Firstly, when a

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person with OCD becomes angry, an inflated sense of responsibility for the cause of that anger may cause them to direct their anger inwardly, (i.e., inward rather than outward aggressiveness). Secondly, the attempt to decrease anxiety resulting from obsessions by performing compulsions is typically futile, leading patients with OCD to become frustrated and angry[1]. Rachman supposes this pattern is particularly pronounced in persons with checking compulsions, as they are often confronted with unchanged feelings of insecurity despite prolonged efforts. In summary, both theories complement each other: While Freud (1976) sees unconscious aggressiveness as a cause and promoter of OCD, Rachman (1993) emphasizes how obsessive compulsive (OC) cognitions may trigger aggressive feelings.

The body of research on aggressiveness in OCD is heterogeneous, applying numerous questionnaires and yielding diverging results. Moritz et al. (2011) found elevated levels of latent aggression in patients with OCD and indications that these were related to OC symptom severity. Similarly, hidden aggression, construed as a composite score of the State-Trait Anger Expression Inventory-II's (STAXI-II; Spielberger, 1999) subscales *Trait Anger* and *Anger Expression-In*, was correlated with OC symptomology in a population of outpatients (Moosavi, Naziri, & Mohammadi, 2014). Moreover, Krug et al. (2009) found that inpatients diagnosed with OCD scored higher on *Trait Anger* and overall *Anger Expression* than non-clinical controls (NCs). Additionally, a study by Cludius, Mannsfeld, Schmidt, and Jelinek (2020) showed higher STAXI-II *Trait anger, Anger Expression-In and Anger Expression-Out scores* in patients with OCD compared to NCs (Cludius et al., 2020). Two studies showed that OC symptoms were associated with anger and aggressiveness even in a community sample (Liu, Liu, & Zhao, 2017; Whiteside & Abramowitz, 2004). Whiteside and Abramowitz (2004), however, found this relationship disappeared after controlling for depressive symptoms. Several other studies observed a confounding influence of depression. When compared to controls, students formally diagnosed with OCD were found to have elevated levels of aggressiveness which were covaried by general distress (Whiteside & Abramowitz, 2005). Elevated levels of anger (Moscovitch, McCabe, Antony, Rocca, & Swinson, 2008) and anger rumination (Jessup, Knowles, Berg, & Olatunji, 2018) in patients with OCD disappeared after controlling for depression and anxiety, respectively. Conversely, two studies found the correlation between OC symptomology and anger/aggressiveness prevailed even after controlling for depression and anxiety (Liu et al., 2017; Tallis, Rosen, & Shafran, 1996).

While Rachman (1993) suggests that aggressiveness may be particularly pronounced in patients with checking compulsions, thus far the evidence is limited. A sample of patients with checking compulsions showed higher levels of anger and aggressiveness than NCs (Radomsky et al., 2007), however no comparison was drawn to a non-checking OCD sample, limiting the conclusiveness of these findings. In another study, checking symptoms in a student population were moderately correlated with aggressiveness and internalization of anger, yet so were washing and doubting (Whiteside & Abramowitz, 2004). Finally, two studies found that neither anger rumination nor aggressiveness were related to checking (Jessup et al., 2018; Whiteside & Abramowitz, 2005).

So far, research on aggressiveness in OCD has mainly relied on self-report questionnaires. However, sensitive target concepts, such as aggressiveness, are susceptible to social desirability bias or imprecise reporting (Barnes-Holmes et al., 2006; Greenwald, Farnham, Greenwald, McGhee, & Schwartz, 2000). Implicit measures can circumvent such barriers by capturing more automatic components of individual attitudes (Barnes-Holmes, Barnes-Holmes, Stewart, & Boles, 2010; Greenwald & Banaji, 1995). Notably, implicit measures were formerly construed as gateways into unconscious thought (Greenwald & Banaji, 1995), yet there is mounting evidence to the contrary (Gawronski, 2009). They do indeed produce responses that are more automatic, spontaneous, and immediate than explicit measures (e.g., questionnaires; Hofmann, Gwaronski, Gschwendner, Le, & Schmitt, 2005; Houwer, 2005).

A study by Cludius, Schmidt, Moritz, Banse, and Jelinek (2017), upon which the current research builds, examined the self-concept of aggressiveness in 58 patients with OCD and 25 NCs using an implicit measure, the Aggressiveness Implicit Association Task (Agg-IAT). In the task, participants categorized themselves ("me") as opposed to others (expressed by vocations, e.g. "architect", "dentist", "carpenter") in conjunction with peaceful and aggressive descriptors. No significant group difference emerged, with participants displaying a bias towards a peaceful self-image. Surprisingly, participants with checking compulsions showed a significantly stronger bias towards *self – peaceful* and *others – aggressive* than NCs, contradicting prior theory and findings. However, the Agg-IAT findings were not compared with an explicit measure, rendering inconsistence with the study's hypotheses unclear. A subsequent study by Cludius et al. (2020) investigating the Agg-IAT again found no difference between patients with OCD and NCs, disconfirming the hypotheses of a more aggressive implicit self-concept in patients with OCD. Additionally, no group difference on the Agg-IAT was found between NCs and patients with checking compulsions in subsequent exploratory analyses.

The IAT has several structural shortcomings (for an overview, see Fiedler, Messner, & Bluemke, 2006). Most importantly, it merely shows that a certain association is relatively stronger than another; e.g. in the aforementioned study, the association *self – peaceful/others – aggressive* was more readily reproduced than *the self – aggressive/others – peaceful* association. It does not, however, provide information about how independently peaceful/aggressive the self or others are perceived, nor whether aggressiveness is perceived as a trait amongst many in a certain vocation, or if the entire vocation is per se considered aggressive.

The Implicit Relational Assessment Procedure (IRAP; Barnes-Holmes et al., 2006) disentangles these underlying relations. Conceptually rooted in relational frame theory (RFT; Hayes, Barnes-Holmes, & Roche, 2001), the IRAP applies latency and accuracy pressure to produce brief and immediate relational responses (BIRRs). Well-learned verbal relations (i.e. *self – peaceful – correct*) are taken to imply the subject's implicit attitude, therefore producing faster responses than unfamiliar relations (i.e., *self – peaceful – incorrect*; Barnes-Holmes, Barnes-Holmes, et al., 2010). Their counterparts, extended and elaborated relational responses (EERRs), are the types of answers produced by questionnaires (Barnes-Holmes, Barnes-Holmes, et al., 2010). They are not subject to latency pressure and incorporate verbal relations beyond the most well-learned – they are reflective, explicit, and therefore subject to response bias (Greenwald et al., 2000).

Several studies have successfully applied the IRAP to socially sensitive subjects, such as normative and paraphilic sexual interests (Dawson, Barnes-Holmes, Gresswell, Hart, & Gore, 2009; Rönspies et al., 2015) and gender stereotypes (Drake, Primeaux, & Thomas, 2018). Moreover, the IRAP has previously been used in patients with OCD (Nicholson, McCourt, & Barnes-Holmes, 2013; Vella, 2017). A meta-analysis of IRAP studies found relatively strong evidence for validity pertaining to contrasted groups, as examined in our study, whereas discriminant validity was found to vary according to whether implicit-explicit dissociations (between the IRAP and an explicit measure) were to be expected (Golijani-Moghaddam, Hart, & Dawson, 2013).

Contrary to most prior research on aggressiveness in OCD in general, the current research focuses specifically on participants' self-concept of their own aggressiveness. That is, the implicit measure (IRAP) employs self-referential statements, whereas the explicit measure (STAXI-II) requires participants to rate their agreement with statements from the first-person perspective. The patients' individual beliefs about their propensity for aggression, particularly considering that patients with OCD rarely indeed act violent, appears most relevant for the treatment of OCD. Regarded in conjunction with cognitive biases such as over-responsibility, these cognitions may have significant behavioral implications.

Based on the body of prior research (e.g., Moritz et al., 2011; Whiteside & Abramowitz, 2005) as well as theories by Rachman (1993)

and Freud (1976), we assumed that patients with OCD differ from NCs in their self-concept of aggressiveness. However, prior research differs in the directionality thereof: the majority of explicit findings showed elevated aggressiveness in patients with OCD (e.g., Liu et al., 2017; Moritz et al., 2011; Whiteside & Abramowitz, 2005), whereas the two prior studies using an implicit measure found no difference in self-image with regard to aggressiveness (Cludius et al., 2017, 2020). Therefore, our hypotheses were non-directional. We refrained from including a clinical control group in this first study due to the novelty of our IRAP design. We expected a group difference in aggressiveness using (1) an implicit measure, the IRAP, as well as (2) an explicit measure, the STAXI-II questionnaire. Moreover, as both instruments assess aggressiveness, albeit in structurally different ways, we expected (3) a positive correlation between scores. Finally, based on Rachman's (1993) theory, corroborated by findings by Radomsky et al. (2007) and Cludius et al. (2017), we expected the same pattern (1, 2, and 3) to emerge in a subsample of participants with checking compulsions.

2. Methods

2.1. Participants

Fifty-nine patients with a primary diagnosis of OCD were recruited ($M = 39.24$ years, $SD = 12.13$) via clinics, psychotherapists, an internal database of patients who provided written consent for future study participation, and a Google AdWords search campaign. For patients, the inclusion criteria comprised diagnosis of OCD, age between 18 and 70 years, and provision of written informed consent. Exclusion criteria were lifetime diagnosis of schizophrenic or schizoaffective symptoms (i.e., mania), severe current or lifetime neurological disorders, and moderate or severe substance abuse in the past 12 months.

Thirty-one healthy individuals were recruited as a non-clinical control group ($M = 43.68$ years, $SD = 14.01$) through word of mouth, leaflets, and the aforementioned internal database. Inclusion criteria were age between 18 and 70 years and written informed consent. Any lifetime or current psychiatric diagnosis (except for mild alcohol abuse) as well as any current or lifetime neurological disorder led to exclusion (as assessed by the Mini International Neuropsychiatric Interview 5th Ed.; MINI, German version: 7.0.2; Sheehan et al., 1998). As this is the first study to investigate aggressiveness with an IRAP, we decided first to test it against healthy controls before recruiting a larger OCD sample to explicitly investigate only patients with checking compulsions.

In patients and controls, diagnostic status (including verification of OCD diagnosis) was assessed using the MINI. All participants provided their written informed consent before participation. This cross-sectional study was part of a larger randomized controlled trial, registered at the German Clinical Trials Register (#DRKS00013539) and approved by the Ethics Committee of the German Psychological Society (Deutsche Gesellschaft für Psychologie; LJ112017). The study was conducted in accordance with the declaration of Helsinki. See supplementary material A for sample size calculation.

2.2. Measures

The Mini International Neuropsychiatric Interview (MINI; Sheehan et al., 1998), used here in the German version 7.0.2, is a structured diagnostic interview that screens for the major psychiatric disorders in DSM-5 (Diagnostic and Statistical Manual of Mental Disorders, Fifth edition; American Psychiatric Association, 2013). It possesses good sensitivity (.79), specificity (.72–.97), and inter-rater reliability (κ = 0.88–1; Lecrubier et al., 1997; Sheehan et al., 1997).

The Yale-Brown Obsessive Compulsive Scale (Y-BOCS; Sheehan et al., 1998; German version: Goodman et al., 1989) is a semi-structured interview that measures OC symptom severity and was conducted with the OCD sample only. The German version shows high inter-rater reliability, $r = 0.90$ (Moritz et al., 2002).

The following questionnaires were administered in both samples. The STAXI-II (Spielberger, 1999; German version: Rohrmann et al., 2013) assesses the experience, expression, and control of anger (Hilsenroth & Segal, 2004) and includes the subscales *State Anger (SA;* not used in this study*)*, *Trait Anger (TA)*, *Anger Expression-Out (AX-O)*, *Anger Expression-In (AX-I)*, *Anger Control-Out (AC-O)*, and *Anger Control-In* (*AC-I*; Lievaart, Franken, & Hovens, 2016). Items are scored on 4-point Likert scales (*almost never* to *almost always*) and grouped into subscales, the raw values of which are in turn transformed into standardized *T*-scores ($M = 50$, $SD = 10$) according to age groups (graduation of subscale scores: 30–39 = below average, 40–60 = average, and 71–70 = above average; Rohrmann et al., 2013). For example, the *TA* scale includes items about being quick tempered and getting furious when criticized in front of others (Lievaart et al., 2016). The German version possesses good internal consistency ($\alpha = 0.73$–0.92) and test-retest reliability ($\alpha = 0.63$–0.81) for the *TA*, *Anger Expression,* and *Anger Control* scales (Rohrmann et al., 2013).

The Obsessive-Compulsive Inventory–Revised (OCI-R; Foa et al., 2002; German version: Gönner, Leonhart, & Ecker, 2007) is a self-rating questionnaire assessing OC symptom severity. It is rated on 5-point Likert scales, with higher scores indicating worse symptoms, and comprised of the subscales *Checking* (e.g., *'I check things more often than necessary.'*), *Ordering*, *Obsessing* (e.g., *'I am upset by unpleasant thoughts that come into my mind against my will.'*), *Hoarding*, and *Mental Neutralizing*. Patients who scored above the cutoff for the *Checking* subscale ($\geq$4) were included in the OCD checking subsample.

The Beck Depression Inventory-II (Beck, Steer, & Brown, 1996; German version: Hautzinger, Keller, & Kühner, 2006) assesses depressive symptoms over the past two weeks using 21 items. Internal consistency of the German version is good (Cronbach's $\alpha \geq .75$) and content validity is high (Kühner, Bürger, Keller, & Hautzinger, 2007). It was administered for the purpose of exploratory analyses.

2.3. Implicit Relational Assessment Procedure (IRAP)

2.3.1. Selection of target stimuli

Six peaceful and aggressive adjectives each were selected as target stimuli (see Table 1). These were determined through a rating completed by ten experts on OCD (see supplementary material B).

2.3.2. IRAP task

The IRAP introductory page informed participants about the general procedure of the task and instructed them to respond as quickly and accurately as possible. They were not informed that latency was being measured. There were six blocks, three consistent and three inconsistent, each consisting of 24 trials, and in each trial, a target stimulus (peaceful/aggressive adjective) appeared in the center of the screen. At the top of the screen, participants saw a sample stimulus (*I am/I am not*). Participants were asked to respond by clicking the x-key to choose *correct* (i.e., as indicated by the introductory page right before the respective block, for example, consistent with a peaceful self-image; see below for a detailed description) and the m-key to choose *incorrect*. The response options were shown in the top right (*incorrect*) and left (*correct*)

Table 1
IRAP target stimuli and presentation frequency.

Aggressive words		Peaceful words	
aggressive (*aggressiv*)	8	peaceful (*friedlich*)	9
ready to use violence (*gewaltbereit*)	6	pacific (*friedfertig*)	9
violent (*gewalttätig*)	8	placid (*friedvoll*)	8
forcible (*gewaltsam*)	7	benign (*gutartig*)	9
brutal (*brutal*)	10	forgiving (*versöhnlich*)	5
physically violent (*handgreiflich*)	8	peace-loving (*friedliebend*)	9

Note. Original German words in parentheses. Numbers beside target stimuli indicate the total number of times they were presented in the trials included in the final analysis.

corners of the screen.

Each trial comprised one of four self-referential statements, yielding four different trial types (TTs) depending on the combination of sample and target stimulus: *I am* – [aggressive adjective], *I am* – [peaceful adjective], *I am not* – [aggressive adjective] and *I am not* – [peaceful adjective]. Before each block, participants were instructed to choose the answer that was either consistent or inconsistent with a peaceful self-image. If participants chose the required response (i.e., according to the instructions), the next trial appeared after a blank screen was displayed for 400 ms. If the required response was not chosen, a red "X" appeared until the participant pressed the required key. Consistent and inconsistent blocks were displayed in alternation, starting with inconsistent. All response latencies were recorded. See Fig. 1 for an example. As our objective is aggressiveness, in the following we will primarily use the term "aggressiveness" to describe TTs, although some pertain to peacefulness.

2.3.3. Subjective appraisal of stimuli

After the task, participants rated each of the 12 target stimuli on a 5-point Likert scale (1 *negative and personally meaningful*, 2 *negative*, 3 *neither*, 4 *positive*, 5 *positive and personally meaningful*). Eligibility of the explicit ratings was assumed if the mean rating was $\geq$4 (*positive*) for positive adjectives or $\leq$ 2 (*negative*) for negative adjectives.

2.4. Procedures

Prior to assessment, all participants received information about the study and self-rating questionnaires, which they were asked to complete and bring to the interview. During the interview, demographic information was obtained, followed by the assessment of the MINI and the Y-BOCS (OCD sample only) as well as the application of the IRAP.

2.5. Strategy of statistical analysis

2.5.1. IRAP scoring

Raw IRAP data were converted into a long format using R version 3.5.0 and then further processed in IBM SPSS 24.0. Data from the first two blocks were regarded as practice blocks and excluded from further analysis (Barnes-Holmes, Barnes-Holmes, et al., 2010). Therefore, the numbers of the presented target stimuli are not equal (see also Table 1); all participants were however presented with the identical sequence of trials. Individual trials with latency times greater than 10,000 ms and participants with reaction time latencies below 300 ms in more than 10% of test block trials (i.e., 3, 4, 5 and 6) were excluded from the analyses (Nicholson & Barnes-Holmes, 2012). We also excluded IRAP data that did not adhere to mastery criteria: If a participant gave the required response in less than 75% of trials or responded with a median latency >2500 ms in either block in a block pair, the entire pair was excluded, and only the remaining block pair was analyzed.

Analysis was conducted by comparing the latencies of consistent and inconsistent blocks. D_{IRAP}-Scores, derived from Cohen's *d*, were calculated from reaction time latencies as suggested by Hussey, Thompson, McEnteggart, Barnes-Holmes, and Barnes-Holmes (2015). Scores were calculated such that in all TTs, D_{IRAP}-Scores greater than zero correspond to relatively faster responding during trials consistent with a peaceful self-image, while negative D_{IRAP}-Scores indicate faster responding during trials inconsistent with a peaceful self-image.

For the calculation of effect sizes, Cohen's *d* (small effect $\approx$ 0.2, medium effect $\approx$ 0.5, large effect $\approx$ 0.8; Cohen, 1988) and partial eta squared were used (η_p^2; small effect $\approx$ .06, medium effect $\approx$ .09, large effect $\approx$ .14). Pearson's correlations coefficients were interpreted as weak if $r \approx .1$, moderate $r \approx .3$, and strong $r \approx .5$. Bonferroni corrected alpha levels were applied for multiple tests.

3. Results

3.1. Sample

The sample consisted of $N = 90$ participants ($n = 59$ patients with OCD and $n = 31$ NCs). There were no group differences in sociodemographic variables (see Table 2). Participants' age ranged between 19 and 70 years in the OCD sample and 18 and 68 years in the NCs. As expected, samples differed on severity of OC and depressive symptoms. OC symptom severity in the OCD sample was moderate ($M = 20.29$, $SD =$

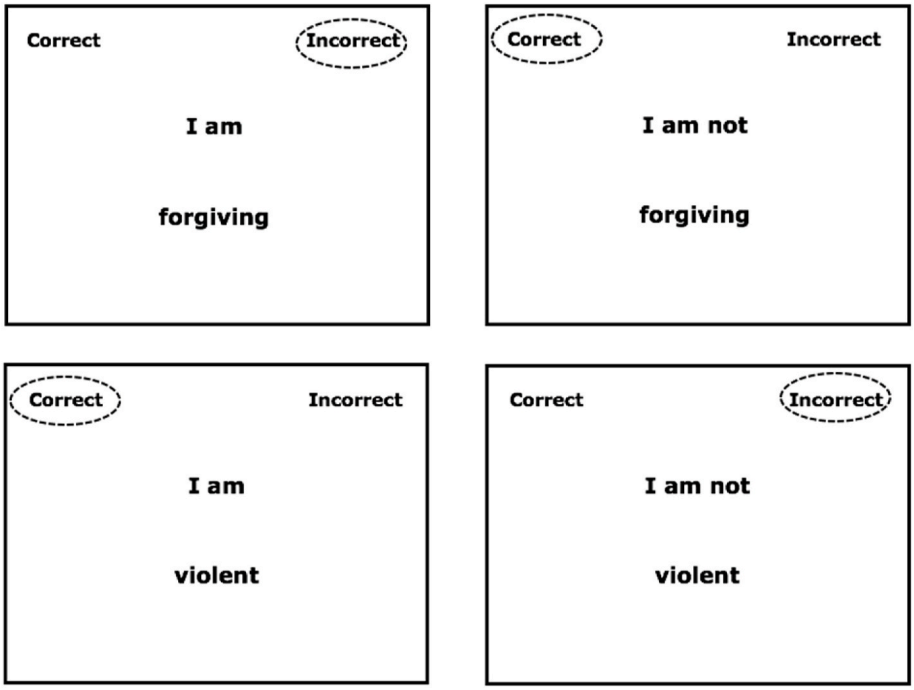

Fig. 1. Example of IRAP Trial Types. Fig. 1. Example of the four different trial types in an inconsistent block (i.e., inconsistent with a peaceful self-image). The required response for each trial is circled.

Table 2
Demographic and psychopathological data of the sample.

Variable	OCD[a] ($n = 59$)		Non-clinical controls[a] ($n = 31$)		Statistics[b]
	n/M	%/*SD*	*n/M*	%/*SD*	
Background					
Gender (f/m)	29/30	49%/51%	16/15	52%/48%	$\chi^2(1) = 0.01$, $p = .824$
Age (years)	39.24	12.13	43.68	14.01	$t(88) = 1.56$, $p = .121$
Years of pre-university education	12.20	1.27	11.69	1.56	$t(51.32) = 1.54$, $p = .130$
Age at illness onset (years)	17.51	10.48	–		–
Illness duration (years)	21.60	12.11	–		–
Psychopathology					
Y-BOCS total	20.29	5.92	–		–
Obsessions	9.56	3.47	–		–
Compulsions	10.73	3.68	–		–
OCI-R total	27.24	10.13	8.90	6.43	$t(84.74) = 10.46$, $p < .001$, 95% CI [14.85, 21.82], $d = 2.16$
Checking	6.14 {41}	3.69	1.48	1.63	$t(86.11) = 8.26$, $p < .001$, 95% CI [3.53, 5.77], $d = 1.63$
Comorbidities					
Major depression	36	61.1	–		–
Generalized anxiety disorder	10	16.9	–		–
Panic disorder	6	10.2	–		–
Agoraphobia	6	10.2	–		–
Medication					
Antidepressants	19	32.2	–		–
Combination of antidepressants and antipsychotics	7	11.9	–		–
None	33	55.9	–		–

Note. CI = confidence interval; OCI-R = Revised Obsessive-Compulsive Inventory; Y-BOCS = Yale-Brown Obsessive Compulsive Scale.
[a] Number of participants above the cutoff for each OCI-R subscale given in curved parentheses.
[b] Degrees of freedom given in round parentheses.

5.92).

3.2. IRAP - group differences

Eight one-sample *t*-tests, one for each TT in both groups, were conducted to examine whether TTs even produced a significant response bias (Bast & Barnes-Holmes, 2015). All individual TTs differed significantly from zero, $2.47 \leq t \leq 6.21$, $ps \leq .016$, aside from the *I am not peaceful* TT (OCD sample: $t(58) = 0.86$, $p = .395$; NCs: $t(30) = 1.22$, $p = .233$). This shows that neither group displayed any significant bias towards either *I am not – peaceful* → correct or *I am not – peaceful* → incorrect, in that latencies during both responding contingencies were similar. The one-sample *t*-tests for patients with checking compulsions revealed that TT D_{IRAP}-Scores differed significantly from zero, $2.30 \leq t \leq 6.21$, $ps \leq .027$, again except for the *I am not peaceful* TT, $t(49) = 1.29$, $p = .205$.

For the primary hypothesis, two 2 × 4 mixed analyses of variance (ANOVAs) were calculated with group (OCD and checking OCD vs. NCs, respectively) as the between-subject factor and the four D_{IRAP}-Scores of the different TTs as the within-subject factor (*I am* – [aggressive adjective], *I am* – [peaceful adjective], *I am not* – [aggressive adjective] and *I am not* – [peaceful adjective]).

In the 2 × 4 mixed ANOVA with the entire OCD sample and NCs, the main effect for group was non-significant, $F(1, 88) = 0.231$, $p = .632$, $\eta_p^2 = 0.003$. Both the OCD sample ($M = 0.22$, $SD = 0.29$) and NCs ($M = 0.25$, $SD = 0.24$) showed a bias towards a peaceful self-image. However, the main effect for TT was significant and moderate in size, $F(3, 264) = 11.558$, $p < .001$, $\eta_p^2 = 0.116$, which was further qualified by a significant interaction between group and TT, $F(3, 264) = 4.170$, $p = .007$, $\eta_p^2 = 0.045$. For the case that the main effect for TT was significant, subsequent independent sample *t*-tests were planned to compare the individual TT D_{IRAP}-Scores between groups. These showed a significantly higher D_{IRAP}-score for *I am aggressive* in the NCs group ($M = 0.49$, $SD = 0.44$) compared to the OCD group ($M = 0.15$, $SD = 0.48$), $t(88) = 3.23$, $p = .002$, 95% CI [0.13, 0.54], $d = 0.73$ (see Fig. 2). This shows that the OCD sample had more similar reaction times when instructed to affirm or deny the statement "*I am aggressive*", indicating a greater ambivalence towards the statement. No group differences emerged for the other TTs, $ps \geq .156$.

Results of the 2 × 4 mixed ANOVA comparing patients with checking compulsions ($n = 41$) to NCs yielded comparable results: There was no significant main effect of group, $F(1,70) = 0.039$, $p = .844$, $\eta_p^2 = 0.001$, but a significant main effect of TT, $F(3, 210) = 8.848$, $p < .001$, $\eta_p^2 = 0.112$, and a significant interaction between group and TT, $F(3, 210) = 4.135$, $p = .007$, $\eta_p^2 = 0.056$. Results of the independent sample *t*-tests again only showed a significant group difference for *I am aggressive*, $t(70) = 3.15$, $p = .004$, 95% CI [-0.54, -0.12], $d = 0.75$, other $ps \geq .081$. NCs ($M = 0.49$; $SD = 0.49$) showed a significantly higher D_{IRAP}-score on the *I am aggressive* TT compared to patients with checking compulsions ($M = 0.16$; $SD = 0.16$).

3.3. STAXI-II group differences

To evaluate explicit aggressiveness, STAXI-II scores were compared between groups (OCD and checking OCD vs. NCs, respectively) by independent sample *t*-tests. Mean *T*-values of both groups were within the average ranges (40–60; Rohrmann et al., 2013). Patients with OCD scored significantly higher on the *TA* and *AX-O* scales. Group comparison between NCs and patients with checking compulsions yielded the same results (see Table 3).

3.4. Correlations between IRAP and STAXI-II

The association between the explicit and the implicit measures of aggressiveness was assessed using Pearson's correlation coefficients computed between the *T*-values of STAXI-II scales and overall D_{IRAP}-Scores. No correlation was found for the overall D_{IRAP}-Score with any of the STAXI-II scales (see Table 4). There was a moderate negative correlation between the *I am aggressive* D_{IRAP}-Score with the *TA* score ($r = -0.33$, $p = .001$; Bonferroni corrected alpha level). The *I am aggressive* D_{IRAP}-Score was moderately negative correlated with the *AX-I* score ($r = -.31$, $p = .003$). Thus, the stronger patients' ambivalence (as indicated by a small positive D_{IRAP}-Score) or bias (as indicated by a negative D_{IRAP}-Score) towards the statement (*I am aggressive*), the more they suppress their anger (as indicated by the STAXI-II subscale *AX-I*).

3.5. Appraisal of stimuli

The explicit appraisal expert-rating of the adjectives used for the IRAP was confirmed by participants: valence mean ratings were ≤ 1.90 for aggressive adjectives (2 = *negative*) and ≥ 4.16 for peaceful adjectives (4 = *positive*). Patients with OCD rated a significantly higher number of aggressive words as personally meaningful ($M = 1.15$, $SD = 1.78$) than NCs ($M = 0.29$, $SD = 0.65$), $t(80.59) = 3.32$, $p = .001$, 95% CI [-1.38, 0.35], $d = 0.64$.

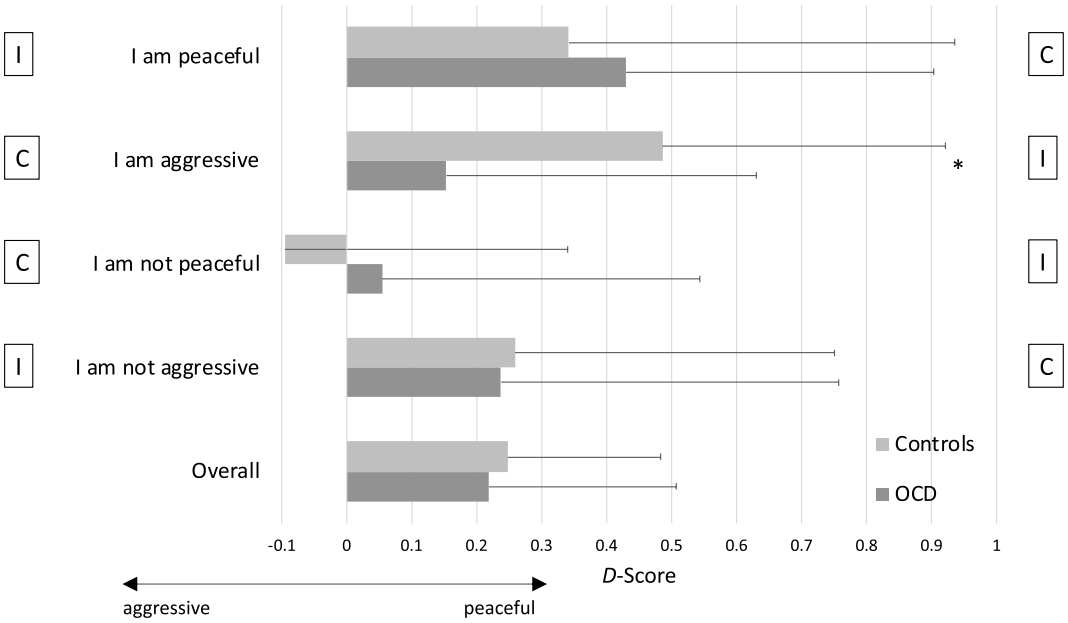

Fig. 2. Group Comparison of D_{IRAP}-Scores. Fig. 2. Mean overall and trial type D_{IRAP}-Scores of patients with OCD and non-clinical controls. Error bars are standard deviations and plotted only in the positive direction. The letters C = correct and I = incorrect represent the direction of the response biases that were recorded by the measures, e.g. during the *I am not aggressive* trial type, both groups responded faster when required to respond "correct" (i.e. inconsistent) than when required to respond "incorrect". *Significant between-group difference.

Table 3
STAXI-II scores and group comparisons.

STAXI-II scale	OCD total sample (n = 59)		OCD checkers only (n = 41)		Non-clinical controls (n = 31)		Group comparison	
	M	*SD*	*M*	*SD*	*M*	*SD*	OCD vs. controls	Checkers vs. controls
T-Ang	55.61	11.93	56.05	11.47	46.52	8.14	$t(81.90) = 4.26$, $p < .001$, 95% CI [4.85, 13.34] $d = 0.89$	$t(70) = 3.93$, $p < .001$, 95% CI [4.70, 14.37], $d = 0.96$
T-Ang/T	54.86	11.26	55.22	10.85	47.19	7.41	$t(83.42) = 3.88$, $p < .001$, 95% CI [3.73, 11.61], $d = 0.80$	$t(69.37) = 3.73$, $p < .001$, 95% CI [3.73, 12.3], $d = 0.86$
T-Ang/R	55.47	11.73	55.95	11.24	48.06	8.64	$t(88) = 3.10$, $p = .003$, 95% CI [2.66, 12.16], $d = 0.71$	$t(70) = 3.25$, $p = .002$, 95% CI [3.04, 12.73], $d = 0.79$
AX-O	53.15	10.45	53.76	10.39	46.90	6.71	$t(84.30) = 3.44$, $p = .001$, 95% CI [2.64, 9.86], $d = 0.71$	$t(68.52) = 3.39$, $p = .001$, 95% CI [2.82, 10.89], $d = 0.78$
AX-I	52.93	14.60	52.54	14.16	47.13	10.89	$t(88) = 1.95$, $p = .055$	$t(70) = 1.77$, $p = .082$
AC	48.86	9.46	48.54	9.73	52.52	10.46	$t(88) = 1.68$, $p = .097$	$t(70) = 1.66$, $p = .101$
AC-O	49.64	10.26	48.76	10.93	52.97	9.32	$t(88) = 1.51$, $p = .136$	$t(70) = 1.72$, $p = .089$
AC-I	47.83	10.23	48.10	10.33	50.77	10.98	$t(88) = 1.27$, $p = .209$	$t(70) = 1.06$, $p = .293$

Note. CI = confidence interval; T-Ang = Trait Anger; T-Ang/T = Trait Anger-Temperament; T-Ang/R = Trait Anger-Reaction; AX-O = Anger Expression-Out; AX-I = Anger Expression-In, AC = Anger Control, AC-O = Anger Control-Out; AC-I = Anger Control-In.

Table 4
Correlations of the Overall and Trial Type D_{IRAP}-Scores with the STAXI-II Scales in the Overall Sample (N = 90).

D_{IRAP}-Score	STAXI-II scales							
	T-Ang	T-Ang/T	T-Ang/R	AX-O	AX-I	AC	AC-O	AC-I
Overall	-.068	.032	-.123	-.002	-.183	-.029	-.094	.032
I am aggressive	**-.330****	-.270*	-.279**	-.159	**-.306****	-.074	-.065	-.082
I am peaceful	.108	.102	.103	.097	-.159	-.213*	-.254*	-.146
I am not aggressive	.061	.124	.008	-.001	.064	.077	-.004	.150
I am not peaceful	.002	.106	-.115	.054	.002	.161	.134	.157

Note. AC = Anger Control; AC-O = Anger Control – Out; AC-I = Anger Control – In; AX-O = Anger Expression – Out; AX-I = Anger Expression – In, STAXI-II = State-Trait Anger Expression Inventory II; T-Ang = Trait Anger; T-Ang/T = Trait Anger – Temperament; T-Ang/R = Trait Anger – Reaction; Correlations which withstood Bonferroni correction (required $p < .0038$) are typed in boldface. **$p < .01$, *$p < .05$.

3.6. Reliability

In keeping with prior IRAP research, internal consistency of two overall D_{IRAP}-Scores (one for even and one for odd trials) was determined by split-half reliability using a Spearman-Brown correction (Bast & Barnes-Holmes, 2015; Campbell, Barnes-Holmes, Barnes-Holmes, & Stewart, 2011; Drake et al., 2010). The split-half correlation was strong and significant, $r = 0.559$, $n = 90$, $p < .001$ (after Spearman-Brown correction).

3.7. Exploratory analyses

To assess potential confounders of IRAP effects, we compared the raw latencies of the two sample stimuli and found that across groups, responses to *I am* trials were faster than to *I am not* trials, $t(89) = 16.56$, $p = < .001$, 95% CI [-772.11; -606.65], $d = 1.33$. Moreover, there was no correlation between cognitive processing speed (Trail Making Test-A) and latency on *I am* or *I am not* trials ($ps > .202$).

Furthermore, we investigated whether higher levels of implicit aggressiveness in patients with OCD were associated with depressive symptoms, as has been previously shown using explicit measures (Jessup et al., 2018; Moscovitch et al., 2008; Whiteside and Abramowitz, 2004, 2005). Therefore, Beck Depression Inventory II (BDI-II) scores were correlated with overall D_{IRAP}-Scores and trial type D_{IRAP}-Scores. We also correlated BDI-II scores with the raw overall STAXI-II score (excluding *State Anger*) to confirm the explicit relationship in the current sample. As a further precondition, we confirmed that there was a group difference on the overall raw STAXI-II score ($t(88) = 2.86$, $p = .005$). We found a strong correlation of the STAXI-II score with the BDI-II score ($r = 0.504$, $p < .001$) and a moderate correlation between the *I am aggressive* TT D_{IRAP}-Score with the BDI-II score ($r = 0.309$, $p = .003$). Results of an ANCOVA (independent variable = group, dependent variable = STAXI-II score, covariate = BDI-II score) showed that the group difference in the STAXI-II score was no longer significant when accounting for depression, $F(1, 87) = 0.334$, $p = .565$. The group difference also became non-significant when calculating the same ANCOVA with the *I am aggressive* D_{IRAP}-Score as the dependent variable, $F(1,87) = 2.612$, $p = .110$.

4. Discussion

The aim of the present study was to investigate whether patients with OCD differ from NCs in their self-concept of aggressiveness. In the explicit assessment, patients with OCD scored higher on overall anger/aggressiveness as well as subscales measuring trait anger and outward expression of anger. There was no group difference in overall implicit aggressiveness. However, patients with OCD showed a less pronounced peaceful bias on the *I am aggressive* TT than NCs, in that while both groups responded faster during consistent blocks (*I am – aggressive → incorrect*) than inconsistent ones (*I am – aggressive → correct*), the relative difference in response latency was smaller in patients with OCD than NCs. With regard to explicit-implicit relations, the smaller the *I am aggressive* D_{IRAP}-Score (implicit; i.e., small peaceful bias [positive but small D_{IRAP}-Score] or even aggressive bias [negative D_{IRAP}-Score]), the stronger patients' experience of anger and outwards expression of anger (explicit). Patients with checking compulsions differed from NCs on the same scales as the overall OCD sample. In sum, the primary hypothesis, expecting a difference in aggressiveness assessed by the IRAP (overall D_{IRAP}-Score), was not confirmed. Secondary hypotheses were confirmed partially, which is discussed in greater detail below.

In the explicit rating, patients with OCD reported experiencing more anger and externalization of aggressive feelings than NCs. This is in line with prior research (Liu et al., 2017; Radomsky et al., 2007; Whiteside and Abramowitz, 2004, 2005), yet it opposes Rachman's (1993) hypothesis by which patients with OCD tend not to express anger outwardly due to internalization of blame. Contradicting this aspect of his theory further, prior research is inconsistent as to which specific facet of aggressiveness is elevated in patients with OCD (Liu et al., 2017; Radomsky et al., 2007; Whiteside and Abramowitz, 2004, 2005). We therefore conclude that while patients with OCD consistently self-report higher levels of aggressiveness than the general population, its expression (internalization/externalization) may not be related to OCD.

Groups did not differ in their overall implicit aggressiveness, in line with the two other studies that investigated implicit aggressiveness in OCD which used the Agg-IAT (Cludius et al., 2017, 2020). This is presumably due to groups differing only on the *I am aggressive* TT: Both groups displayed an implicit bias towards non-affirmative trials (*I am – aggressive → incorrect* faster than *→ correct*), yet patients with OCD scored significantly lower. A small absolute D_{IRAP}-Score indicates that latencies were more similar during both responding contingencies. This tentatively implies that patients with OCD were ambivalent about their own aggressiveness compared to NCs, who were faster to reject an aggressive self-image. Moreover, the standard deviation (0.48) of the OCD group's mean *I am aggressive* D_{IRAP}-Score (0.15) spans negative values, indicating that several patients responded faster during some aggressiveness-affirming trials.

This is the first study using an implicit measure that, at the least, shows patients with OCD displayed a smaller bias towards disagreeing with the statement *I am aggressive* than NCs as expressed through response latency; and at the most, implies that they lean towards a more aggressive self-concept than NCs. As these findings directly contradict the studies on aggressiveness in OCD using another implicit measure (Cludius et al., 2017, 2020), they must be viewed only as a first indication and require replication.

Both groups exhibited a peaceful bias in the *I am peaceful* TT (*correct* faster than *incorrect*). For NCs, this bias is expectable; in patients with OCD the bias does not necessarily contradict their low mean *I am aggressive* D_{IRAP}-Score. While linguistically, peacefulness may be the opposite of aggressiveness, both can coexist as well-learned relations because they are highly situational emotional traits (Spielberger & Reheiser, 2010). Our findings tentatively suggest that the *I am peaceful* TT was lacking in discriminant validity, implying that patients with OCD do not differ in their implicit self-concept of peacefulness from NCs. The constellation of these findings highlights the value of the IRAPs ability to assess relations independently (i.e., self – peaceful *and* self – aggressive), and not just the relative strength of associations as revealed in the IAT (i.e., self – peaceful *vs.* self – aggressive).

As for TTs with negation statements, *I am not aggressive* produced a peaceful bias in both groups (*correct* faster than *incorrect*), while *I am not peaceful* failed to produce any bias. For one, double-negative thinking (in a block asking participants to respond in line with a peaceful self-image: *I am not – peaceful → incorrect*) requires multiple cognitive steps, inherent to EERRs. Therefore, these TTs may not have produced implicit responses. We presume that affirmation and negation of a statement cannot be considered two sides of the same coin in IRAP designs (seeing as the *I am peaceful* TT *did* produce a bias), because they produce systematically different responses. This is confirmed by comparison of raw latencies: across both groups, *I am* yielded faster responses than *I am not*. The difference suggests cognitive processing speed may have skewed IRAP results. However, while participants with OCD did show slower cognitive processing than NCs (TMT-A), cognitive processing speed was unassociated with *I am* or *I am not* response latency.

The discussion thus far was conducted through the lens of the REC model, which dominated IRAP effect interpretation at the time this study was designed. Since then, the differential arbitrarily applicable relational responding effects (DAARRE) model (Finn, Barnes-Holmes, & McEnteggart, 2018) has gained traction as a framework for explaining the differing sizes of trial-type effects. To reflect the current state of research, we conducted a post-hoc DAARRE model interpretation of our IRAP results. The model is not explained here in the interest of brevity; for a detailed description, see Finn et al. (2018).

We conducted the DAARRE interpretation in keeping with our

hypotheses. The orienting function (*Cfunc*) properties of the sample stimuli are labeled "+" for *I am* and "–" for *I am not* (cf. Pidgeon, McEnteggart, Harte, Barnes-Holmes, & Barnes-Holmes, 2020). The most plausible *Cfunc* properties of the target stimuli are positive for peaceful adjectives (+) and negative for aggressive ones (−). The relationship (*Crel*) properties likely differ between groups, therefore we created two separate DAARRE models. For NCs, we posit a stronger coherence (+) for *self-peaceful* relations, i.e. *I am – peaceful* and *I am not – aggressive* (Fig. 3). The *Crel* between sample and target stimuli in the OCD sample was, in a sense, the central research question of this study. Explicit findings suggest a stronger coherence for *self-aggressive* relations, while Cludius et al.'s (2017, 2020) IAT studies provide evidence for a positive *self-peaceful Crel.* For the OCD sample, we therefore labeled the *Crels* as +/− to reflect this ambiguity (Fig. 4). In line with prior DAARRE models (e.g., Pidgeon et al., 2020), the relational coherence indicators (RCIs, i.e., response options) are labeled + for *correct* and – for *incorrect.*

IRAP results in the OCD sample show a single trial-type dominance effect (STTDE) for the *I am peaceful* TT, in line with the post-hoc DAARRE model. This effect denotes a large difference in the size of bias between trial types that have the same Cfunc properties (i.e., *I am* and *peaceful* both +, *I am not* and *aggressive* both −) and share a required response option within blocks (Finn et al., 2018, 2019). In contrast, the NC group responding pattern deviated: The strongest peaceful bias emerged for the *I am – aggressive* (→ incorrect) TT. A tentative explanation for this is the coherence between properties of the target stimulus and response option, which may have dominated the responding pattern (cf. Kavanagh et al., 2019; Pidgeon et al., 2020). This logic holds for the *I am – peaceful* TT (*peaceful* and *correct* both +) and the *I am – aggressive* TT (*aggressive* and *incorrect* both −), which produced the largest IRAP effects in the NC group. Contradicting this line of thinking, *I am not – aggressive* (−) → *correct* (+) also produced a significant peaceful bias.

A potential priming influence of procedures conducted prior to the IRAP on the functional properties of the stimuli, and how this may differentially impact groups, remains a further open question. Again, we emphasize that the DAARRE model interpretation is speculative and post-hoc. We hope our experiences may aid fellow researchers in their design of IRAP experiments, especially those using self-referential statements.

Correlational analysis revealed that an implicit aggressiveness bias was associated with a higher self-reported propensity for anger and a tendency to internalize aggressiveness. These correlations were only moderate in strength, in line with meta-analysis showing implicit-explicit correlations to be generally modest (Hofmann et al., 2005).

Analyses of the subsample of patients with checking compulsions resembled those of the overall sample in the implicit and explicit assessments. This finding adds to the mounting evidence (Tellawi, Williams, & Chasson, 2016; Whiteside & Abramowitz, 2004) contradicting Rachman's (1993) hypothesis by which patients with checking compulsions are especially affected by aggressiveness.

In exploratory analysis we showed that the covarying influence of depression on aggressiveness in OCD observed in explicit rating (Whiteside & Abramowitz, 2004) was also present when analyzed using the IRAP. In light of extensive research showing elevated aggressiveness in patients with depression (for a summary, see Busch, 2009), it is conceivable that aggressiveness is not specifically related to OCD, but rather a feature of depression or negative affect in general (Moscovitch et al., 2008). Given that 40% of patients with OCD suffer from comorbid major depressive disorder (Ruscio et al., 2010), the interplay between self-perceived aggressiveness, OCD, and depression remains a topic of interest, even if the premise of investigation may shift in the future. We conclude from our findings that the influence of depression must be a target of investigation in future research and considered in the design of any future studies on aggressiveness in OCD.

Internal consistency was suboptimal ($r = 0.559$), yet largely similar to the weighted mean $r = 0.653$ from a meta-analysis of nine individual IRAP samples (Golijani-Moghaddam et al., 2013). The meta-analysis suggests that a 2000 ms latency criterion could improve consistency – we refrained from this since our OCD population's cognitive processing speed may have been reduced due to medication or comorbid depression (Benkert & Hippius, 2012; Lam, Kennedy, Mclntyre, & Khullar, 2014). Mean TT D_{IRAP}-Scores did not exceed 0.5 in our sample, whereas the theoretical range of the D_{IRAP}-Scores is −2 to +2. This again resembles the results of other IRAP studies which used self-referential statements (e.g., Bast & Barnes-Holmes, 2015; Remue, De Houwer, Barnes-Holmes, Vanderhasselt, & De Raedt, 2013).

Diagnosis of OCD was verified using a standardized interview (MINI 5th Ed.) and the IRAP task was completed under standardized conditions. The IRAP stimuli were chosen by experts for their relevance to OCD, which was verified by participants' stimulus rating: On average, patients with OCD found more stimuli personally meaningful than NCs, and all stimuli used were clearly identified as aggressive or peaceful, respectively. Further, mastery criteria and sample size adhere to current

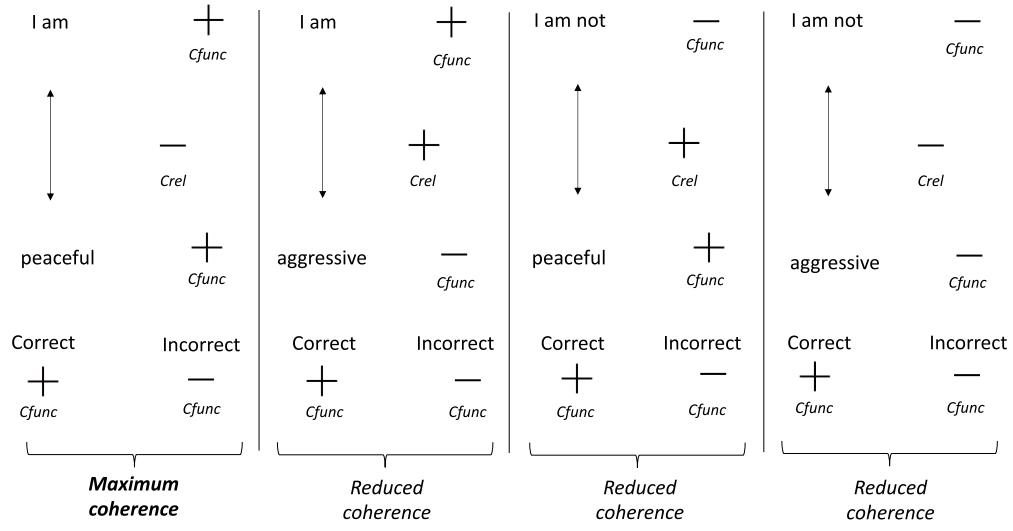

Fig. 3. DAARRE Model for non-clinical controls. Fig. 3. The DAARRE model as applied to the non-clinical control group. The plus and minus signs refer to the relative positivity/negativity of the *Cfuncs* for the sample-, target stimuli, and response options, and the positivity/negativity of the *Crels* between sample and target stimuli. Note that the results of this post-hoc interpretation do not mirror the actual findings in the non-clinical control group.

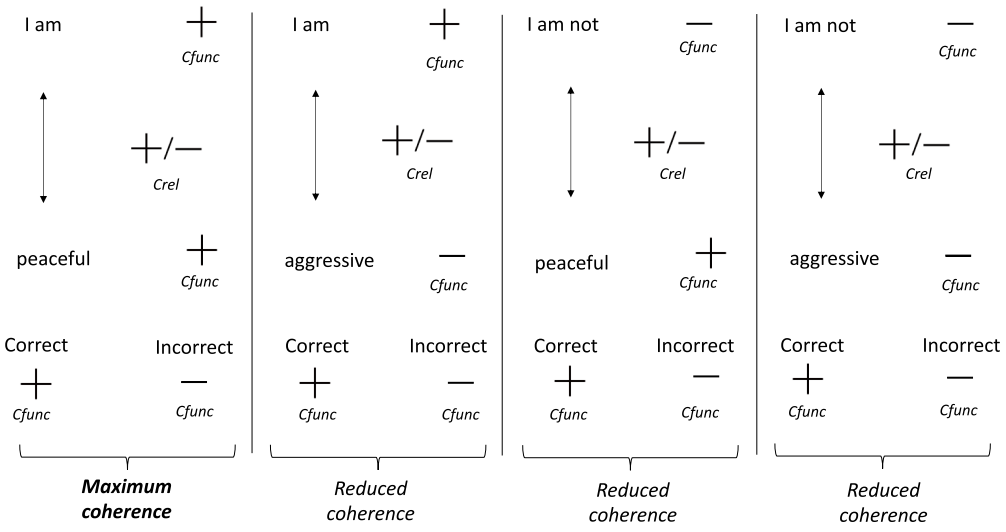

Fig. 4. DAARRE Model for Patients with OCD. Fig. 4. The DAARRE model as applied to the OCD sample. The plus and minus signs refer to the relative positivity/negativity of the *Cfuncs* for the sample-, target stimuli, and response options, and the positivity/negativity of the *Crel* between sample and target stimuli. The results of this post-hoc interpretation mirror the actual responding pattern in the OCD sample.

IRAP recommendations, and internal reliability was comparable to other IRAP studies. Therefore, we presume that the observed group difference in the *I am aggressive* D_{IRAP}-Score stems from a true difference in responding pattern. Further, our study confirms the feasibility of using the IRAP in a clinical sample.

However, our IRAP design yielded only one TT group difference. As discussed above, this may be attributed to the fact that TTs lacked discriminant validity (*I am peaceful*, *I am not aggressive*) or were unsuitable for producing an immediate relational response (*I am not peaceful*). A typical obstacle in the design of IRAPs (cf. Bast & Barnes-Holmes, 2015; Parling, Cernvall, Stewart, Barnes-Holmes, & Ghaderi, 2012), this highlights that all combinations of sample and target stimuli should ideally amount to statements that are commonplace. A further limitation of our data was the absence of further practice blocks ahead of the IRAP (Kelly & Barnes-Holmes, 2013), which would have led to faster responses in the trial blocks, in turn resulting in less exclusions of block pairs/participants. Additionally, some procedural details of the IRAP slightly differed from the typical IRAP (e.g., response options were at the top vs. the bottom of the screen). Thus, it cannot be completely ruled out that these differences affected the outcome, although the procedure was already used and tested by Rönspies et al. (2015). Furthermore, as we conducted several ANOVAs, error rates may be inflated, thus results must be interpreted cautiously.

One of the aims of this study was to reconcile Cludius et al.'s finding (2017) of no group difference in aggressiveness using an implicit task with prior research using explicit assessments. Our results also yielded no overall difference in implicit self-rated aggressiveness yet tentatively suggest that patients with OCD were more ambivalent about their own aggressiveness than NCs. This implicit finding is ambiguous compared to the consistently elevated levels of aggressiveness in self-report, contradicting Freud's theory of latent aggression at the core of OCD. Our research further implies that depression likely plays a confounding role in self-perceived aggressiveness. The extent to which implicit aggressiveness is inherent to the emotional landscape of patients with OCD remains subject to further research, especially due to the novelty of our design and the continuing evolution of IRAP analysis strategies. Our research confirms the feasibility of the IRAP in a clinical sample and prospectively allows aggressive tendencies to be appropriately interpreted and addressed in therapeutic settings.

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Declaration of competing interest

None.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.jcbs.2021.06.008.

Anger is an emotional state, whereas *aggression* describes the behavioral component of anger expression (Spielberger & Reheiser, 2010). *Aggressiveness* denotes the propensity for aggression.

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