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ARTICLE

Certainty in holistic thinking and responses to contradiction: Dialectical proverbs, counter-attitudinal change and ambivalence

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Abstract

The present research examined whether consideration of individuals' certainty in their holism can enhance the ability of this individual difference to predict how they respond to contradiction-relevant outcomes. Across four studies, participants first completed a standardized measure of holistic-analytic thinking. Then, they rated how certain they were in their responses to the holism scale or were experimentally induced to feel high or low certainty. Next, participants were exposed to dialectical proverbs (Study 1a and 1b), to a counter-attitudinal change induction (Study 2), or to a paradigm of attitudinal ambivalence (Study 3). Results revealed that participants with higher certainty in their holistic thinking exhibited higher preference for dialectical proverbs (Study 1a and 1b), changed their attitude less following a counter-attitudinal task (Study 2) and showed weaker correspondence between objective and subjective ambivalence (Study 3). Beyond examining new domains and discovering novel findings, the present work was designed to be the first to show moderation of previously identified effects in the domain of holistic thinking and responses to contradiction.

KEYWORDS

ambivalence, certainty, contradiction, counter-attitudinal change, holistic-analytic thinking, individual differences

CULTURAL DIFFERENCES IN HOLISTIC THINKING

Cross-cultural research indicates that individuals from East Asian cultures exhibit a holistic thinking style, whereas those from Western cultures tend to have an analytic thinking style (Ji & Yap, 2016; Spencer-Rodgers et al., 2009; see Nisbett & Masuda, 2003; Spencer-Rodgers & Peng, 2017, for extensive reviews). Holistic thinkers are more willing to accept contradictions and seek a middle ground between opposing propositions, whereas analytic thinkers strive to determine the most plausible position and reject contradictions. For example, in a study on cultural differences, participants were exposed to dialectical proverbs characterized by containing contradictory information -proverbs are expressions that reflect the folk wisdom of a culture about ways of handling life's events. Results showed that individuals from holistic cultures preferred the proverbs that contain contradictory information compared to analytic cultures (Peng & Nisbett, 1999). This research has been replicated using holistic-analytic thinking style as an individual-difference predictor variable (Santos et al., 2021).

The present research aims to investigate whether certainty in one's holistic thinking moderates the association between individual differences in holism views and responses to contradiction. We propose that certainty is a key variable capable of moderating traditional effects regarding holism, as well as serving to identify new effects in this domain. As will be described, this moderation effects are expected *because* confidence affects perceived validity of the mental construct for which that confidence is attributed and the responses to the holism scale are the available mental construct to be validated at the time that confidence is induced or measured. The contradiction paradigms used in the present research to assess the effects of certainty in holism are the preference for dialectical proverbs containing internal contradictions (Studies 1a and 1b), the amount of attitude change after writing a counter-attitudinal essay (Study 2) and the correspondence between objective ambivalence (OA) and subjective ambivalence (SA) after learning contradicting information about a person (Study 3).

INDIVIDUAL DIFFERENCES IN HOLISTIC THINKING AND RESPONSES TO CONTRADICTION

Just as cultures can vary in their relative thinking style (Nisbett & Masuda, 2003; Spencer-Rodgers & Peng, 2017), there are also individual differences in holistic thinking within the same culture (Knight & Nisbett, 2007). For example, Choi et al. (2007) developed an instrument, the Analysis-Holism Scale (AHS), that measures systematic cognitive differences among individuals in their propensity to process information ranging from relatively holistically to more analytically. Whatever the research approach applied (within- or cross-cultural), this scale has been used successfully in many studies to show the impact of relatively holistic versus analytic thinking in diverse areas such as consumer behaviour (Allman et al., 2019; Hildebrand et al., 2019), donation (Zhou et al., 2021), connectedness with nature (Leong et al., 2014), cooperative/competitive behaviour (Apanovich et al., 2018), performance creativity (Chen, 2020), information processing (Hsieh et al., 2020) and materialism (Elphinstone & Critchley, 2016), to mention a few examples. The current research examines the link between relative holism and contradiction by using an individual differences approach within the same culture.

Holistic thinking includes several dimensions such as locus of attention, perceptions of change, or attribution of causality. Among these, a key component has to do with dealing with contradiction. Specifically, holistic thinking has been proposed to be associated with a greater tolerance for contraction. Tolerance for contradiction is defined as the cognitive acceptance of and comfort with conflicting information or with contradictory perspectives. It involves the preference for resolving contradictions through a reconciliation strategy, seeking the 'middle way', rather than feeling the need to eliminate the inconsistency (Peng & Nisbett, 1999). This dimension of holistic thinking reflects a broader, more integrative approach to understanding the world, where contradictions are seen as natural and expected, rather than problematic (Spencer-Rodgers et al., 2010). Indeed, holism

can influence perceptions of contradictions, the conflict experienced in response to those contradictions, and/or how people deal with those experiences.

Recent research has shown that individual differences in holistic thinking can influence how people deal with other contradiction-relevant situations (e.g., where two cognitions are not fully consistent one with the other), such as attitudinal ambivalence (Luttrell et al., 2022; Study 1). Ambivalence refers to holding both positive and negative reactions toward an attitude object (Kaplan, 1972; Thompson et al., 1995). This construct has been typically analysed at two levels: 'objective' and 'subjective' (Priester & Petty, 1996). Objective ambivalence (OA) is the degree to which people report both positive and negative evaluations of an object whereas subjective ambivalence (SA) refers to feeling conflicted about the attitude object. One recent study (Luttrell et al., 2022) showed that increased dialectical thinking (a construct which is related to holistic thinking) was associated with a weaker correspondence between OA and SA. Thus, this research revealed that holding simultaneous positive and negative evaluations toward the same object (OA) was experienced as relatively less conflicting (SA) for those scoring higher in dialectic thinking. Similar effects would be expected for holistic thinking given the analogies between these constructs (Spencer-Rodgers et al., 2010).

Importantly, in addition to moving from cultural to individual differences in holistic thinking, another aim of the current research is to examine the extent to which those individual differences can be made more predictive of a variety of contradiction-relevant outcomes by taking certainty in one's holism into consideration. In the following section we describe our key hypotheses regarding the moderating role of certainty in the impact of holistic thinking on several contradiction-related paradigms such as reactions to dialectical proverbs, counter-attitudinal change and ambivalence.

CERTAINTY IMPROVES THE LINK BETWEEN PERSONALITY AND BEHAVIOUR

Prior literature has found that mental constructs (e.g., thoughts, attitudes) held with high certainty are more predictive of judgement and behaviour than those held with low certainty (e.g., Briñol & Petty, 2009; Horcajo et al., 2020; Moreno et al., 2021; Pelham, 1991; Pelham & Swann Jr., 1994; Requero et al., 2020). For instance, research on Self-Validation Theory (SVT; Briñol & Petty, 2022) has revealed that certainty can apply to a wide variety of mental constructs (e.g., attitudes, beliefs, goals). This work has shown that mental contents are especially predictive of judgement and behaviour the greater the perceived validity that individuals have in their thoughts. These perceptions of validity (i.e., how valid people consider their mental contents to be) can be easily assessed by asking people to rate the confidence or certainty they have in their responses to any psychological inventory. Also relevant, perceived validity can not only be measured but also manipulated. Regardless of whether it is measured or manipulated, perceptions of validity have been useful in moderating the effects of individual differences in the domains of political ideology (Shoots-Reinhard et al., 2015; Vitriol et al., 2019), group identity (Paredes et al., 2020) and aggressive responses (e.g., Santos et al., 2019).

As an illustration of certainty applied to an individual-difference variable, Santos et al. (2019) showed that participants' trait aggressiveness was more predictive of their aggressive behavior as individuals' certainty in their own aggressiveness increased. Put simply, the more confident people were in their own trait aggressiveness, the more their perceptions of aggressiveness predicted their aggressive behaviour. This means that people who scored higher in trait aggressiveness were more aggressive when their certainty was high than low, but people lower in trait aggressiveness were less aggressive when their certainty was high than low. As noted, this certainty not only can be measured but also manipulated. In another illustration, Paredes et al. (2021) showed that participants' responses to a porn-usage scale were associated with porn consumption to a greater extent in high induced certainty conditions. The induced certainty following completion of an inventory is misattributed to feeling certain in one's responses to the inventory (see also Horcajo et al., 2022). Manipulating certainty is important because showing the same conceptual results when certainty is manipulated provides evidence in favour of a causal role for certainty. Beyond

these examples, in the present research, we examine both measured and manipulated certainty in one's responses to another important individual difference variable – holistic-analytic thinking.

It is important to note that measuring certainty by directly asking participants about how sure they are in their responses to a scale (aggressiveness, holism) and manipulating certainty, for example by asking them to recall past episodes in which they felt certain, are two very different operationalizations of what is ultimately a common thing. In the case in which certainty is measured regarding responses to a scale, the certainty scores can originate from differences in the content of the responses to the inventory (Petty et al., 2002), from feelings experienced while answering the scale (e.g., the ease with which responses come to mind; Tormala et al., 2007) or even from personality variables (e.g., certainty-related traits; DeMarree et al., 2020). In the case of the manipulation, the induced certainty comes from prior experiences unrelated to the responses to the initial inventory. As noted, this induced certainty is then misattributed to the mental content currently available in people's minds, specifically the responses previously provided to the scale. Importantly, in each case, the certainty (whatever its origin) becomes attached to participants' perceptions of their own holism. Therefore, a unique feature of SVT is that it makes similar predictions for certainty regardless of whether it is measured or manipulated and, therefore, regardless of whether certainty arises from origins related to the initial responses (as will be the case in Study 1a and Study 2) or from origins unrelated to holism (as in Study 1b and Study 3).

Holistic thinking is an interesting candidate variable to test these SVT predictions because previous research has shown that holism can be associated with uncertainty (Li et al., 2014; Ng & Hynie, 2016). Given this association, it is plausible that holism would be more likely to guide responses to contradiction under relevant conditions, with doubt being more relevant to holism than certainty. In contrast to this view, based on SVT we expected certainty to improve the ability of individual differences in holism to predict how people respond to contradiction-relevant outcomes. Beyond examining new domains relevant to contradiction, such as attitude change following writing counter-attitudinal essays and beyond discovering new findings in the literature regarding dialectical proverbs and ambivalence, the present research was designed to be the first research to demonstrate moderation of previously identified effects in the domain of individual differences in holistic thinking. Therefore, the key novelty of the present research is that perceived certainty in one's holism, whether measured or manipulated, can improve the predictive validity of the holism scale on responses to contradiction operationalised through the aforementioned paradigms.

OVERVIEW OF THE PRESENT RESEARCH

Across studies, the present research examined to what extent certainty in holistic thinking can help predict responses to contradiction as assessed using different paradigms: the preference for dialectical proverbs containing internal contradictions (Studies 1a and 1b), the amount of attitude change after writing a counter-attitudinal essay (Study 2) and the correspondence between objective ambivalence (OA) and subjective ambivalence (SA) after learning contradicting information about a person (Study 3). Importantly, we expected certainty to improve the ability of individual differences in holism to predict responses to contradiction whether certainty was measured (Study 1a and 2) or manipulated (Study 1b and 3). That is, the following effects are expected *because* confidence affects perceived validity of the mental construct for which that confidence is misattributed and the responses to the holism scale are the available mental construct to be validated at the time that confidence is induced or measured. Therefore, our hypotheses were:

> **Hypothesis 1a.** Increases in holistic thinking will be associated with greater evaluation of contradiction materials (as indicated by a greater preference for dialectical proverbs containing contradictory information) as certainty in holistic thinking also increases. According to SVT, we predicted an interaction between holistic thinking and measured certainty on preference for dialectical proverbs.

Hypothesis 1b. Increases in holistic thinking will be associated with increased evaluation of contradiction-relevant information as indicated by a greater preference for dialectical proverbs containing contradictory information, especially when assigned to the certainty (vs. doubt) condition. According to SVT, we predicted an interaction between holistic thinking and manipulated certainty on preference for dialectical proverbs.

Hypothesis 2. Increases in holistic thinking will be associated with differential responses to contradiction as indicated by less attitude change in a self-persuasion paradigm regarding information that contradicts one's initial position and that effect will be stronger for those holding their scores with higher certainty. According to SVT, we predicted an interaction between holistic thinking and certainty on attitude change.

Hypothesis 3. Increases in holistic thinking will be associated with differential responses to contradiction as indicated by a reduced correlation between OA and SA and that effect will be stronger for individuals who were assigned to the certainty (vs. doubt) condition. According to SVT, we predicted an interaction between holistic thinking, manipulated certainty and OA on SA.

STUDY 1A

The main goal of Study 1a was to examine whether a trait inventory of holistic-analytic thinking (subsequently referred to as 'holistic thinking') would impact differently on dealing with contradictory information as a function of the certainty that individuals have in their responses to the scale. Specifically, we predicted that certainty in people's scores on the holistic thinking scale would moderate the extent to which those who scored higher on this trait would prefer dialectical proverbs to a greater extent. Thus, we expected that certainty would moderate the impact of holistic thinking scores on favourable reactions to dialectical proverbs.

Method

Participants and design

Three hundred and two participants (34.5% females, $M_{age} = 37.16$, $SD = 10.85$) were collected through Amazon MTurk in exchange for monetary compensation ($0.40). We assessed the relationship between holistic thinking (predictor variable) and certainty (moderator variable) on the preference for dialectical proverbs (criterion variable). Because no prior research had specifically examined our key predicted interaction, an a priori power analysis was performed using G*Power (Faul et al., 2009), which assumed a generic small-to-medium value for the interaction effect size (Cohen's $f^2 = 0.03$). Results of this analysis suggested that the desired sample size for a two-tailed test ($\alpha = 0.05$) with .80 power was $N = 264$. Our final sample ($N = 304$) exceeded this number because data collection continued until the end of the day when we anticipated reaching the target sample size. Based on a sensitivity analysis (conducted with G*Power), this sample size allowed us to detect effects equal or higher than $f^2 = 0.026$. All measures, manipulations and exclusions in the studies are disclosed. All data can be found at: https://osf.io/yhgre/?view_only=fe3a1ed7f79e476b99bd0480d9fa5221.

Procedure

Permission to conduct the study was provided by the university institutional ethics committee before the study began. Participants were recruited from MTurk in exchange for monetary compensation.

First, the participants completed a measure of holistic thinking, then they responded to a measure regarding certainty in their responses to the scale and reported the extent to which they liked each of several proverbs containing contradictions (see Friedman et al., 2006; Peng & Nisbett, 1999; Study 1, for similar procedures). Finally, participants answered several demographic questions, then were debriefed about the purpose of the study.

Predictor variables

Holistic thinking

Participants' holistic thinking was measured using a brief version of the AHS composed of 12 items (AHS-12, Martín-Fernández et al., 2022). The scale is based on four subscales: Causality (e.g., 'Even a small change in any element of the universe can lead to significant alterations in other elements'), attitude toward contradiction (e.g., 'We should avoid going to extremes'), perception of change (e.g., 'Future events are predictable based on present situations') and locus of attention (e.g., 'It is more important to pay attention to the whole than its parts'). Participants indicated how much they agreed with the items on a 7-point Likert-type scale anchored at 1 ('Strongly disagree') to 7 ('Strongly agree'). Higher scores indicated greater holistic thinking ($\alpha = .82$, $M = 4.69$, $SD = 0.60$).[1]

Certainty

After completing the AHS, participants responded to the following question: 'Overall, how certain are you in the responses you just gave to the previous questions?' (1 = 'Extremely uncertain' to 7 = 'Extremely certain'). Thus, higher scores on this item indicated greater certainty ($M = 5.96$, $SD = 1.06$). This item was identical to the one used in prior research (e.g., Santos et al., 2019).

Criterion variable: Preference for dialectical proverbs

Participants were exposed to a compendium of eight dialectical proverbs characterized by containing contradictory information. Some examples of these proverbs included 'A man is stronger than iron and weaker than a fly,' which suggests that a person can simultaneously possess opposite characteristics such as strength and weakness, or the proverb 'Too humble is half proud' that explicitly contrasts the very meaning of the word 'humble' and 'proud.' These dialectical proverbs have been used previously in the domain of holistic-analytic thinking (see Friedman et al., 2006; Peng & Nisbett, 1999). Afterwards, participants rated how much they liked each proverb on a 7-point Likert-type scale anchored at 1 ('Not at all') to 7 ('Very much'). Responses to these items were highly correlated ($\alpha = .81$), thus were aggregated to form a global index of preference for dialectical proverbs. Higher scores indicated a higher preference ($M = 4.75$, $SD = 1.09$).

Results

Table 1 summarizes the descriptive statistics and correlation matrix. Following the suggestions of Cohen et al. (1983), preference for dialectical proverbs was submitted to a hierarchical regression analysis. Holistic thinking (centered), certainty (centered) and the interaction term were entered as predictors. Main effects were interpreted in the first step of the regression and the two-way interaction in the second, final step.[2] The regression analysis revealed the expected main effect of holistic thinking, $B = 0.401$, $\beta = .221$, $t(301) = 3.920$, $p < .001$, 95% CI [0.200, 0.602], indicating that higher holistic thinking was

[1]The alpha of the reduced AHS scale was .82 when only the 9 direct items were included in the merged index and .72 for the 3 reverse scored items.

[2]Multicollinearity was unlikely to be a problem given the highest variance inflation factor (VIF) was 1.181.

TABLE 1 Means, standard deviations and correlations between the variables in Study 1A.

	M (*SD*)	1	2
1. Holistic thinking	4.69 (0.60)		
2. Certainty	5.96 (1.06)	.237**	
3. Preference for dialectical proverbs	4.75 (1.09)	.263**	.228**

*$p < .01$; **$p < .001$.

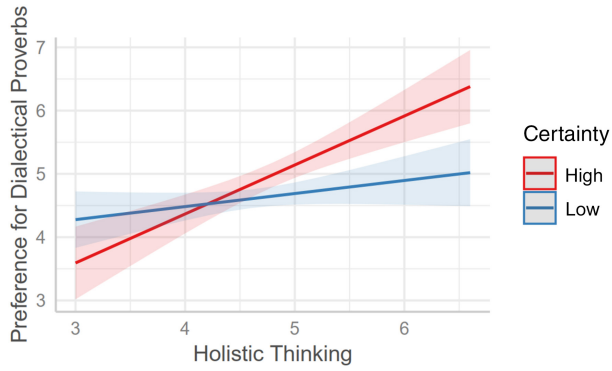

FIGURE 1 Preference for Dialectical Proverbs as a Function of Holistic Thinking and Certainty (measured) in Study 1a.

associated with greater preference for the dialectical proverbs. We also found a main effect of certainty, $B = 0.180$, $\beta = .176$, $t(301) = 3.119$, $p = .002$, 95% CI [0.066, 0.294], indicating that individuals higher in certainty had a higher preference for the dialectical proverbs.

In line with our primary prediction, we found a significant interaction between holistic thinking and certainty, $B = 0.194$, $\beta = .132$, $t(300) = 2.299$, $p = .022$, 95% CI [0.028, 0.360], $f^2 = 0.018$. As illustrated in Figure 1, among those with higher certainty in AHS scores (analysed one standard deviation above the mean), holistic thinking positively predicted preference for dialectical proverbs, $B = 0.588$, $\beta = .326$, $t(300) = 4.518$, $p < .001$, 95% CI [0.332, 0.844]. For those with lower certainty in AHS scores (analysed one standard deviation below the mean), holistic thinking was not associated with preference for dialectical proverbs, $B = 0.180$, $\beta = .099$, $t(300) = 1.283$, $p = .201$, 95% CI [−0.096, 0.455].

Described differently, for those participants with higher levels of holistic thinking (+1SD), those with higher scores in reported certainty had a higher preference for the dialectical proverbs than did those with lower levels of certainty, $B = 0.341$, $\beta = .333$, $t(300) = 3.768$, $p < .001$, 95% CI [0.163, 0.519]. In contrast, for those participants with lower holistic levels (-1SD), no significant relationship between holistic thinking and preference for dialectical proverbs was found, $B = 0.108$, $\beta = .106$, $t(300) = 1.655$, $p = .099$, 95% CI [−0.020, 0.237].

Discussion

The results of this study conceptually replicated the findings of Peng and Nisbett (1999; Study 1) by applying an individual-difference approach rather than a cultural-difference approach and thus illustrating that as holistic thinking increases, dialectical proverbs are liked more. Importantly, reported certainty further moderated this outcome. As hypothesized, we found that higher holistic thinking predicted preference for dialectical proverbs to a greater extent if participants were higher in their certainty in their reported holistic thinking. Thus, as certainty in holistic thinking increased, so too did the ability of this individual difference variable to predict participants' preferences for the conflict-relevant material (dialectical proverbs). Because participants' certainty was measured in this study, it is possible that

other, unmeasured factors (e.g., knowledge, abilities, experiences, etc.) may have been confounded with reported certainty. Therefore, in the next study, we moved to an experimental paradigm manipulating participants' certainty to infer the causal role of this variable.

STUDY 1B

The main goal of Study 1b was to provide evidence for the causal role of certainty and replicate the moderating results for holistic thinking introduced for the first time in the previous study. We predicted that individuals induced with high certainty would act more in accord with their holistic thinking scores and would therefore prefer dialectical proverbs more than individuals induced with doubt. As explained earlier, the logic behind this manipulation is that creating a general momentary feeling of certainty by recalling past experiences, though incidental to holistic thinking, would be misattributed to certainty in the current thoughts available in mind (i.e., in this case, the previous responses to the holism scale), similar to the manner in which incidental emotion can be misattributed to other events (e.g., Briñol et al., 2018; Requero et al., 2021; Schwarz & Clore, 1983). Importantly, measuring certainty by directly asking participants about how sure they are in their responses to the holism scale and manipulating certainty by asking them to recall past episodes in which they felt certain (regardless of holism) are two different inductions that can both produce a sense of certainty in one's holism.

We examined the effectiveness of this manipulation in two post-test studies described below. If induced correctly, manipulating certainty would speak to the causal moderating role of perceptions of certainty. Thus, we predicted that as holism increased, preference for dialectical proverbs would increase, especially for participants assigned to the certainty (vs. doubt) condition.

Method

Participants and design

Three hundred fifty-four participants (46.3% women, 53.7% men, $M_{age} = 40.55$, $SD = 12.14$) were recruited anonymously via Connect CloudResearch in exchange for monetary compensation ($0.40). The study took approximately 10 minutes to complete. We assessed the relationship between holistic thinking (predictor variable) and certainty (moderator variable) on the preference for dialectical proverbs (criterion variable). Given that the current design varied from the previous study because we move from measuring certainty to manipulating it, we could not take its effect size. Thus, we assumed again a generic small-to-medium value for the interaction effect size (Cohen's $f^2 = 0.03$). Results of this analysis suggested that the desired sample size for a two-tailed test ($\alpha = 0.05$) with .80 power was $N = 264$. Our final sample ($N = 354$) exceeded the expected number because data collection continued until the end of the day when we anticipated reaching the target sample size.[3]

Procedure

Permission to conduct the study was provided by the university institutional ethics committee before the study began. Participants were recruited from Connect CloudResearch in exchange for monetary

[3]We did not exclude any participant. There were two attention checks in the survey, one consisting of asking participants to leave a box blank at the beginning of the study, and the other consisting of clicking a specific key in response to a math operation. The predicted two-way interaction improved when the first attention check was employed (filtering out 12 participants), $B = 0.314$, $\beta = .155$, $t(338) = 3.051$, $p = .003$, 95% CI: 0.112, 0.517. The results were the same when the second attention check was employed (filtering out 6 participants), $B = 0.242$, $\beta = .122$, $t(344) = 2.422$, $p = .016$, 95% CI: 0.112, 0.517, and when the two checks were used in combination (filtering out 18 participants), the results were also similar, $B = 0.306$, $\beta = .152$, $t(332) = 2.971$, $p = .003$, 95% CI[0.103, 0.508].

compensation. First, the participants completed the AHS (Choi et al., 2007), then they were randomly assigned to one of two conditions: confidence vs. doubt. Next, participants were presented with the same dialectical proverbs of Study 1a and were asked to report the extent to which they liked each of the proverbs. Finally, participants answered several demographic questions, then were debriefed about the purpose of the study.

Predictor variables

Holistic thinking

Participants' holistic-analytic thinking was measured using the complete original version of AHS composed of 24 items (Choi et al., 2007). The reliability in this sample was adequate ($\alpha = .76$). Higher scores indicated greater holistic thinking ($M = 4.90$, $SD = 0.57$).

Certainty

Participants' certainty was manipulated by asking them to describe two personal episodes in which they felt either confidence (high certainty) or doubt (low certainty) in their thoughts. Examples of episodes described in the doubt condition included: 'I was doubtful about being asked to go to church and it felt sad to turn down my grandmother's offer.' and, 'I would say the time I quit my job. I did not like what I was doing and out of impulse I quit my job after my lunch break.' Examples of episodes described in the confidence condition were: 'I took my dog for a walk and I felt confident about myself. I thought for the first time in a while that I'm doing a good job as a parent and a teacher,' and 'One time I felt confident in my beliefs was when I was arguing a point with someone and had plenty of evidence to support my point of view.' Prior research has shown that this manipulation is successful at inducing relative confidence versus doubt in one's thoughts (Moreno et al., 2021; Paredes et al., 2020; Petty et al., 2002; Requero et al., 2020).

We conducted a post-test to examine whether this induction of certainty affected reported feelings of certainty. In this post-test, 91 undergraduates from a large public university (83.5% women, 15.4% men and 1.1% non-binary, $M_{age} = 20$, $SD = 4.80$) were randomly assigned to the certainty manipulation just described in which they had to recall past episodes of confidence or doubt. Following the induction, participants indicated to what extent they felt certain using three items: 'How certain are you at this moment?', 'How confident are you at this moment?' and 'How sure are you at this moment?' (Paredes et al., 2020). The inter-reliability of these items was high ($a = .95$) and we averaged the items to form a composite index as our manipulation check. As predicted, results showed that the certainty manipulation affected this composite index of self-reported certainty, $t(89) = 3.811$, $p < .001$, $d = 0.79$, such that participants assigned to recall past episodes of confidence ($M = 9.13$, $SD = 1.53$) reported higher levels of perceived certainty than those assigned to the doubt condition ($M = 7.67$, $SD = 2.10$).[4]

In another post-test, we examined whether this induction of certainty affected reported feelings of certainty while not affecting other features such as conscientiousness. In this post-test, 154 participants (44.8% women, 53.9% men and 1.3% not answer, $M_{age} = 27.70$, $SD = 10.58$) were collected through MTurk in exchange for monetary compensation ($0.20). They were randomly assigned to the same certainty manipulation described previously in which they had to recall past episodes of confidence or doubt. Following the induction, participants indicated to what extent they felt certain (i.e., 'How certain are you at this moment?') on a 9-point Likert-type scale anchored at 1 ('Extremely uncertain') to 9 ('Extremely certain'). As predicted,

[4]Moreover, we also measured the more chronic trait of self-confidence (DeMarree et al., 2020). We used a validated scale of 4 items (e.g., 'I am a confident person;" "I generally feel self-assured in various aspects of my life'; $\alpha = .87$). As this measure was originally designed to assess chronic (rather than transitory) feelings of certainty, we reasoned that it could serve as a good criterion to assess the discriminant validity of our measures of transitory certainty. Thus, although the induction affected the state measure of confidence, it did not influence the chronic self-confidence measure ($p = .137$).

results showed that the certainty manipulation affected the self-reported certainty, $t(152) = -4.435$, $p < .001$, $d = 0.71$, such that participants assigned to recall past episodes of confidence ($M = 7.60$, $SD = 1.69$) reported higher levels of perceived certainty than those assigned to the doubt condition ($M = 6.10$, $SD = 2.43$). Furthermore, we also assessed conscientiousness to examine the potential role of this construct. Participants rated how careful they were in their responses (as a proxy for conscientiousness) on a 9-point Likert-type scale anchored at 1 ('*Not at all*') to 9 ('*Very much*'). The results showed that our confidence manipulation did not affect this measure of conscientiousness, $t(152) = -0.570$, $p = .570$, $d = 0.09$. Although past research has found that, if anything, doubt is likely to be associated with more careful, meticulous and precise thinking than confidence (Maio et al., 1996), in this particular sample we found the certainty item to be positively correlated with the conscientiousness item ($r = .309$, $p < .001$).

Criterion variable: Preference for dialectical proverbs

Participants were exposed to the same eight dialectical proverbs as in Study 1a and then rated how much they liked each one. Responses to these items were highly correlated ($\alpha = .80$), thus were aggregated to form a global index of preference for dialectical proverbs. Higher scores indicated a higher preference ($M = 4.50$, $SD = 1.14$).

Results

The initial holistic thinking scores did not differ as a function of the subsequent certainty manipulation ($t[352] = -0.418$, $p = .676$, $d = 0.05$) as expected since it was assessed prior to the induction. Following the suggestions of Cohen et al. (1983), preference for dialectical proverbs was submitted to a hierarchical regression analysis. Holistic thinking (centered), certainty (contrast coded: −1 doubt, 1 confidence) and the interaction term were entered as predictors. Main effects were interpreted in the first step of the regression and the two-way interaction in the second step. The regression analysis revealed the expected main effect of holistic thinking, $B = 0.772$, $\beta = .384$, $t(351) = 7.802$, $p < .001$, 95% CI [0.578, 0.967], indicating that higher holistic thinking was associated with greater preference for the dialectical proverbs. We did not find a main effect of certainty, $B = 0.032$, $\beta = .028$, $t(351) = 0.565$, $p = .573$, 95% CI [−0.078, 0.142].

Consistent with the key prediction, we found a significant interaction between holistic thinking and certainty, $B = 0.251$, $\beta = .125$ $t(350) = 2.505$, $p = .013$, 95% CI [0.054, 0.448], $f^2 = 0.018$. As illustrated in Figure 2, among those assigned to the confidence condition, holistic thinking positively predicted preference for dialectical proverbs, $B = 1.072$, $\beta = .533$, $t(350) = 6.928$, $p < .001$, 95% CI [0.767, 1.376]. For those assigned to the doubt condition, holistic thinking was also associated with preference for dialectical proverbs but to a significantly lesser extent, $B = 0.570$, $\beta = .284$, $t(350) = 4.479$, $p < .001$, 95% CI [0.320, 0.820].

Described differently, for those participants with higher levels of holistic thinking (+1SD), those in the confidence condition had a higher preference for the dialectical proverbs than did those in the doubt condition, $B = 0.173$, $\beta = .152$, $t(350) = 2.185$, $p = .030$, 95% CI [0.017, 0.329]. In contrast, for those participants with lower holistic levels (-1SD), no significant difference in preference for dialectical proverbs between confidence vs. doubt condition was found, $B = -0.111$, $\beta = -.098$, $t(350) = -1.396$, $p = .164$, 95% CI [−0.268, 0.045].

Discussion

Individuals who are higher in holistic thinking liked dialectical proverbs more, conceptually replicating previous findings of Peng and Nisbett (1999; Study 1) but this time using an individual-difference

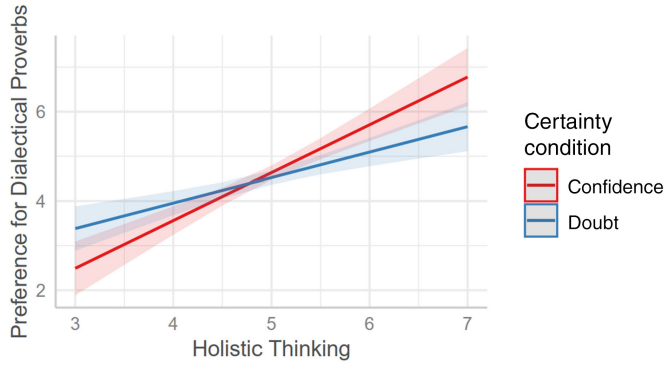

FIGURE 2 Preference for Dialectical Proverbs as a Function of Holistic Thinking and Certainty (manipulated) in Study 1b.

approach, replicating Study 1a. Most relevant, manipulated certainty further moderated this effect. As hypothesized, we found that higher holistic thinking predicted preference for dialectical proverbs to a greater extent if participants were assigned to the confidence (vs. doubt) condition. Thus, Study 1a illustrated the moderating role of reported certainty when we use a measure of certainty, whereas Study 1b manipulated certainty with a well-established induction. Predicting and showing that operationalizing certainty through these different approaches (measurement in a content-dependent approach and manipulated in an incidental content-independent manner) is capable of producing the very same SVT effects is a strength of this research. It provides convergence validity for our different procedures.

An open question worth examining is whether these effects would generalize to dealing with other contradiction-relevant paradigms. Moreover, we have established the causal role of certainty in improving the predictive validity of this inventory by manipulating this construct. In the next study, natural variations in certainty will again be measured as we turn to a different contradiction paradigm. Thus, Study 2 examines a different contradiction paradigm and returns to using a measure instead of a manipulation of certainty.

STUDY 2

The main goal of Study 2 was to generalize to a different paradigm of contradiction and to extend the results to consequential changes in evaluation. Instead of evaluating responses to dialectical proverbs as an indicator of contradiction as in Studies 1a and 1b, Study 2 was based on a counter-attitudinal persuasion paradigm. Beyond generalizing, this study allowed us to rule out the possibility that the previously obtained effect occurred because those high in holistic thinking are also more agreeable, such that they rate proverbs as more likable. This acquiescence effect can be ruled out by moving to a paradigm in which we expect that as holistic thinking increases, the key outcome decreases. The amount of attitude change after writing a counter-attitudinal essay served as an indicator of how participants dealt with contradiction. Research on cognitive dissonance theory (Festinger, 1957) has shown that writing against one's view typically causes discomfort and people can resolve this discomfort by moving their attitudes toward their advocacy (Aronson et al., 1995). If people higher in holistic thinking are less bothered by their counter-attitudinal advocacy, they should show less change. On the contrary, more attitude change in the direction of the essay would suggest that there is more contradiction or that the contradiction is more bothersome. Thus, we predicted that increased holism would be associated with less attitude change in response to writing the counter-attitudinal essay and this effect would be more pronounced as certainty was increased (or attenuated as certainty was decreased).

Method

Participants and design

Three hundred and thirty-five undergraduate students (84.2% females, $M_{age} = 19.66$, $SD = 1.50$) participated anonymously in this study in exchange for course credit. Holistic thinking (continuous variable) and the extent of certainty in their responses to the holistic thinking scale (continuous variable) were included as predictor variables, whereas attitude change in response to a counter-attitudinal essay was measured as the criterion variable. Because we moved from dialectical proverbs to an attitude change paradigm, we could not rely on the effect sizes of Studies 1a and 1b. Thus, we again assumed a generic small-to-medium value for the interaction effect size (Cohen's $f^2 = 0.03$). Results of this analysis suggested that the desired sample size for a two-tailed test ($\alpha = 0.05$) with .80 power was $N = 264$. Our final sample ($N = 335$) again exceeded this number because data collection continued until the end of the week when we anticipated reaching the target sample size.

Procedure

Permission to conduct the study was provided by the university institutional ethics committee before the study began. First, participants completed the AHS and responded how certain they were in their scores. Then, they were told that a university committee was considering requiring senior comprehensive exams before graduation (cf., Cialdini et al., 1976) and participants were asked to report their opinion about that proposal (initial attitudes measure). After that, participants were told that the university committee was interested in learning more about the thoughts students might have regarding this possibility. Then, participants were asked to write some arguments in favour of comprehensive exams (and all did so). After that, all of them were again asked to report their opinion about the exams (post-attitude measure after the writing task). Finally, participants answered several demographic questions and were thanked and debriefed.

Predictor variables

Holistic thinking

Participants' holistic-analytic thinking was measured using the same scale as in Study 1b, the AHS. The reliability in this sample was adequate ($\alpha = .74$). Higher scores indicated greater holistic thinking ($M = 4.74$, $SD = 0.51$).

Certainty in holistic thinking

After completing the AHS, participants indicated to what extent they were certain in their responses to the scale using the same item as in Study 1a. Thus, higher scores on this item indicated greater certainty ($M = 6.89$, $SD = 1.12$).

Criterion variable: Attitude change

Participants reported their attitudes before and after writing the essay in favour of exams. Both measures of attitudes were assessed using four 9-point semantic differential scales: *dislike-like, negative–positive, bad-good* and *unfavourable-favourable* and were averaged to create an attitude score at each administration. Then, the difference between participants' initial attitudes toward the exams ($M_{T1} = 3.92$,

TABLE 2 Means, standard deviations and correlations between the variables in Study 2.

	M (*SD*)	1	2
1. Holistic thinking	4.74 (0.51)		
2. Certainty	6.89 (1.12)	.191**	
3. Attitude change	1.03 (1.00)	−.032	−.008

*$p < .01$; **$p < .001$.

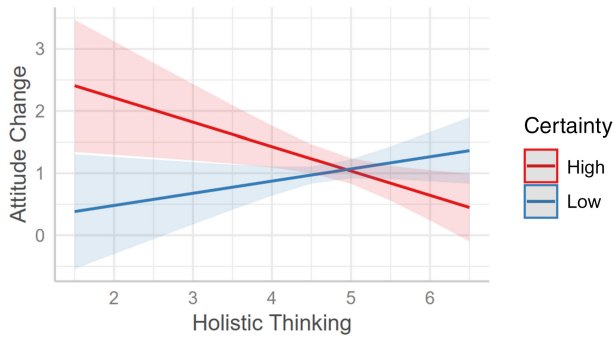

FIGURE 3 Attitude Change as a Function of Holistic Thinking and Certainty (measured) in Study 2.

$SD_{T1} = 2.31$; $\alpha = .98$) and their attitudes after completing the writing task ($M_{T2} = 4.72$, $SD_{T2} = 1.98$; $\alpha = .90$) was calculated to create an index of attitude change (for a similar procedure, see Cárdaba et al., 2014; Tormala et al., 2006). Higher values represented more attitude change in the direction of the advocacy ($M = 1.03$, $SD = 1.00$).

Results

Table 2 summarizes the descriptive statistics and correlation matrix. Following the suggestions of Cohen et al. (1983), attitude change was submitted to a hierarchical regression analysis. Holistic thinking (centered), certainty (centered) and the interaction term were entered as predictors. Main effects were interpreted in the first step of the regression and the two-way interaction in the second step.[5] There were no significant main effects for either holistic thinking, $B = -0.061$, $\beta = -.031$, $t(332) = -0.562$, $p = .575$, 95% CI [−0.275, 0.153], or certainty, $B = -0.002$, $\beta = -.002$, $t(332) = -0.039$, $p = .969$, 95% CI [−0.100, 0.096]. Importantly, a significant interaction between holistic thinking and certainty on attitude change was obtained, $B = -0.231$, $\beta = -.154$, $t(331) = -2.784$, $p = .006$, 95% CI [−0.395, −0.068], $f^2 = 0.023$. As illustrated in Figure 3, among those with higher certainty in their responses to the AHS (analysed one standard deviation above the mean), more holistic thinking was associated with less attitude change, $B = -0.265$, $\beta = -.136$, $t(331) = -2.032$, $p = .043$, 95% CI [−0.521, −0.008]. For those with relatively lower certainty in their responses to the AHS (analysed one standard deviation below the mean), there was no relationship between holistic thinking and attitude change, $B = 0.256$, $\beta = .131$, $t(331) = -1.632$, $p = .104$, 95% CI [−0.053, 0.565].

Described differently, for participants with higher levels of holistic thinking (+1SD), those with higher scores in reported certainty tended to show less attitude change than did those with lower scores in reported certainty, $B = -0.129$, $\beta = -.145$, $t(331) = -1.923$, $p = .055$, 95% CI [−0.262, 0.003]. In contrast, for participants with lower holistic thinking (-1SD), those with higher scores in reported certainty

[5]Multicollinearity was unlikely to be a problem given the highest variance inflation factor (VIF) was 1.036.

tended to show more attitude change than did those with lower scores in reported certainty, $B = 0.109$, $\beta = .122$, $t(331) = 1.716$, $p = .087$, 95% CI [−0.016, 0.233].

Discussion

Study 2 extended the effects found in the previous studies to a new important outcome. In this new contradiction-relevant paradigm, we found that as certainty in holistic thinking increased, so too did the ability of this individual difference variable to predict participants' attitude change following the writing of a counter-attitudinal essay. Specifically, participants with higher certainty in their holistic thinking changed their attitudes less after engaging in counter-attitudinal advocacy, suggesting they were better able to deal with their counter-attitudinal behaviour without changing.

Moreover, these findings help rule out agreeability as an alternative explanation for the effects of holism observed in the earlier studies by showing that high holistic thinking was associated with less rather than more attitude change –especially for those individuals with higher certainty in that trait. One question worth examining is whether we could extend the findings to yet another contradiction-relevant paradigm and also replicate the impact of manipulated certainty on holism. Therefore, the final study was designed to expand the contribution to the domain of attitudinal ambivalence.

STUDY 3

As in Study 2, Study 3 has the potential to further rule out the alternative explanation based on agreeability according to which people higher in holistic thinking could be more likely to show higher levels of agreement with anything. In this case, we expected that individual differences in holistic thinking would show lower levels of association between objective and subjective ambivalence (OA-SA correspondence), especially when participants are induced to be sure of their holism (a previously unexplored effect). We first predicted that higher holism scores would be associated with a reduced relationship between objective and subjective ambivalence. That is, as holism increased, people would be less likely to translate their objective ambivalence into feelings of conflict because having mixed views is less bothersome for those higher in holism. We also predicted that this reduced link between OA and SA as holism increased would be stronger among participants in the manipulated certainty than in the doubt condition. Therefore, this study hypothesized a three-way interaction between holism, manipulated certainty and objective ambivalence predicting subjective ambivalence.

Method

Participants and design

Two hundred and ninety-nine participants (39.1% females, *M*age = 34.07, *SD* = 8.92) were collected through MTurk in exchange for monetary compensation ($0.50). The study took approximately 15 min to complete. Holistic thinking (continuous variable), certainty (dichotomous variable) and objective ambivalence (continuous variable) were included as predictor variables, whereas subjective ambivalence (continuous variable) was assessed as the dependent measure. Given that the current design is different from the previous studies, we again planned for a relatively small-to-medium effect in multiple regression (Cohen's $f^2 = .030$; Cohen, 1988). Results indicated that the desired sample size for a two-tailed test ($\alpha = .05$) of a three-way interaction with .80 power was $N = 264$ participants (as indicated by an a priori power analysis using G*Power, see Faul et al., 2009). Our final sample size exceeded the estimated

because data collection continued until the end of the day when we anticipated reaching the target sample size, resulting in 299 participants.

Procedure

Permission to conduct the study was provided by the university institutional ethics committee before the study began. Participants first completed a brief version of the AHS. After that, they were randomly assigned to either a confidence or doubt condition using a procedure based on a memory task as used in Study 1b (i.e., writing about prior personal experiences in which they felt either confidence or doubt). Next, participants were led to believe that they were engaged in a forming impression task about a person called Bob. They received behavioural information consisting of a set of 10 actions that Bob had performed (cf., Durso et al., 2021). This information included a mixture of five positive and five negative behaviours (mixed information). After exposure to the information, objective and subjective ambivalence were measured. Subjective ambivalence served as our main criterion measure in this study and the extent to which subjective ambivalence was predicted by objective ambivalence, moderated by certainty, served as the key analyses to test our predictions. Finally, participants answered several demographic questions and were thanked and debriefed.

Independent/predictor variables

Holistic thinking

Participants' holistic-analytic thinking was measured using a brief version of the AHS composed of 12 items (AHS-12, Martín-Fernández et al., 2022). Higher scores indicated greater holistic thinking ($\alpha = .83$, $M = 4.82$, $SD = 0.46$).[6]

Certainty

Participants' certainty was manipulated by asking participants to describe two personal episodes in which they felt either confidence (high certainty) or doubt (low certainty) in their thoughts (as in Study 1b). Examples of episodes described in the doubt condition included: 'A few years ago, I moved to another state and was very uncertain about what I wanted to do from there,' and 'I was in doubt when I went to buy my house, if I was buying the right house, in the right place, etc.' Examples of episodes described in the confidence condition were: 'When I attended my first match I felt confident of my training,' and 'When I wanted to choose the course to study in the university, I was so sure of my decision….'

Objective ambivalence (OA)

After reading the information about Bob's behaviours, participants reported their overall positive and negative reactions to Bob, using items adapted from prior research (DeMarree et al., 2014; Kaplan, 1972; Priester & Petty, 1996). Specifically, participants were asked: 'Rate the extent to which you have negative thoughts or feelings towards Bob. (In doing this, you should ignore any positive thoughts or feelings you may have about Bob).' and 'Rate the extent to which you have positive thoughts or feelings towards Bob. (In doing this, you should ignore any negative thoughts or feelings you may have about Bob).' Responses were provided on scales from 1 ('I feel no [negative/positive] thoughts or feelings)' to 11 ('I feel maximum [negative/positive] thoughts or feelings'). These scales were used to create an index of objective ambivalence subtracting the absolute value of the difference between the positive (P) and the negative (N) responses from the average of the two responses (i.e., $(P+N)/2 - |P - N|$; see Thompson et al., 1995). Higher values on this index reflected greater degrees of objective ambivalence ($M = 7.11$, $SD = 4.36$).

[6]The alpha of the reduced AHS scale was .83 when only the 9 direct items were included in the merged index and .74 for the 3 reverse scored items.

TABLE 3 Means, standard deviations and correlations between the variables in Study 3.

	M (*SD*)	1	2
1. Holistic thinking	4.82 (0.46)		
2. Objective ambivalence	7.11 (4.36)	.167*	
3. Subjective ambivalence	7.95 (2.18)	.287**	.337**

*$p < .01$; **$p < .001$.

Criterion variable: Subjective ambivalence (SA)

Following the objective ambivalence measure, subjective ambivalence was assessed by directly asking participants to report the extent to which they felt '*conflicted*,' '*undecided*,' and '*mixed*' about Bob, using 11-point response scales (Priester & Petty, 1996). These items showed good internal reliability ($\alpha = .82$), so they were averaged to form an index of subjective ambivalence ($M = 7.95$, $SD = 2.18$). As noted, the extent to which SA is predicted by OA and certainty will serve as the key outcomes of this study.

Results

Table 3 summarizes the descriptive statistics and correlation matrix. Holistic thinking scores did not differ as a function of the subsequent certainty manipulation ($t[297] = -1.134$, $p = .258$, $d = -0.13$), nor did OA scores($t[297] = 0.622$, $p = .535$, $d = 0.07$). Subjective ambivalence was submitted to a multiple regression with holistic thinking (centered), certainty (contrast coded: −1 doubt, 1 confidence), objective ambivalence (centered) and the interaction terms (the three two-ways and the three-way) entered as predictors. There was a significant main effect for holistic thinking, $B = 1.103$, $\beta = .233$, $t(295) = 4.331$, $p < .001$, 95% CI [0.602, 1.604], indicating that individuals who reported higher holistic thinking scored higher in SA than those who reported lower holistic thinking. We also found a main effect of objective ambivalence, $B = 0.150$, $\beta = .300$, $t(295) = 5.579$, $p < .001$, 95% CI [0.097, 0.203], revealing that individuals who scored higher in OA also had higher scores in SA. There was no main effect of the certainty manipulation, $B = 0.116$, $\beta = .053$, $t(295) = 1.005$, $p = .316$, 95% CI [−0.112, 0.345].

When testing the two-way interactions, the Certainty × Objective Ambivalence interaction was significant, $B = -0.079$, $\beta = -.157$, $t(294) = -2.888$, $p = .004$, 95% CI [−0.133, −0.025]. This interaction showed that the OA-SA correspondence was stronger in the doubt condition, $B = 0.261$, $\beta = .521$, $t(294) = 6.297$, $p < .001$, 95% CI [0.179, 0.342], than in the confidence condition, $B = 0.103$, $\beta = .206$, $t(294) = 2.894$, $p = .004$, 95% CI [0.033, 0.173]. The other two-way interactions were not significant (Holistic Thinking × Certainty, $B = -0.501$, $\beta = -.106$, $t(294) = -1.905$, $p = .058$, 95% CI: −1.019, 0.047 and Holistic Thinking × Objective Ambivalence, $B = -0.055$, $\beta = -.054$, $t(294) = -0.993$, $p = .322$, 95% CI [−0.164, 0.054]).

Importantly, a significant three-way interaction between holistic thinking, certainty and objective ambivalence on subjective ambivalence was obtained, $B = -0.142$, $\beta = -.142$, $t(290) = -2.500$, $p = .013$, 95% CI [−0.255, −0.030], $f^2 = 0.021$. As illustrated in Figure 4, there was a significant Holistic Thinking × Objective Ambivalence interaction in the confidence condition, $B = -0.139$, $\beta = -.137$, $t(290) = -2.039$, $p = .042$, 95% CI [−0.274, −0.005]. This two-way interaction indicated that among those participants assigned to the confidence condition, objective ambivalence was associated with subjective ambivalence for participants with lower levels of holistic thinking (−1 SD), $B = 0.178$, $\beta = .356$, $t(290) = 3.242$, $p = .001$, 95% CI [0.070, 0.286], but not for participants with higher levels of holistic thinking (+1 SD), $B = 0.049$, $\beta = .099$, $t(290) = 1.226$, $p = .221$, 95% CI [−0.030, 0.129]. In contrast, for those participants assigned to the doubt condition, the Holistic Thinking × Objective Ambivalence interaction was not significant, $B = 0.146$, $\beta = .143$, $t(290) = 1.596$, $p = .112$, 95% CI [−0.034, 0.325] and was directionally in the opposite pattern.

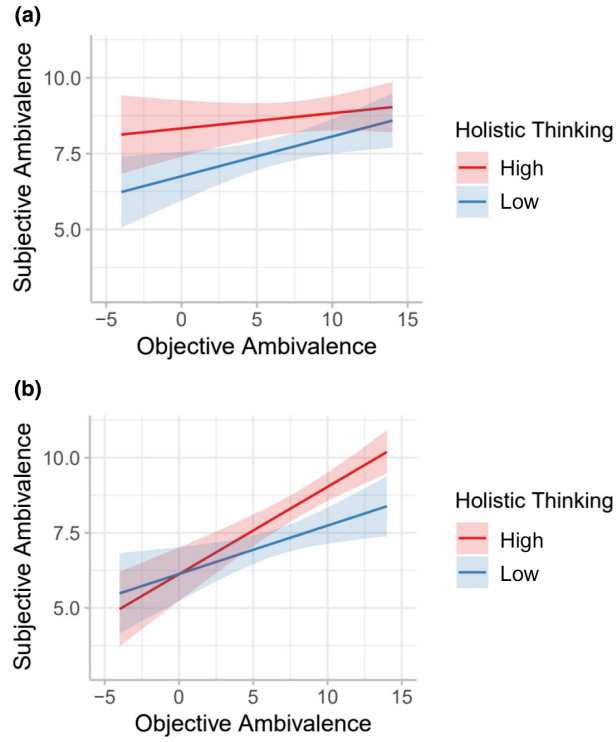

FIGURE 4 Subjective Ambivalence as a function of Holistic Thinking, Certainty and Objective Ambivalence (OA) in Study 3 (Panel a = Confidence condition and Panel b = Doubt condition).

Discussion

Study 3 extended the findings from the previous studies to a contradiction paradigm based on attitudinal ambivalence. Across participants assigned to the confidence condition, higher levels of holistic thinking were associated with lower OA-SA correspondence. For those assigned to the doubt condition, individual differences in holism did not moderate the link between OA and SA. First, along with Study 1b, this study offered causal evidence for the role of certainty in moderating the use of chronic holistic tendencies. Second, these findings further contributed to ruling out agreeability as an alternative explanation by showing that high holistic thinking was associated with less correspondence between related constructs (OA-SA) –at least for those individuals assigned to the confidence (vs. doubt) condition. If participants scoring higher in holism tended to agree with all measures, this would be expected to produce a higher correlation between OA and SA for those higher in holistic thinking. Finally, the results of this study offered a conceptual replication of previous research on dialectical thinking (a proxy to holism) and ambivalence (Luttrell et al., 2022), again, especially for those individuals assigned to the confidence (vs. doubt) condition.

GENERAL DISCUSSION

Previous research has shown how cultural differences in holistic thinking can influence the way people respond to contradictions (Choi & Nisbett, 2000; Peng & Nisbett, 1999; Spencer-Rodgers et al., 2010). Instead of examining cultural differences, the present work employed an individual differences approach to assess variations in holistic-analytic thinking within the same culture. Across four studies, we showed that participants with higher scores in holistic thinking liked dialectical proverbs containing contradictory information more (Studies 1a and 1b), tended to change their attitudes less after writing a

counter-attitudinal essay that contradicts one's initial position (Study 2) and displayed a smaller OA-SA correspondence after learning contradicting information about a person (Study 3).

In addition to moving from cultural to individual differences, the present research examined the extent to which the impact of holistic thinking on dealing with contradiction can be moderated by the certainty that people have in their own holistic thinking. In accord with SVT (Briñol & Petty, 2022), we predicted and found that the effect of holism on how people respond to contradicting information was moderated by the certainty with which individuals hold their self-perception. Specifically, as certainty increased (Study 1a Study 2) or participants were induced to feel certainty experimentally (Study 1b and 3), holistic thinking scores became better predictors of contradiction-relevant outcomes. That is, the effect of certainty in holism was shown in response to the external information presented (Study 1a and Study 1b), when changing after writing a counter-attitudinal essay contradicting one's initial position (Study 2) and also when faced with valence contradictory information (Study 3). These results supported the SVT hypothesis that the predictive validity of individual differences in holism on contradiction outcomes can be enhanced by considering certainty.

Research implications

The present research has a number of implications for holism and also for research on individual differences more generally. First, just as certainty moderates the impact of holistic thinking in paradigms relevant to contradiction, certainty can also play a moderating role in other domains relevant to this construct. As noted, past research has shown that holism can predict how people react in many different areas such as attention (Masuda et al., 2008; Senzaki et al., 2014), information processing (Miyamoto et al., 2011; Noguchi et al., 2014; Santos et al., 2023; Savani & Markus, 2012), categorization and memory processes (Ji et al., 2004; Yang et al., 2013) and decision making (Li et al., 2015). The present work suggests the possibility that there is also room for greater certainty (relative to doubt) to enhance the impact of holistic thinking in these other domains.

These data might also be of interest to personality and individual differences researchers more broadly, since they could benefit from including a measure of certainty in their questionnaires. As shown in the present research, a single item (i.e., certainty) was able to enhance the impact of holistic thinking on important outcomes such as dealing with contradiction. As noted, prior research has shown that certainty can also moderate the predictive validity of other scales relevant to aggression (Santos et al., 2019), identity fusion (Paredes et al., 2020) and beyond. Similarly, after measuring the big-five personality, researchers might ask 'how certain were you in the responses you just gave to the previous questions?' As we observed in the context of holistic thinking, adding this single item could also enhance the utility of a given personality trait to predict differential responses to contradictory informationt. Thus, we encourage personality researchers to use certainty measures as a moderator of individual difference scales because of their ease of application and their impact on the predictive validity of these scales. Moreover, including a measure of certainty requires only one extra item, thus has a minimal impact on the length of the questionnaire and it should be easy and efficient to respond. Although in this study we have used a meta-cognitive variable such as certainty, SVT suggests that there are other meta-cognitive assessments that might also magnify or reduce the impact of holistic thinking, such as how much one likes or enjoys the way they think or their style of thinking (e.g., Gascó et al., 2018). Of course, certainty cannot only be measured but also made to vary both directly and incidentally (as in the present studies), therefore, opening many possibilities for future research.

Limitations and future research

The present research has some limitations that should be considered. First, although we followed past work on responses to contradiction, the first two studies were open to an alternative interpretation based on agreeability (high holistic individuals tend to agree with the proverbs regardless of the

content). However, the subsequent two studies rendered this possibility less plausible by showing that those higher in holistic thinking did not agree more with everything. In the last two studies, we found that the higher the scores in holistic thinking the lower the scores for the outcomes of interest (i.e., less attitude change after writing a counter-attitudinal essay contradicting one's initial position and smaller OA-SA correspondence after learning contradicting information).

Second, another potential limitation of the present research is that this work focused on the upper continuum of the holistic-analytic thinking scale, where people with more holistic tendencies are located. That is, if we observe the mean scores on the scale of Studies 1a ($M = 4.69$), 1b, ($M = 4.90$), 2 ($M = 4.74$) and 3 ($M = 4.82$), we note that they are above the midpoint (ranged from 1 to 7). Although this is the general tendency in this area of research given that all the items in the scales refer to holism, one still might expect perceptions of validity to moderate the impact of analytic thinking when dealing with materials directly relevant to analytic thinkers, such as for example resolving logical problems.

Third, future studies should be undertaken to generalize these findings to other contexts in which contradiction is relevant, including, for example, moral dilemma scenarios and interpersonal contradictions (Choi et al., 2007; Santos et al., 2023), explicit-implicit attitudinal discrepancies (Petty et al., 2012), or self-control (Butera et al., 2019; Kleiman et al., 2014; Schneider et al., 2019). As noted, although we used quite different domains relevant to contradiction in the current studies, other areas of research within the domain of discrepancies can presumably benefit from assessing perceived scale certainty (e.g., Clarkson et al., 2008; DeMarree et al., 2015; Durso et al., 2016; Itzchakov et al., 2017; Luttrell et al., 2016). Fourth, not only might other areas of research on contradiction benefit from taking certainty into consideration, but also many other individual differences related to contradiction could benefit from examining the moderating role of certainty such as preference for consistency (Cialdini et al., 1995), tolerance for uncertainty (Shuper et al., 2004) and the fear of invalidity (Kruglanski et al., 1997).

Fifth, while the pattern of results is consistent in the present research, no psychological process occurs for all people in all situations. Thus, future research might benefit from identifying when certainty in holistic thinking is most likely to be considered and therefore have the potential to enhance reliance on predictive validity of the construct. According to SVT (Briñol & Petty, 2022), taking certainty into consideration is especially likely when people have enough motivation and ability to think about their own thoughts. Thus, it would be interesting to study when people consider their own assessment of their traits and their certainty before acting. Furthermore, future research is needed to specify to what extent holism affects either the level of contradiction perceived, the subsequent conflict experienced, how people deal with those subjective experiences, or a combination of them.

Sixth, the current studies were based on participants' holistic thinking self-report measures to assess chronic individual differences in this cognitive style. Future research could manipulate holistic thinking to establish a causal link in dealing with contradiction and beyond (see Sacchi et al., 2016; Santos et al., 2023; Smith & Redden, 2020, for successful manipulations of holism). In addition, the self-reported certainty in Study 1a and Study 2 was a single-item measure. Although this measure was capable of detecting the effect of the certainty induction in the post-test studies (reported in Study 1b) and was capable of moderating the impact of holism (Study 1a and Study 2), more reliable measures are always desired. Therefore, the post-test included a more reliable, three-item measure of certainty that was correlated with the single-item measure and that was also affected by the certainty manipulation, suggesting convergent validity across measures.

AUTHOR CONTRIBUTIONS

David Santos: Conceptualization; methodology; formal analysis; data curation; project administration; writing – review and editing; visualization; writing – original draft. **Blanca Requero:** Conceptualization; methodology; writing – original draft; writing – review and editing. **Lorena Moreno:** Writing – review and editing; writing – original draft; methodology; formal analysis. **Pablo Briñol:** Supervision; resources; conceptualization; writing – review and editing. **Richard Petty:** Supervision; conceptualization; writing – review and editing.

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CONFLICT OF INTEREST STATEMENT

None of the authors have any conflict of interest to declare.

DATA AVAILABILITY STATEMENT

The data that support the finding of this study are openly available in Open Science Framework at https://osf.io/c4yq6/?view_only=f9042befdb6b48b699c0ea3ade1b6e13.

DECLARATION OF ETHICAL GUIDELINES

All authors confirm that this manuscript adheres to ethical guidelines specified in the APA Code of Conduct as well as authors' national ethics guidelines.

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