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# Do perfectionists show negative, repetitive thoughts facing uncertain situations?

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## Abstract

Perfectionism, intolerance of uncertainty and repetitive negative thinking are all psychological traits, which are treated as transdiagnostic phenomena for the development and the maintenance of psychopathology. The aim of the current work was to investigate the associations between repetitive negative thinking and the multidimensional aspects of perfectionism (perfectionistic strivings and perfectionistic concerns) and intolerance of uncertainty (prospective and inhibitory) in one model. Two studies were conducted in which participants ( $N_1 = 227$ ;  $N_2 = 148$ ) completed questionnaires in an online survey. The first study measured rumination and worry separately as repetitive negative thinking processes. The second study measured repetitive negative thinking as an underlying construct of rumination and worry using a single questionnaire. We applied hierarchical regression analyses and mediation analyses in both studies. The mediation analyses in both studies showed that inhibitory intolerance of uncertainty significantly partially mediated the relationship between perfectionistic concerns and repetitive negative thinking (as well as worry and rumination). Perfectionistic concerns seem to be the more crucial perfectionism aspect for transdiagnostic considerations, particularly in association with a heightened inhibitory intolerance of uncertainty and repetitive negative thinking. Both studies strongly affirm the necessity to use the multidimensional aspects of perfectionism and intolerance of uncertainty in psychological research.

**Keywords** Perfectionism · Perfectionistic strivings · Perfectionistic concerns · Repetitive negative thinking · Worry · Rumination · Intolerance of uncertainty · Transdiagnostic phenomena

## Introduction

### Perfectionism

Perfectionism is a stable personality trait that can generally be defined as the demand of being perfect (i.e. absolutely faultless) in all sorts of performance-related situations combined with the anxiety of being insufficient and the emotional belief that only perfection leads to self-acceptance (Greenspon, 2008; Stoeber, 2018) described perfectionism as a personality trait which combines subdimensions that are characterized by one's own exceptional high standards, the attempt to be flawless and being very critical towards

one's own behaviour. Perfectionism has been described as a transdiagnostic phenomenon that contributes to the development and the maintenance of psychopathology across multiple domains, e.g. affective disorders, anxiety disorders or eating disorders (Egan et al., 2011; Limburg et al., 2017). Different multidimensional models (e.g. Frost et al., 1990) highlighted that this personality disposition is characterized through several dimensions such as doubts about actions, concern over mistakes, organisation, self-oriented perfectionism or other-oriented perfectionism (for an overview, see Stoeber, 2018). Two higher-order dimensions of perfectionism – often termed *perfectionistic concerns* (PC) and *personal standards or strivings* (PS; Sirois & Molnar, 2016; Stoeber & Otto, 2006) – frequently and reliably emerge in factor analytical approaches (Bieling et al., 2004; Stoeber, 2018).

High PC describes the tendency to fear negative performance evaluation by others. Furthermore, people with high PC are more anxious to make mistakes, they are less confident about their actions, and they show negative reactions

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to imperfection (e.g., if a person shows imperfect performance, they are likely to treat it as personal failure). PS, in turn, reflects the need to set high criteria to one's own performance and the intrinsic motivation to show an outstanding performance. People with high PS are also more conscientious and show a higher endurance (Stoeber, 2018).

These two perfectionism dimensions are clearly varying in their outcomes regarding psychopathology (Stoeber, 2018). PC perfectionists appear to be associated with obsessive compulsive disorder (OCD; Martinelli et al., 2014), depression (Drieberg et al., 2019; Smith et al., 2017), anxiety (Handley et al., 2014; Limburg et al., 2017) or eating disorders (Bardone-Cone et al., 2007; Drieberg et al., 2019). Due to the heterogeneous findings there is still a scientific debate about the adaptive or maladaptive character of PS (e.g., Stricker et al., 2019). On the one hand, PS perfectionists have been associated with lower levels of depression (Rice et al., 2008), anxiety (Gnilka et al., 2012), and stress (Ashby & Gnilka, 2017). On the other hand, several studies concurrently associate PS with psychological maladjustment (Egan et al., 2011; Smith et al., 2017), especially regarding eating disorders (Brososof et al., 2019; Limburg et al., 2017). Eventually, it is possible to state that PS can be viewed as a double-edged sword with potential psychological adaptive and maladaptive outcomes (Gaudreau et al., 2018).

In their 2×2-model of perfectionism, Gaudreau and Thompson (2010) address these incoherent findings concerning the effect of PS. This interaction model facilitates the examination of the combination of the two dimensions such as non-perfectionism (low PS and low PC), pure PS (high PS and low PC), pure PC (low PS and high PC), and mixed perfectionism (high PS and high PC; cf., Gaudreau et al., 2018; Gaudreau & Thompson, 2010). Gaudreau and Thompson (2010; 2018) propose that these four subtypes of perfectionism are associated with different outcomes regarding psychological *adjustment* (e.g. life satisfaction, well-being, positive self-evaluation) or *maladjustment* (e.g. depression, burnout, anxiety). The authors suggest that high PC perfectionism is associated with worse outcomes (e.g., negative affect, avoidant coping) than the other three subtypes.

Mixed perfectionists are hypothesized to be associated with worse outcome than pure PS but better outcome than pure PC (Gaudreau et al., 2018; Gaudreau & Thompson, 2010), as they assume a protective character of PS. Several studies support this 2×2 model (Damian et al., 2014; Gaudreau et al., 2019). However, the 2×2 model challenges another prominent approach the tripartite model, which differentiates maladaptive perfectionists, adaptive perfectionists and non-perfectionists (Rice & Ashby, 2007; Stoeber & Otto, 2006). The model describes adaptive perfectionists as

high in PS and low in PC, maladaptive perfectionists as high in PS and high in PC and non-perfectionists as low in PS.

### Repetitive negative thinking

The pertinent components of perfectionism like the fear of negative evaluation by others or the evaluation of one's own performance can lead to actual or anticipated distress (Stoeber & Otto, 2006; Stoeber et al., 2018). This could be accompanied by negative maladaptive emotion regulation strategies (Wahl et al., 2019) such as repetitive negative thinking (RNT) processes (Flett et al., 2016). RNT consists of negative, uncontrolled, and excessive thoughts about present problems, previous experiences, and future worries (Watkins & Roberts, 2020). This definition comprises two common forms of RNT, rumination and worry. *Rumination* can be described as 'a mode of responding to distress that involves repetitively and passively focusing on symptoms of distress and the possible causes and consequences of these symptoms' (Nolen-Hoeksema et al., 2008, p. 400). *Worry* in turn can be defined as 'a chain of thoughts and images, negatively affect-laden, and relatively uncontrollable' (Borkovec et al., 1983, p. 10).

Some researchers argued that these processes are two types of RNT, who share the same underlying process and should not be differentiated (e.g. McEvoy et al., 2013; Topper et al., 2014). However, there is also evidence that they can be distinguished concerning their content and temporal orientation; while worry is described more future-oriented, rumination is characterized as past-oriented (Seegerstrom et al., 2000; Watkins et al., 2005). Nevertheless, increasing evidence suggest that RNT is a transdiagnostic risk factors for the development and maintenance of multiple forms of psychopathology such as depression and anxiety disorders (McEvoy et al., 2019; McLaughlin & Nolen-Hoeksema, 2011; Spinhoven et al., 2018) and OCD (Arditte et al., 2016; Wahl et al., 2011).

### Perfectionism and repetitive negative thinking

Previous studies highlight unique associations between PC perfectionists and rumination (Blankstein & Lumley, 2008; van der Kaap-Deeder et al., 2016) as well as PC and worry (Kawamura et al., 2001; Santanello & Gardner, 2007) and RNT in general (Garratt-Reed et al., 2018). Whereas the studies by Santanello and Gardner (2007) and Kawamura et al. (2001) did not report any significant associations with PS perfectionists, a study by Buhr and Dugas (2006) showed only a significant association between PS perfectionists and worry. However, several studies showed that PC perfectionists and PS perfectionists can both be linked to worry (Flett et al., 2011; Handley et al., 2014; Xie et al., 2019),

rumination (Blankstein & Lumley, 2008; Flett et al., 2011; Xie et al., 2019) and RNT in general (Macedo et al., 2015).

The two perfectionism subdimensions were jointly and systematically investigated with worry, rumination and repetitive negative thinking in several studies (for an overview of these studies, see Table S1 supplementary material).

There are multiple purposes, why perfectionists uses maladaptive emotion regulation strategies such as RNT, e.g. coping with the fear of failure, trying to obtain helpful feedback to limit future errors, and making uncertain situations more predictable (Flett et al., 2016; van der Kaap-Deeder et al., 2016). The tendency to cope with uncertain situations in a (maladaptive) way as we can observe with RNT might be a part of a trait known as intolerance of uncertainty (IU), a further important transdiagnostic phenomenon besides perfectionism and RNT.

### Intolerance of uncertainty

IU is the dispositional characteristic associated with negative beliefs and reactions to situations that are perceived as unpredictable (Robichaud et al., 2019). IU was postulated to consist of two different dimensions, *prospective* IU and *inhibitory* IU (Birrell et al., 2011; Carleton, 2012; Hong & Cheung, 2015). Prospective IU comprises the appraisal of future uncertainty as threatening, a desire for predictability and resulting coping strategies to decrease the experienced uncertainty. In contrast, inhibitory IU is related to behavioral inhibition or avoidance also described as a paralysis of cognition and action in case of uncertain situations (Birrell et al., 2011; Carleton, 2012). Although the concept of IU was initially developed as a specific characteristic of the general anxiety disorder (Dugas et al., 1998), more recently, compelling evidence suggests that IU is a transdiagnostic process for multiple psychopathologies such as depression (Boelen et al., 2016), OCD (Reuther et al., 2013), social anxiety (Whiting et al., 2014) and eating disorders (Brosf et al., 2019; Shihata et al., 2016) propose that a generally higher IU creates a conflicting cognitive-motivational state due to the diverging effects of the two IU dimensions: on the one hand, prospective IU promotes strategies to increase predictability, on the other hand, inhibitory IU rather leads to cognitive avoidance strategies.

### Intolerance of uncertainty and repetitive negative thinking

IU is also described as a key component in the development and maintenance of worry and accordingly associated with worrying (Buhr & Dugas, 2006; Jong-Meyer et al., 2009). Thus, IU is also linked to ruminative processes (Barry et al., 2019; Huang et al., 2019) and RNT in general (McEvoy &

Mahoney, 2013; Yook et al., 2010) showed that worry and rumination are partially mediating the association between IU and anxiety and depressive symptoms.

In the context of the two-dimensional approach of IU, Hong and Lee (2015) reported that inhibitory IU was more associated to cognitive perseveration, in form of rumination and worry, compared to prospective IU. The authors suggested that the feeling of being paralysed facing uncertainty, increased through inhibitory IU, is related to a negative, uncontrolled, and excessive thinking style. An overview of studies linking intolerance of uncertainty, worry, rumination and repetitive negative thinking is provided in Table S2 (supplementary material).

### Intolerance of uncertainty and perfectionism

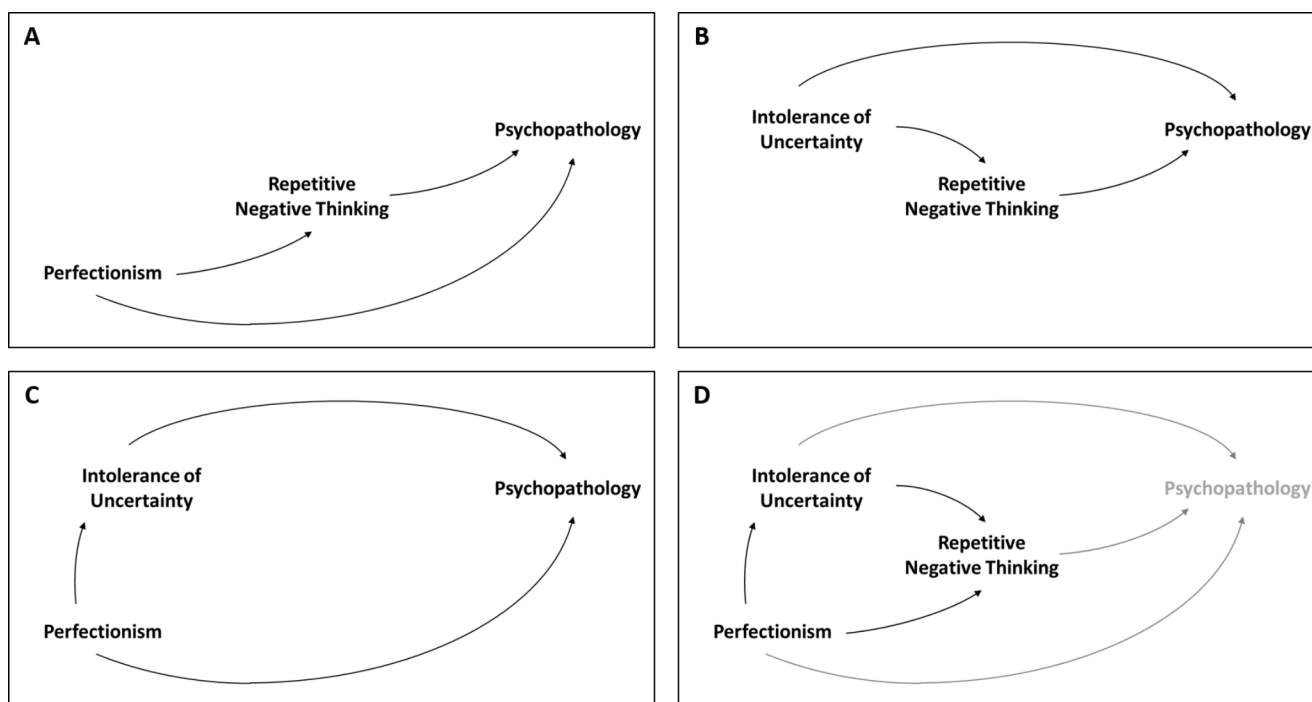
The absence of predictability and lack of information in uncertain situations make it hard for perfectionists to satisfy their high expectations and prevent negative evaluations or errors. Accordingly perfectionists, particularly PC perfectionists suffer from high IU (Brosf et al., 2019; Kawamoto & Furutani, 2018; Williams & Levinson, 2021). This is also shown in studies reporting that IU mediated the relationship between perfectionism and eating disorders (Brosf et al., 2019), or psychological maladjustment (Kawamoto & Furutani, 2018).

Unfortunately, to our knowledge no study examined possible relations between the two-dimensional approach of IU and the two superordinate dimensions of perfectionism. However, Whiting et al. (2014) showed that inhibitory IU was more strongly associated with fear of negative evaluation than prospective IU. Accordingly, it is derivable that inhibitory IU could be more related to PC perfectionism than to PS perfectionism (for a list of studies linking intolerance of uncertainty and perfectionism, see Table S3 supplementary material).

### Intolerance of uncertainty, perfectionism, and repetitive negative thinking

The above-mentioned studies demonstrate some notable relationships between the three transdiagnostic phenomena perfectionism, RNT and IU. Based on these findings, we propose that IU has a mediating effect on the relationship between perfectionism and RNT. We derive this hypothesis based on three mediation models reported in the literature.

First, RNT has been shown to mediate the association between perfectionism and psychopathology (Fig. 1A; Flett et al., 2011; Macedo et al., 2015). Second, studies have demonstrated that RNT mediates the relationship between IU and psychopathology (Fig. 1B; Huang et al., 2019; Yook et al., 2010). Thus, it appears that both, perfectionism, and IU



**Fig. 1** Illustration of the derivation of the hypothesis. RNT has been shown to mediate the relationship between perfectionism and psychopathology (panel A) and IU and psychopathology (panel B). Furthermore, IU has been found to mediate the relationship between perfectionism and psychopathology (panel C). These mediation models imply that IU serves as a mediator for the relationship between perfec-

tionism and RNT. Panel D shows the amalgamation of all three mediation models. The black words and arrows mark the derived mediation model that we investigate in the current study. The grey word and arrows indicate implied relationships and variables which are not relevant for the current study

contribute to the development and maintenance of psychopathological symptoms through specifics of RNT. Third, IU has been found to mediate the relationship between perfectionism and psychopathology (Fig. 1C), probably because perfectionists have issues to endure insufficient information (Brosof et al., 2019; Kawamoto & Furutani, 2018; Reutehr et al., 2013). While these three mediation models helped investigate how perfectionism, IU, and RNT relate to psychopathology, to our knowledge, the relationship among these three psychological constructs has not been investigated jointly, especially in the context of the interactionist assumptions of the  $2 \times 2$  model of perfectionism (Gaudreau et al., 2018; Gaudreau & Thompson, 2010) and the two-dimensional approach of IU (Birrell et al., 2011; Carleton, 2012). Our study aims at filling this gap. We draw on the mediation models of previous studies (Fig. 1A and C) to derive that IU is likely to mediate the relationship between perfectionism and RNT (Fig. 1D).

## Aims of the studies

We examined if the four perfectionism subtypes share unique associations with the two dimensions of IU and RNT. Further, we investigated to what extent the two dimensions

of IU are linked to the RNT processes and if a relationship between perfectionism and RNT is mediated by IU. Hereby, we hoped to fill the gaps in the current research (see Fig. 1 and Table S2, Table S3 supplementary material). We pre-registered the study and our hypotheses via *aspredicted* ([https://aspredicted.org/blind.php?x=/FZZ\\_DEE](https://aspredicted.org/blind.php?x=/FZZ_DEE))<sup>1</sup>. To this end, we conducted two questionnaire studies, which we will describe briefly in the following.

The first study considered the  $2 \times 2$  model of perfectionism and the two-dimensional approach of IU. Rumination and worry were measured separately as RNT processes to investigate, if they share the same underlying features or show unique effects.

Based on the results of the first study, a second questionnaire study was carried out, measuring RNT as an underlying construct of rumination and worry with a single questionnaire.

<sup>1</sup> Due to a technical error, the first survey did not include the perseverative thinking questionnaire (Ehring et al. 2011) as planned but two questionnaires (Barenbrügge et al. 2012; Huffziger and Kühner 2012), measuring RNT processes separately. As we collected 227 datasets, we wanted to present the data, but to run a follow-up study (with the planned questionnaires) based on the findings of the first study.

## Study 1

In line with the considerations from Gaudreau and Thompson (2010), we assumed for our correlation analyses that pure PC perfectionists will have the strongest associations with inhibitory IU as a negative outcome (Hypothesis 1). Even though prospective IU can also be related to negative consequences, we expect that pure PS perfectionists will show a stronger association with prospective IU than pure PC perfectionists (Hypothesis 2). Both, PS perfectionists and persons with higher prospective IU should show more active coping strategies facing uncertainties. Rumination and worry are more passive and avoidant emotional regulation strategies; accordingly, we assumed that PC perfectionists show a stronger association with worry and rumination than PS perfectionists (Hypothesis 3). Additionally, we expected rumination and worry to be more positively associated with inhibitory IU than with prospective IU (Hypothesis 4).

For our regression analyses, with the RNT aspects as dependent variable, we expected a confirmation of the correlation analyses (Hypothesis 5). Additionally we assumed an interaction effect of PC and PS perfectionists, which should reflect the mixed perfectionists according to Gaudreau and Thompson (2010). Mixed perfectionists should show a minor association with the RNT aspects than PC perfectionists and worse outcomes than PS perfectionists (Hypothesis 6). Eventually, we also expect a mediating effect of IU of the relationship between perfectionism and RNT, which will be analysed exploratorily.

## Methods

### Participants

Data from 235 German participants were collected. We aimed to collect at least 210 participants (80% power) to identify small to medium mediation effects using the Sobel first-order test (Fritz & MacKinnon, 2007). After removing data of eight participants based on incomplete questionnaires our final sample consisted of 227 German participants (166 female, 1 diverse and 60 male) aged 18 to 66 years ( $M=27.54$ ;  $SD=9.81$ ). The sample consisted of 147 students, 67 employed persons and 13 others (e.g., unemployed, retired). Of the 147 students, 86 were students from the University of Cologne and were credited participation points for completing the survey.

## Measures

### Repetitive negative thinking

*The Münster Worry Questionnaire* (Münsteraner Sorgenfragebogen; MSF; Barenbrügge et al., 2012) is a 12-item questionnaire that assesses pathological worry. Participants answer on a 5-point-scale from 1 ('trifft überhaupt nicht zu', German for 'not correct at all') to 5 ('trifft voll und ganz zu', German for 'completely right'). The questionnaire showed a satisfactory homogeneity and reliability through the calculation of a one-dimensional confirmatory factor analysis (Barenbrügge et al., 2012). In the current study, we found a high internal consistency (Cronbach's  $\alpha=0.94$ ).

*The German version of the Response Styles Questionnaire* (RSQ; Treynor, 2003; German version RSQ10-D, (Huffziger & Kühner, 2012) is a 10-item questionnaire, which measures two subfactors, brooding and reflection, of rumination. Only the subscale brooding with five items on a 4-point-scale from 1 ('fast nie', German for 'almost never') to 4 ('fast immer', German for 'almost always') was used.

Huffziger and Kühner (2012), reported an acceptable retest-reliability in a young adult sample ( $r=.66$ ). We found an acceptable internal consistency (Cronbach's  $\alpha=0.72$ ) in our sample.

### Perfectionism

*The Frost Multidimensional Perfectionism Scale* (FMPS; Frost et al., 1990; German version MPS-F, Altstötter-Gleich & Bergemann, 2006) was used to assess PS perfectionism by the scores of the personal standard scale (seven items, reported Cronbach's  $\alpha=0.84$ ) and PC perfectionism by the scores of the concern over mistakes scale (nine items; reported Cronbach's  $\alpha=0.89$ ). The items are rated on a 5-point-scale from 1 ('trifft überhaupt nicht zu', German for 'does not apply at all') to 5 ('trifft voll und ganz zu', German for 'fully applies'). We found a satisfactory internal consistency for PS perfectionism (Cronbach's  $\alpha=0.81$ ) and PC perfectionism (Cronbach's  $\alpha=0.88$ ) in our sample.

### Intolerance of uncertainty

*The German 12-item version of the Intolerance of Uncertainty Scale* (UIS-12; Dietmaier et al., 2008) was used to assess prospective IU (six items; reported Cronbach's  $\alpha=0.77$ ) and inhibitory IU (six items; reported Cronbach's  $\alpha=0.75$ ). The items are rated on a 5-point-scale from 1 ('gar nicht charakteristisch für mich'; German for 'not at all characteristic of me') to 5 ('sehr charakteristisch für mich'; German for 'very characteristic of me'). We found a satisfactory internal consistency for prospective IU (Cronbach's

**Table 1** Descriptive statistics (reliability coefficients, mean and standard deviation), zero-order correlations between perfectionism dimensions, rumination, worry and intolerance of uncertainty dimensions and partial correlations controlling for personal standards and perfectionistic concerns ( $N=227$ )

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6
<b>1. Intolerance of uncertainty – inhibitory</b>	2.59	0.87	<b>0.83</b>					
<b>2. Inhibitory of intolerance – prospective</b>	3.12	0.76	0.33***	<b>0.78</b>				
<b>3. Rumination</b>	2.38	0.64	0.61***	0.25***	<b>0.72</b>			
<b>4. Worry (MSF)</b>	2.33	0.81	0.68***	0.27***	0.60***	<b>0.94</b>		
<b>5. Perfectionistic Concerns (PC)</b>	2.82	0.93	0.51***	0.44***	0.53***	0.54***	<b>0.89</b>	
<b>6. Perfectionistic Strivings (PS)</b>	3.50	0.77	0.05	0.34***	0.19*	0.16*	0.53***	<b>0.82</b>
PC controlling for PS			0.57***	0.33***	0.52***	0.54***		
PS controlling for PC			–0.30***	0.14*	–0.13*	–0.17***		

Note: Cronbach's alpha coefficients are in the diagonal, \*\*\*  $p < .001$ ; \*\*  $p < .01$ ; \*  $p < .05$

$\alpha=0.78$ ) and inhibitory IU (Cronbach's  $\alpha=0.83$ ) in our sample.

## Procedure

The online survey with anonymous data recording (Qualtrics online survey software: Qualtrics, Provo, UT) was distributed through different social media platforms and mailing lists and was available online for a period of six weeks (from the beginning of March until Mid-April 2021).

Only adults were allowed to participate, and they gave informed consent before starting the survey. This study was approved by the Ethics Committee of the Faculty of Humanities at the University of Cologne (KKHF0097). Participants were debriefed about the study's purpose after survey completion.

## Statistical analysis

The data were analysed using R (R Core Team, 2020). We analysed univariate outliers using z-score analysis and multivariate analyses according to Tabachnick and Fidell (2019) using Mahalanobis distance. Possible outliers and incomplete questionnaires were removed from the dataset. To analyse the internal consistencies of the questionnaires and calculate zero-order correlations and partial correlations, the R package psych (Revelle, 2021) was used. After having found significant associations (Pearson correlations) between the outcome variables (PC, PS, prospective IU, inhibitory IU, worry, rumination), two hierarchical regressions were computed to assess the ability of perfectionism and IU dimensions to predict worry and rumination. Additional analyses were conducted to ensure that the assumptions of normality, linearity, multicollinearity, and homoscedasticity were not violated.

Worry and rumination scores, as representatives for RNT, were each used as dependent variables. In a first step, the centred PC and PS scores, as well as the PS-by-PC-interaction were added to the model. The centred scores of

prospective IU and inhibitory IU were added in a second model.

Depending on the results of the hierarchical regressions a mediation model was tested through path analysis using the lavaan package in R (Rosseel, 2012).

Bootstrapping (1000 iterations) was used to test the resulting parameters for significance (Preacher & Hayes, 2008).

The decision, if a mediation is full or partial was made using the output information: a variable (M) fully mediates the associations between to variables (A and B), if path c (total effect of A on B) is significant and path c' (direct effect of A on B controlling for M) is not significant.

## Results

### Preliminary analyses

Using z-score analysis as common univariate outlier analysis technique and Mahalanobis distance to detect multivariate outliers (Tabachnick & Fidell, 2019), no univariate ( $|z\text{-scores}| > 3.29$ ) and no multivariate outliers [ $\chi^2(4)=9.49$ ] were identified.

### Descriptive statistics, zero-order correlations, and partial correlations

Descriptive statistics, zero-order correlations, partial correlations, and internal consistencies for all variables are presented in Table 1.

The zero-order correlation analysis showed that both perfectionism dimensions (PS and PC) were significantly and positively correlated with the scores of rumination and worrying. Medium to large positive correlations were found for PC perfectionism and both dimensions of IU. PS perfectionism showed only a significant positive correlation with prospective IU. Both IU dimension are significantly positively correlated with rumination and worry.

**Table 2** Two two-step hierarchical regression analyses of perfectionism and intolerance of uncertainty on rumination and worry ( $N=227$ )

	Rumination			Worry		
	$\beta$	Standardised $\beta$	SE	$\beta$	Standardised $\beta$	SE
<b>Step 1: Perfectionism</b>						
PC	0.42***	0.60***	0.04	0.55***	0.63***	0.06
PS	-0.10	-0.12	0.06	-0.18*	-0.17*	0.07
PC x PS	0.04	0.04	0.05	<0.01	<0.01	0.06
<i>F</i> test ( <i>df,df</i> )		31.43*** (3,223)		33.96*** (3,223)		
$R^2$		0.29		0.31		
<b>Step 2: Perfectionism and Intolerance of uncertainty</b>						
	$\beta$	Standardised $\beta$	SE	$\beta$	Standardised $\beta$	SE
PC	0.21***	0.30***	0.05	0.23***	0.26***	0.06
PS	0.02	0.03	0.05	<0.01	<0.01	0.06
PC x PS	0.03	0.03	0.04	<0.01	<0.01	0.05
P-IU	-0.04	-0.05	0.05	-0.03	-0.03	0.06
I-IU	0.35***	0.48***	0.04	0.52***	0.56***	0.05
<i>F</i> test ( <i>df,df</i> )		35.40*** (5,221)		47.38 ***(5,221)		
$R^2$		0.43		0.51		
<i>F</i> change ( <i>df,df</i> )		29.35*** (2,221)		46.64*** (2,221)		
$R^2$ change		0.13		0.20		

Note:  $R^2$  = adjusted  $R^2$ , PC = perfectionistic concerns, PS = personal standards, I-IU = inhibitory intolerance of uncertainty, P-IU = prospective intolerance of uncertainty; SE = standard error; \*\*\*  $p < .001$ ; \*\*  $p < .01$ ; \*  $p < .05$

The partial correlations for both perfectionism dimensions (PS and PC) with the remaining variables (P-IU, I-IU, rumination, and worry) were analysed to examine their unique contribution to the single relationships.

After controlling for PS, PC perfectionism was still significantly positively correlated with worry and rumination and the two IU dimensions. For PS perfectionism after controlling for PC, the analysis showed three changes in the correlation pattern compared to the zero-order correlation analysis. The non-significant correlation between PS and inhibitory IU became significantly negative. The significant positive correlations with rumination and with worry became significantly negative (bottom rows of Table 1).

### Hierarchical regression analysis

Hierarchical regression analyses showed a significant change in  $R^2$  at Step 2, indicating that intolerance of uncertainty explained additional variation in rumination and worry (see Table 2).

As expected, PC perfectionism was a significant positive predictor for worry and rumination, even after adding prospective IU and inhibitory IU in the second step of the regression analysis. However, adding both dimensions of IU decreased the effect. PS perfectionism predicted worry in the first step of the hierarchical regression significantly negatively. This effect disappeared after performing the second

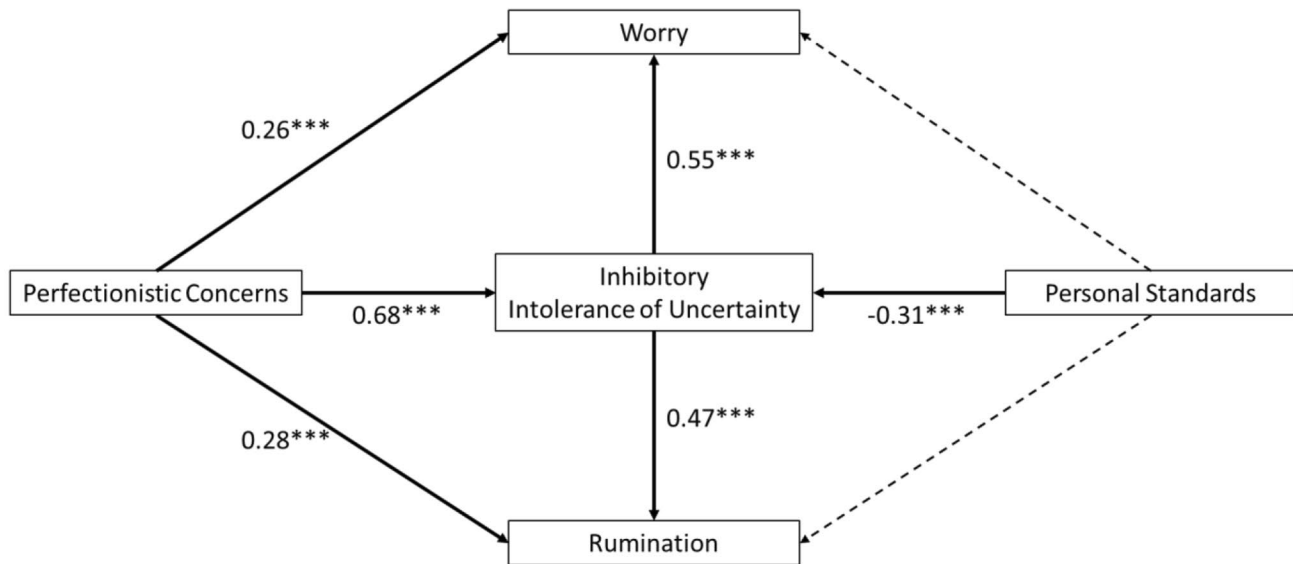
step (adding the two IU dimensions). The analysis showed no significant interaction of PC and PS, which challenged the postulated interactionist effect of the two perfectionism sub-dimensions, at least for rumination and worry. Inhibitory IU was a significant predictor for worry and rumination, whereas prospective IU was not a significant predictor for the two indicators of RNT.

### Mediation analysis

Based on the results of the hierarchical regression, we tested a model with PS perfectionism and PC perfectionism as the independent variables, inhibitory IU as mediator and worry and rumination as dependent variables (see Fig. 2).

We found significant positive direct effects of inhibitory IU on worry and on rumination (for detailed results see Table 3). For PC, the analysis showed significant positive direct effects on inhibitory IU, on worry and on rumination. Further the analysis revealed significant positive indirect effects of PC on worry and of PC on rumination through inhibitory IU. For PS, we found a significant negative direct effect of PS on inhibitory IU and significant negative indirect effects of PS on worry and PS on rumination through inhibitory IU.





**Fig. 2** Path model of relationships between the superordinate perfectionism dimensions, perfectionistic concerns and personal standards, worry and rumination, mediated by inhibitory intolerance of uncer-

tainty. Note, path diagrams show unstandardized path coefficients for significant paths. Bold, solid lines denote significant paths and non-bold, dashed lines denote non-significant paths. \*\*\* $p < .001$

## Discussion

The first study's main objective was to investigate the relationship of perfectionism and the two IU dimensions and RNT using the interactionist model of perfectionism by Gaudreau and Thompson (2010). This 2-by-2 model postulates four perfectionism subtypes. There were several main effects of PS perfectionism and PC perfectionism on worry and rumination, but contrary to our expectations, there was no significant interaction of PC and PS, and thus, no evidence for specific effects of the different subtypes on worry or on rumination. The main effect of PC perfectionism predicted increased worry and rumination. Further, PC perfectionism showed the highest positive associations with inhibitory IU. Inhibitory IU displayed higher positive relationships with worry and rumination than prospective IU. These results are in line with our assumptions.

The mediation analyses revealed the important influence of inhibitory IU, which partially mediated the positive effect of PC on both aspects of RNT, and fully mediated the negative effect of PS on worry and rumination.

In this study, RNT was measured separately through rumination and worry questionnaires and our findings showed similar effects of PC perfectionism and inhibitory IU on worry and rumination. This observation was supported by the identified direct and indirect effects in the mediation analyses on worry and on rumination. However, the analyses of PS perfectionism showed also differences between rumination and worry. PS was only a significant negative predictor on worry but not on rumination in the

hierarchical regression analyses. Further, PS showed no significant total effect on rumination in contrast to worry in the mediation analysis. The varying results between rumination and worry regarding PS are explicable considering the temporal orientation of both types of RNT. Worry was described as the more future-oriented aspect of RNT ("what will be ..."), whereas rumination can be characterized as past-oriented thinking ("what did I do...?"; Segerstrom et al., 2000; Watkins et al., 2005).

Therefore, as PS perfectionists are assumed to have a higher need to limit future errors (Flett et al., 2016; van der Kaap-Deeder et al., 2016), they probably rather tend to think in a more future-oriented than past-oriented manner. However, we cannot rule out that the conceptual overlap between worry and rumination was artificially increased given that we used two separate questionnaires to assess the constructs. To avoid this, we conducted a second study in which we employed a questionnaire that considered rumination and worry simultaneously, limiting the conceptual overlap to a certain degree.

## Study 2

In the second study, our goal was to examine if the analyses would show similar results as in Study 1. Based on the results of Study 1, we assumed that PC perfectionists will show significant positive associations with IU and RNT. Inhibitory IU will partially mediate the positive relationship of PC on RNT. PS perfectionists on the other hand should

**Table 3** Standardised, unstandardised estimated path coefficients, standard error for the unstandardised coefficients, (SE) and *p*-value from a mediation analysis using path analysis with bootstrapping (1000 iterations)

	Stan- dardised path coefficients	Unstan- darised path coefficients	SE	<i>p</i>
<b>Direct effects</b>				
Perfectionistic Concerns on				
<i>Inhibitory–IU</i>	0.68	0.63	0.07	<0.001
<i>Worry</i>	0.26	0.22	0.06	<0.001
<i>Rumination</i>	0.28	0.20	0.06	<0.001
Perfectionistic Strivings on				
<i>Inhibitory–IU</i>	-0.31	-0.35	0.08	<0.001
<i>Worry</i>	<0.01	<0.01	0.05	0.96
<i>Rumination</i>	0.02	0.01	0.06	0.84
Inhibitory – IU on				
<i>Worry</i>	0.55	0.51	0.05	<0.001
<i>Rumination</i>	0.47	0.35	0.04	<0.001
<b>Indirect effects</b>				
Perfectionistic Concerns on through Inhibitory – IU				
<i>Worry</i>	0.37	0.32	0.04	<0.001
<i>Rumination</i>	0.32	0.22	0.04	<0.001
Perfectionistic Strivings on through Inhibitory – IU				
<i>Worry</i>	-0.17	-0.18	0.04	<0.001
<i>Rumination</i>	-0.14	-0.12	0.03	<0.001
<b>Total effects</b>				
Perfectionistic Concerns on				
<i>Worry</i>	0.63	0.55	0.06	<0.001
<i>Rumination</i>	0.60	0.41	0.05	<0.001
Perfectionistic Strivings on				
<i>Worry</i>	-0.17	-0.18	0.07	0.009
<i>Rumination</i>	<0.01	<0.01	0.01	0.85

N = 227; IU = intolerance of uncertainty

show negative associations with inhibitory IU. Further inhibitory IU will fully mediate the negative relationship of PS on RNT.

## Methods

### Participants

Data from 158 German participants were collected. As the effect in Study 1 was large, we aimed to collect data of at least 140 participants. After removing ten participants based

on incomplete questionnaires our final sample consisted of 148 German participants (123 female, 3 divers, 4 n/a and 18 male) aged 18 to 66 years ( $M=26.85$ ;  $SD=10.36$ ). The sample consists of 96 students, 39 employed persons and 13 others. Of the 96 students, 75 were students from the University of Cologne and they were credited participation points for completing the survey.

## Measures

### Repetitive negative thinking

*The perseverative thinking questionnaire* (PTQ; Ehring et al., 2011) is a 15-item questionnaire assessing the tendency to engage in RNT. Participants answer on a 5-point-scale from 0 ('nie', German for 'never') to 4 ('fast immer', German for 'almost always'). Ehring et al. (2011) reported a good internal consistency in three samples (Cronbach's  $\alpha=0.94-0.95$ ) and a satisfactory retest-reliability ( $r=.69$ ). In the current study, we found a good internal consistency (Cronbach's  $\alpha=0.95$ ).

### Perfectionism

*The Frost Multidimensional Perfectionism Scale* (FMPS; Frost et al., 1990; German version MPS-F, Altstötter-Gleich & Bergemann, 2006) was used as in Study 1. Cronbach's  $\alpha$  of the present data for PS ( $\alpha=0.81$ ) and PC ( $\alpha=0.88$ ) were good.

### Intolerance of uncertainty

The participants complete the German 12-item version of the *Intolerance of Uncertainty Scale* (UIS-12; Dietmaier et al., 2008) as in Study 1. Cronbach's  $\alpha$  of the present data for prospective IU ( $\alpha=0.86$ ) and inhibitory IU ( $\alpha=0.85$ ) were good.

## Procedure

The second survey, created via Qualtrics online survey software (Qualtrics, Provo, UT), was distributed through social media and mailing lists and was available online for a period of four weeks from Mid-May till Mid-June 2021. The remaining procedure was identical to Study 1 (see 4.3).

## Statistical analyses

To assess RNT, the PTQ was used instead of the RSQ and MSF. We performed the same screening for univariate and multivariate outliers, the same analysis of internal

**Table 4** Descriptive statistics (reliability coefficients, mean and standard deviation), correlations between perfectionism dimensions, repetitive negative thinking (PTQ) and intolerance of uncertainty dimensions and partial correlations controlling for personal standards and perfectionistic concerns ( $N=148$ )

	<i>M</i>	<i>SD</i>	1	2	3	4	5
<b>1. Intolerance of uncertainty – inhibitory</b>	2.92	0.94	<b>0.85</b>				
<b>2. Intolerance of uncertainty – prospective</b>	3.29	0.87	0.40***	<b>0.86</b>			
<b>3. Repetitive negative thinking (PTQ)</b>	3.33	0.76	0.62***	0.39***	<b>0.95</b>		
<b>4. Perfectionistic Concerns</b>	2.95	0.89	0.53***	0.46***	0.48***	<b>0.88</b>	
<b>5. Perfectionistic Strivings</b>	3.52	0.72	0.06	0.32***	0.13	0.51***	<b>0.81</b>
PC controlling for PS			0.57***	0.37***	0.48***		
PS controlling for PC			–0.28***	0.11	–0.13		

Note: Cronbach's alphas are on the diagonal; \*\*\*  $p < .001$ ; \*\*  $p < .01$ ; \*  $p < .05$

consistencies, zero-order correlations, and partial correlations as in Study 1 (see 4.4).

After identifying significant associations (Pearson correlations) between the outcome variables (PC, PS, prospective IU, inhibitory IU, RNT), a hierarchical regression was used to assess the ability of the perfectionism and IU dimensions to predict RNT. As in study 1, preliminary analyses were conducted to ensure no violation of the assumptions of normality, linearity, multicollinearity, and homoscedasticity. In the hierarchical regression, RNT was used as a dependent variable. Centred PC and centred PS scores, as well as the interaction term (PS  $\times$  PC) were added as predictors to the model. The centred scores of prospective IU and inhibitory IU were added in a second model. As in Study 1 we tested in a mediation model whether inhibitory IU mediated the associations between PC, PS and RNT.

## Results

### Preliminary analyses

Using z-score analysis as common univariate outlier analysis technique and Mahalanobis distance to detect multivariate outliers (Tabachnick & Fidell, 2019), no univariate ( $|z\text{-scores}| > 3.29$ ) and no multivariate outliers ( $\chi^2(3) = 7.82$ ) were identified.

### Descriptive statistics, zero-order correlations, and partial correlations

Descriptive statistics, zero-order correlations, partial correlations, and internal consistencies for all variables are presented in Table 4.

The zero-correlation analysis showed that PC was significantly positively correlated with RNT, inhibitory IU and prospective IU, whereas PS only showed a significant positive correlation with prospective IU. RNT in turn was statistically significantly and positively associated with prospective IU and inhibitory IU.

**Table 5** Two-step hierarchical regression analysis of perfectionism and intolerance of uncertainty on RNT ( $N=148$ )

	<i>RNT</i>
<b>Step 1: Perfectionism</b>	
Perfectionistic Concerns	0.48***
Perfectionistic Strivings	–0.16
PC $\times$ PS	–0.03
<i>F</i> test ( <i>df,df</i> )	15.75*** (3,144)
<i>R</i> <sup>2</sup>	0.23
<b>Step 2: Perfectionism and Intolerance of uncertainty</b>	
Perfectionistic Concerns	0.18*
Perfectionistic Strivings	–0.03
PC $\times$ PS	<0.01
Prospective – IU	0.11
Inhibitory – IU	0.38***
<i>F</i> test ( <i>df,df</i> )	20.81*** (5,142)
<i>R</i> <sup>2</sup>	0.40
<i>F</i> change ( <i>df,df</i> )	21.63*** (5,142)
<i>R</i> <sup>2</sup> change	0.17

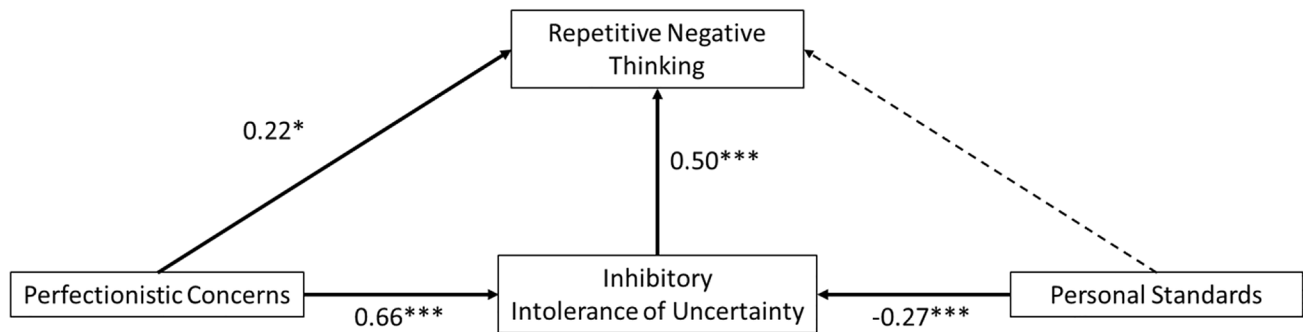
Note:  $R^2$  = adjusted  $R^2$ , IU = intolerance of uncertainty, \*\*\*  $p < .001$ ; \*\*  $p < .01$ ; \*  $p < .05$

After controlling for PS perfectionism, the correlation coefficients remained statistically significant for the associations between PC, inhibitory IU, prospective IU and RNT. Once PC scores were controlled for, the analysis showed two changes in the correlation pattern. The non-significant correlation between PS and inhibitory IU became significantly negative and the significant positive association between PS and prospective IU disappeared.

### Hierarchical regression analysis

Hierarchical regression analyses resulted in a significant change in  $R^2$  at Step 2, indicating that intolerance of uncertainty predicted RNT above and beyond perfectionism (see Table 5).

The analyses showed that PC was a significant positive predictor for RNT, even after adding both IU dimensions in



**Fig. 3** Path model of relationships between the superordinate perfectionism dimensions, perfectionistic concerns and personal standards and repetitive negative thinking, mediated by inhibitory intolerance of uncertainty. Note that standardised path coefficients are displayed for

significant paths. Bold, solid lines denote significant paths and non-bold, dashed lines denote non-significant paths  
 \*\*\* $p < .001$ , \*\* $p < .01$ , \* $p < .05$

**Table 6** Standardised and unstandardised path coefficients, standard error for the unstandardised coefficients (SE), and  $p$ -value from a mediation analysis using path analysis with bootstrapping (1000 iterations)

	Standardised path coefficients	Unstandardised path coefficients	SE	$p$
<b>Direct effects</b>				
Perfectionistic Concerns on				
<i>Inhibitory–IU</i>	0.66	0.70	0.08	<0.001
<i>RNT</i>	0.22	0.19	0.08	0.013
Perfectionistic Strivings on				
<i>Inhibitory–IU</i>	-0.27	-0.35	0.11	0.001
<i>RNT</i>	-0.01	-0.01	0.09	0.896
Inhibitory – IU on				
<i>RNT</i>	0.50	0.40	0.07	<0.001
<b>Indirect effects</b>				
Perfectionistic Concerns on RNT through Inhibitory – IU	0.33	0.29	0.06	<0.001
Perfectionistic Strivings on RNT through Inhibitory I-IU	-0.14	-0.14	0.05	0.003
<b>Total effects</b>				
Perfectionistic Concerns on RNT	0.55	0.48	0.06	<0.001
Perfectionistic Strivings on RNT	-0.15	-0.16	0.10	0.129

N = 148; IU = intolerance of uncertainty, RNT = repetitive negative thinking

the second step of the analysis, though this decreased the effect.

PS perfectionism on the other hand was no significant predictor for RNT in the first or second step of the analysis. As expected, there was no significant effect for the

interaction term (PC x PS). Prospective IU was no significant predictor for RNT, unlike inhibitory IU.

**Mediation analysis**

We tested a model with PS perfectionism and PC perfectionism as the independent variables, inhibitory IU as mediator and RNT as dependent variable (see Fig. 3).

We found significant positive direct effects of inhibitory IU on RNT (for detailed results see Table 6). For PC the analysis showed significant positive direct effects on inhibitory IU and on RNT. Further the analysis revealed significant positive indirect effects of PC on RNT through inhibitory IU. For PS we found a significant negative direct effect on inhibitory IU and significant negative indirect effect of PS on RNT through inhibitory IU.

**Discussion**

The aim of Study 2 was to replicate the results of Study 1. The results of Study 2 were in line with our expectations. We found similar associations between perfectionism, IU and RNT and the analysis of the mediation model showed the same pattern of results as in Study 1.

**General discussion**

Study 1 and Study 2 showed similar results independent of how RNT was assessed, i.e., independent of whether one scale was used (RNT) or two scales were used (rumination and worry). These results indicate that RNT is an important underlying process of rumination and worry (Arditte et al., 2016; Wahl et al., 2019) and a relevant strategy in the context of perfectionistic concerns. Further, the regression

analyses revealed no significant findings regarding the interaction of PS and PC. This was unexpected and contradicts the assumptions concerning the 2×2 model of perfectionism (Gaudreau et al., 2018; Gaudreau & Thompson, 2010) and the tripartite model of perfectionism (Rice & Ashby, 2007; Stoeber & Otto, 2006), at least here in the context of RNT and IU. Therefore, the present results are more in line with a two-factor model of perfectionism (Bieling et al., 2004; Dunkley et al., 2000).

Broadly, PS perfectionism seem to have a psychological adaptive character on psychological adjustment (Kljajic et al., 2017; Stoeber & Childs, 2010) as indicates by the negative effect of PS perfectionism on RNT, which was fully mediated by inhibitory IU. Concurrently, the findings challenge research showing that PS perfectionism predicts psychological maladjustment (Smith et al., 2017) and that a positive association between PS perfectionism and eating disorder symptoms is moderated through unidimensional IU (Brosof et al., 2019; Smith et al., 2017). One possible framework of explanation for these diverging results is that eating disorders symptoms can be seen as a dysfunctional attempt to reduce anxiety/negative affect and to manage a perceived lack of control through controlling behaviour (Kesby et al., 2017; Renjan et al., 2016).

PS perfectionists show less avoidant coping strategies (e.g., reassurance seeking) and they seemingly favour more active adaptive and maladaptive coping strategies such compensatory behaviours in eating disorders. In general, they show more reappraisal and less suppression (Stoeber et al., 2018; van der Kaap-Deeder et al., 2016).

This indicates associations with prospective IU, which is as well in line with an EEG-Study by Jackson et al. (2016). They suggest that their results show that inhibitory IU reflects avoidance in uncertain situations, whereas prospective IU implies action.

These results in combination with the hypothesis that PS perfectionists are possibly more susceptible to environmental influences than non-perfectionists (Gaudreau & Thompson, 2010), suggest that individuals with high PS and elevated prospective IU, affected by stress inducing environmental influences, could develop dysfunctional controlling behaviours (e.g. eating disorders symptoms) to cope with perceived uncertainty. Next to the adaptive effects of PS perfectionism the results showed a maladaptive effect of PC perfectionism on RNT, which was partially mediated through inhibitory IU. Our results comply with findings from Kawamoto and Furutani (2018), who reported an association between PC and IU, as well as results from Hong and Cheung (2015) who showed that cognitive perseveration is more associated with inhibitory IU. Consequently, our findings are in line with previous research that showed that PC perfectionism is the more maladaptive dimension (Stoeber

& Otto, 2006; Suh et al., 2017). Despite the present study identified previously not examined associations between the two dimensions of IU, RNT and the 2×2 model of perfectionism, there are recommendations for future studies considerations concerning some limitations.

### Future directions and limitations

It should be emphasized that we extended the existing perfectionism research through distinguishing between prospective and inhibitory IU. Thus, we could show that PC perfectionists and PS perfectionists show substantial diverging association with the two IU facets. However, especially the specific relationships between perfectionism, prospective IU and possible dysfunctional coping strategies remain unclear and need further investigation.

Besides IU and perfectionism, the results also emphasize that RNT does not need to be distinguished between the future-oriented worry and past-oriented rumination.

Nevertheless, it could be merited to differentiate the underlying characteristics of RNT, like the repetitiveness, the intrusiveness and difficulty of disengaging, and apart from that also to distinguish between possible functional and dysfunctional forms of repetitive thinking (Ehring & Watkins, 2008; Ehring et al., 2011). Functional repetitive thinking seems to be a less abstract, more reflective, problem-solving experiential processing, whereas a dysfunctional form appears to be more abstract, ruminative, evaluative processing with unconstructive consequences. (Ehring & Watkins, 2008; Watkins, 2008).

A limitation is that the sample of both studies particularly consisted of a nonclinical and mainly European females. Women seem to score higher in RNT questionnaires (McEvoy et al., 2019). Therefore, it is possible that our results cannot be generalised to males or other ethnicities. Furthermore, we did not control for any clinical diagnoses so we cannot make any statement about further mediating effect we cannot rule out with the present data.

Another limitation is the use of a cross-sectional sample. A mediation model is preferably tested with a longitudinal sample (Reuther et al., 2013). Though, we derived our model and the temporal ordering of the variables from previous approved studies, some of which used prospective and longitudinal data (e.g., Brosof et al., 2019; Handley et al., 2014; Huang et al., 2019). Though, it is largely considered as adequate to measure mediation this way, if longitudinal data are not available (Edwards & Lambert, 2007).

Nevertheless, more longitudinal studies are needed to determine causality, even though the used design still can add understanding how these transdiagnostic phenomena might collaborate. We cannot rule out any effect of social desirability as we did not include any measures assessing

social desirability. Furthermore, some authors are sceptical, whether participants can adequately depict their styles of thinking (Wahl et al., 2019) making the assessment of social desirability difficult.

Therefore, future studies should add behavioural indicators, e.g., electrophysical measurements like the error-related negativity (Ne/ERN), a negative deflection in an event-related potential after the commission of an error, which was used by Jackson et al. (2016) to examine if IU is associated with the Ne/ERN.

## Conclusion

Our study investigated the associations between three transdiagnostic phenomena perfectionism (PC and PS), IU (inhibitory and prospective) and RNT for the first time. We demonstrated that the adaptive effect of PS perfectionism on RNT could especially rely on the negative direct effect on inhibitory IU. The maladaptive effect of PC perfectionism on RNT is in turn partially mediated through inhibitory IU. Prospective IU does not seem to be relevant in the association between perfectionism and RNT. Our findings extend previous research through showing that PC perfectionism is the more crucial facet of perfectionism concerning transdiagnostic considerations, especially in association with an increased paralysis of cognition and action in case of uncertain situations (inhibitory IU) and the resulting start of continuous thinking about negative events in the past or future (RNT). This differentiation within the multidimensional constructs of perfectionism and IU can have an important impact on treatment of psychological disorders associated with IU and perfectionism. The present study shows the necessity to differentiate between prospective and inhibitory IU.

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**Data Availability** The datasets analysed during the current study are available in the open science framework repository, [https://osf.io/48aym/?view\\_only=7baea7f1d8454192a537214c1b669ff9](https://osf.io/48aym/?view_only=7baea7f1d8454192a537214c1b669ff9).

## Declarations

**Conflict of Interest** The authors have no known conflict of interest to disclose.

**Ethics approval** An ethics committee carefully checked the project and rated it as ethically unobjectionable.

**Consent to participate** Informed consent was obtained from all individual participants included in the study.

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