Journal of Community & Applied Social Psychology

WILEY

RESEARCH ARTICLE OPEN ACCESS

Cognitive Liberalisation Through a Different Lens: Intergroup Contact Attenuates the Relationship Between Intolerance of Uncertainty and Intergroup Bias Across Three Contexts

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Received: 20 November 2024 | **Revised:** 12 March 2025 | **Accepted:** 1 May 2025

Funding: This work was supported by the Leverhulme Trust (R209595).

Keywords: cognitive liberalisation | intergroup bias | intergroup contact | intolerance of uncertainty

ABSTRACT

Researchers in the field of intergroup contact recently proposed that contact can broaden the mind, a process referred to as cognitive liberalisation. Under the right conditions, contact can increase flexible and creative thinking, as well as encourage the adoption of less rigid worldviews. The current research takes a novel approach by exploring whether contact can also "liberalise" people from the need to rely on intergroup bias to manage discomfort with uncertainty. We draw on Uncertainty-Identity Theory to argue that intergroup contact can ameliorate the regulatory function of intergroup bias for reducing subjective uncertainty. Using three large-scale Project Implicit datasets ($N_{total} = 25{,}046$), we tested whether contact moderates the relationship between intolerance of uncertainty and intergroup bias and found that intolerance of uncertainty was associated with intergroup bias among people who do not experience contact with gay, transgender, or disabled people, but this association was generally weaker or non-significant among people who experience contact. These results add to growing support for the liberalising impact of intergroup contact by elucidating a new benefit: Reduced reliance on intergroup bias as a means of managing subjective uncertainty.

1 | Introduction

It has long been established that intergroup contact reduces prejudice (Allport 1954; Hodson and Hewstone 2013; Lemmer and Wagner 2015; Pettigrew and Tropp 2006; Van Assche et al. 2023), but recent research has also uncovered benefits of contact that extend *beyond* intergroup relations (Boin et al. 2021; Meleady et al. 2019). Building on work showing how diversity experiences can enhance a broad range of cognitive outcomes, from creativity to cognitive flexibility (Crisp and Turner 2011), Hodson et al. (2018) proposed the *cognitive liberalisation hypothesis* (CLH). The CLH suggests specifically that repeated intergroup contact can 'liberalise' thinking as it enables people to break away from rigid, habitual thought patterns. This may be expressed in multiple ways other than changes in prejudice, including by more creative and flexible thinking as well as changes in ideology and worldview. For example, one cross-sectional study found that having high quality cross-group friendship was associated with increased perspective taking and empathy skills, and cognitive flexibility (Bagci et al. 2019). Another

study found an indirect effect of contact on wellbeing mediated sequentially through positive stereotype content and cognitive flexibility (Navarro et al. 2023). Longitudinal work, meanwhile, has shown that contact predicts more environmentally-friendly attitudes and behaviours through the adoption of less hierarchical and more egalitarian ideologies (Meleady et al. 2020). Furthermore, recent work using latent profile analysis demonstrated that people who have more positive and intimate contact have a greater likelihood of belonging to a cognitively flexible personality profile (Fuochi et al. 2024).

In the present research, we explore cognitive liberalisation from a different perspective: the ability to break away from regulatory strategies for managing subjective uncertainty. Research indicates that people typically manage uncertainty by increasing intergroup bias in order to maintain clear category distinctions and predictable frameworks for understanding the social world (Hogg 2021). We propose that if contact serves as an agent of cognitive liberalisation, it should weaken the relationship between intolerance of uncertainty and intergroup bias. While previous research has demonstrated contact's liberalising effects on attitudes and ideologies distinct from intergroup bias, the current work tests whether contact moderates the relationship between intolerance of uncertainty and intergroup bias. In doing so, we examine how contact might liberalise the very processes underlying intergroup bias itself by enabling individuals to move beyond their typical uncertainty-management strategies.

1.1 | Uncertainty and Bias

The present research draws on Uncertainty-Identity Theory (UIT; Hogg 2007, 2007, 2021). UIT has established that one psychological response to high personal levels of uncertainty is the reinforcement of intergroup bias, with bias not simply seen as an attitudinal outcome, but fulfilling a functional role in meeting core epistemic needs (Grieve and Hogg 1999; Hogg and Abrams 1993; Mullin and Hogg 1998; see also Scheepers et al. 2006; Sorrentino and Roney 2000). Identifying with and preferring one's group, in contrast to outgroups, serves as a coping mechanism, providing a sense of security, identity, and self-knowledge in the face of ambiguity or unpredictability. Prior work found that certainty-oriented people—those who tend to avoid uncertainty and aim to resolve it quickly using heuristics rather than careful information processing—were more likely to respond to uncertainty by expressing increased intergroup bias (Hodson and Sorrentino 2001). Similarly, other research focusing on racial bias found that, among White-US participants, a stronger need for cognitive closure (i.e., a stronger desire to eliminate ambiguity and have firm answers) was associated with stronger ingroup bias in favour of participants' own racial group, especially when the ingroup was perceived to be of high status (Federico et al. 2013). Collectively, such findings demonstrate a link between people's subjective approach to uncertainty and intergroup bias.

Related research on the need for cognitive closure suggests that the ingroup provides a validated common reality and belief system, helping people overcome their discomfort with uncertainty (Kruglanski 2004; Kruglanski et al. 2006). This work aligns with the UIT proposition that uncertainty reduction is a central motivation for ingroup identification (Hogg 2000). Ingroup-outgroup categorisation triggers a process of depersonalisation, where people perceive others (and also themselves) as more in line with the group prototype rather than as unique individuals. This process helps predict how others will behave and, importantly, helps people know what they themselves should think and feel and how they should behave, bolstering people's sense of self and, crucially, reducing uncomfortable feelings of uncertainty (Hogg 2007). Because the ingroup can offer a sense of certainty, the ingroup is evaluated positively compared with other groups (Mullin and Hogg 1999).

One way that people manage intolerance of uncertainty is therefore by drawing sharp ingroup-outgroup distinctions and preferring the ingroup over the outgroup. Group categorisation and intergroup bias serve regulatory roles by providing people with clear social categories, shared worldviews, predictable frameworks, and a connection with their ingroup that helps make their social world feel more manageable. In this paper, we propose that through intergroup contact this regulatory function of intergroup bias will be attenuated as individuals develop more complex ways of considering social categories, reducing their reliance on intergroup bias as a means of managing uncertainty. This process of expanding one's capacity to tolerate more ambiguity and complexity in social categorisation is a hallmark of cognitive liberalisation.

1.2 | Intergroup Contact as a Liberalising Agent

It has recently been proposed that intergroup contact can serve as an agent of cognitive liberalisation, opening up the mind and leading to changes in worldview, ideology, and a more flexible and creative mindset (Hodson et al. 2018). Broader cognitive shifts following intergroup contact, known as tertiary transfer effects, are those that extend beyond the intergroup domain, influencing general patterns of thought and promoting flexibility in processing information (Boin et al. 2021; Meleady et al. 2019). A liberalised mindset relies less on schematic knowledge structures—pre-existing mental frameworks that help us quickly process and organise information—and is thus better equipped to handle complexity and blurred boundaries (Prati et al. 2021). Because repeated contact typically challenges people's stereotypes and cultural schemas, it may lead people to move away from rigid, simplistic and category-based thinking towards more individuated information processing (Crisp and Turner 2011; Fiske and Neuberg 1990; Gocłowska and Crisp 2013; Meleady et al. 2019). Consequently, through this mental exercise contact may train the mind to inhibit heuristic, category-based responses *in general* and "think outside the box."

A growing corpus of research has found that experiencing diversity appears to enhance cognitive flexibility. For instance, racially diverse higher education environments were found to lead to more integrative thinking (Antonio et al. 2004) and were associated with a range of better learning outcomes (Gurin et al. 2002). Similarly, time spent living abroad has been found to increase creative problem solving and convergent thinking (Maddux and Galinsky 2009) and integrative complexity

(Tadmor et al. 2012). Related work has found that after being exposed to counterstereotypes (e.g., a female mechanic), participants relied less on schematic knowledge when generating names for a pasta product and came up with more creative ideas for a university event (Gocłowska et al. 2013), indicating increased cognitive flexibility. Notably, a set of studies by Dhont et al. (2011) found that contact was more effective in reducing prejudice among those with a higher (vs. lower) need for cognitive closure (for related findings, see Hodson 2011; Hodson et al. 2013; Kteily et al. 2019; Turner et al. 2020). This suggests that contact may be a particularly powerful tool for changing mindsets of those who are generally more close-minded and intolerant of ambiguity.

We build on existing research, but take a different approach to testing the liberalising effects of intergroup contact. We focus on how the intolerance of uncertainty–intergroup bias relationship exemplifies rigid, categorical 'us vs. them' thinking, which serves to satisfy a psychological need for subjective certainty. By weakening this relationship, intergroup contact fosters cognitive liberalisation, as individuals begin to rely less on rigid group-based categories to manage their intolerance of uncertainty. This perspective positions contact not only as a tool for reducing bias but also as a mechanism for disrupting rigid thinking, ultimately promoting more open-minded and flexible social perception.

In addition, it may also be important to distinguish between the mere presence or absence of contact and the quality or closeness of such interactions. Contact that lacks depth may fail to generate meaningful cognitive shifts, as it is unlikely to facilitate the individuated thinking that can promote change. In contrast, intergroup friendships have been found to be particularly powerful in promoting the positive effects of contact (Davies et al. 2011; Pettigrew 1998). Friendship involves spending time with outgroup members and self-disclosure, which build trust (Miller 2002) and also provides insight into outgroup experiences, potentially broadening perspectives beyond the ingroup (Hodson et al. 2018). Studies have found that deeper intercultural engagement and cross-group friendships are not only associated with better intergroup relations (Blaylock et al. 2018; Page-Gould et al. 2008), but also with increased creativity and cognitive complexity (Lu et al. 2017). Contact that is closer, meaningful and sustained may therefore be especially impactful for making people more open to new ideas and less constrained by rigid social categories.

1.3 | The Current Research

In the current work, we argue that if contact is an agent of cognitive liberalisation, the relationship between intolerance of uncertainty and intergroup bias described above will be weaker among those who have experienced contact compared with those who have not. As noted by work on UIT, intergroup bias is a response designed to meet a psychological need (Hogg 2000, 2007, 2021). For people with less contact and a higher intolerance of uncertainty, this need may be met by expressing intergroup bias (by differentiating between the ingroup and outgroups they maintain the coherence of their worldview and keep category boundaries salient). We therefore expect to observe a positive correlation between intolerance of uncertainty and intergroup bias among people who do not have intergroup contact. However, we expect that this relationship will be significantly weaker among those who have intergroup contact, as contact may reduce reliance on intergroup bias as a means of managing uncertainty (see Figure 1).

We tested the proposed liberalising effect of contact in three different intergroup contexts using large-scale Project Implicit datasets. The Project Implicit (Xu et al. 2024) initiative has measured intergroup bias and other variables from millions of respondents online. We identified three datasets that contained self-report measures of intolerance of uncertainty, intergroup contact, and intergroup bias: the *Sexuality* dataset (2020, Sample 1), available at https://osf.io/eskzr; the *Transgender* dataset (2020, Sample 2), available at https://osf.io/wabzy; and the *Disability* dataset (2020, Sample 3), available at https://osf.io/7qnra.

On the Project Implicit website, participants completed an Implicit Association Test (IAT) that measured implicit bias by evaluating the speed at which individuals associate different positive or negative words or concepts with specific social groups. Participants were also asked to complete a range of self-report measures, including those assessing explicit bias. We chose to focus on explicit bias, rather than implicit bias, as we expected that *conscious* intergroup bias would be used instrumentally to manage *conscious* intolerance of uncertainty (see e.g., Grieve and Hogg 1999; Hodson and Sorrentino 2001; and Mullin and Hogg 1998, which show that explicit bias is expressed by those who experience subjective uncertainty).[1]

We analysed the data provided by respondents belonging to the dominant group (i.e., "Straight" (Sample 1), "Cis-gender" (their birth sex corresponded with their current gender identity; Sample 2), and "Abled" (Sample 3)), as this way we were able to test the effect of *intergroup* contact as the contact items only asked about contact with the stigmatised group (i.e., "Gay and "Lesbian" (Sample 1), "Transgender" (Sample 2), and "Disabled" (Sample 3). We also included only US residents given that they constitute approximately 85% of respondents (Ratliff and Smith 2025). Project Implicit samples from other countries are relatively small and biased towards international citizens who speak English, tending to be more demographically skewed (Charlesworth et al. 2023). Given that participants resided in different US states, we calculated intraclass correlations (ICCs) to assess the proportion

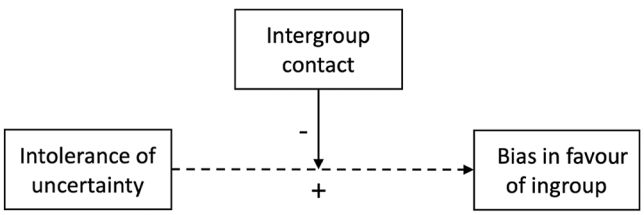

FIGURE 1 | Proposed moderation model. The figure illustrates the hypothesised relationship between intolerance of uncertainty and intergroup bias, moderated by intergroup contact. In the proposed model, the plus (+) symbol indicates a positive relationship between intolerance of uncertainty and bias in favour of the ingroup. The minus (–) symbol indicates that intergroup contact attenuates this positive relationship.

of variance in our key variables attributable to state-level differences. The ICC values for all key variables were close to zero (≤0.01) or resulted in a singular fit, indicating that variance components were estimated at zero (Bates et al. 2015; see also McNabb and Murayama 2021), suggesting state-level variance was minimal (see Table S1 in Supporting Information). Although there are no agreed-upon standards for evaluating ICCs, researchers have suggested that multilevel modelling becomes necessary when ICC values are non-trivial and are greater or equal to 0.05 (Geldhof et al. 2014). Consequently, we proceeded without employing multilevel modelling.

2 | Method

2.1 | Participants

We analysed data from respondents who resided in the United States and belonged to the dominant group. Additionally, participants were included if they answered each of the demographic questions that we used as controls, responded to at least one of the intergroup contact measures and one of the intergroup bias measures, and at least one item from the intolerance of uncertainty scale, resulting in no missing data at the construct level (similar criteria for missing responses have been used by Gebauer et al. 2015; MacInnis et al. 2017). When applying these criteria, 99% of participants completed at least 80% of the intolerance of uncertainty measure, indicating very low item-level missingness.[2] Our inclusion criteria resulted in $N = 14{,}744$ in Sample 1 ($M_{age} = 35.80$, $SD_{age} = 13.99$, 10,162 females and 4582 males); $N = 2778$ in Sample 2 ($M_{age} = 34.94$, $SD_{age} = 14.13$; 2072 females and 706 males); and $N = 7524$ in Sample 3 ($M_{age} = 33.61$, $SD_{age} = 13.71$, 5828 females and 1696 males).

2.2 | Measures

2.2.1 | Intolerance of Uncertainty

A short 12-item scale developed by Carleton et al. (2007) measured intolerance of uncertainty (IUS-12; see the full scale in the Appendix A). This measure has two factors representing prospective anxiety (e.g., "Unforeseen events upset me greatly") and inhibitory anxiety (e.g., "When I am uncertain I can't function very well"). Responses ranged from 1 (not at all characteristic of me) to 5 (entirely characteristic of me). Although the IUS-12 includes two factors, evidence supports using the total score of the IUS-12, which has been found to account for a substantially greater proportion of total and shared variance and has higher reliability than the single factors (Hale et al. 2016). Across our samples, the IUS-12 scale demonstrated strong internal reliability, with Cronbach's alphas of 0.89 (Sample 1), and 0.90 (Sample 2), and 0.90 (Sample 3).

2.2.2 | Intergroup Bias

Explicit intergroup bias was assessed using two measures. The first, *ingroup warmth bias*, captured differences in perceived warmth between the ingroup and outgroup. Participants rated their feelings towards the dominant ingroup and the stigmatised outgroup using 11-point feeling thermometers, ranging from 0 (coldest feelings) to 10 (warmest feelings). Following other research on intergroup bias (see Aberson 2019; Rudman et al. 2002), we calculated a difference score by subtracting positive affect towards the outgroup from positive affect towards the ingroup.[3] Scores ranged from −10 to 10, with positive values indicating feeling more warmth for the ingroup compared with the outgroup. The second measure was a one-item *ingroup preference* scale, ranging from 1 ("I strongly prefer [stigmatised outgroup]") to 7 ("I strongly prefer [dominant ingroup]").

2.2.3 | Intergroup Contact

In Samples 1 (Gay/Straight) and 2 (Cis-gender/Transgender), contact was measured with three items: *Regular positive contact*: "Do you have friendly interactions with [gay/transgender] people on a regular basis?"; *friendship contact*: "Do you have a friend who is [gay/transgender]?"; and *family contact*: "Do you have a family member who is [gay/transgender]?"[4] Each question had a binary response option of "yes" or "no." We recoded contact items (no contact = −1, contact = +1). We did not create mean scores with the contact items as the reliability of a scale with all items was poor (Sample 1: $\alpha = 0.40$; Sample 2: $\alpha = 0.56$). We therefore considered each form of contact separately. In Sample 3, there was only one contact item and it measured *close contact*: "Do you have a close friend or family member with a disability or learning difficulty?" Response options were "yes" or "no," recoded as no contact = −1 and contact = +1.

2.2.4 | Demographics

Age, sex (with response options of male and female), educational level,[5] as well as political orientation (reverse coded so that 1 = strongly liberal to 7 = strongly conservative) were included as control variables. We controlled for these variables as they have often been found to be associated with intergroup biases towards people who are gay (Brown and Henriquez 2008), transgender (Norton and Herek 2013), have disabilities (Wang et al. 2021), and with generalised prejudice (Hodson and Puffer forthcoming). By doing this, we were better able to examine the unique relationship between intolerance of uncertainty and intergroup bias, beyond the effects of socio-demographic factors. Previous research using this Project Implicit data has similarly controlled for these variables (MacInnis et al. 2017). Moderation models without covariates are presented in Supporting Information.

2.3 | Results

In all moderation models, the continuous predictor (i.e., intolerance of uncertainty) was mean-centred and effect coding was used for contact (no contact = −1, contact = +1).

2.4 | Sample 1 (Straight/Gay Intergroup Context)

Descriptive statistics and correlations between the key variables and demographics are presented in Table 1. As expected, there was a significant positive association between intolerance of uncertainty and measures of ingroup warmth bias and ingroup

TABLE 1 | Means, standard deviations, and correlations in Sample 1 (straight/gay intergroup context).

Variable	*M*	SD	1	2	3	4	5	6	7	8	9
1. Intolerance of uncertainty	2.43	0.73									
2. Ingroup warmth bias	0.50	1.91	0.04**								
3. Ingroup preference	4.44	0.99	0.08**	0.64**							
4. Regular positive contact	—	—	−0.06**	−0.30**	−0.27**						
5. Friendship contact	—	—	−0.03**	−0.29**	−0.28**	0.40**					
6. Family contact	—	—	−0.03**	−0.09**	−0.10**	0.13**	0.10**				
7. Age	35.80	13.99	−0.25**	−0.04**	−0.04**	0.08**	0.02*	0.11**			
8. Sex (+Female)	—	—	0.10**	−0.21**	−0.19**	0.14**	0.16**	0.08**	−0.02*		
9. Education	6.50	1.90	−0.14**	−0.12**	−0.09**	0.12**	0.08**	0.03**	0.53**	0.02**	
10. Political ideology (+ Conservative)	3.27	1.68	0.00	0.42**	0.38**	−0.16**	−0.17**	−0.05**	−0.02*	−0.13**	−0.14**

Note: M and SD represent mean and standard deviation, respectively. * indicates $p < 0.05$. **indicates $p < 0.01$. Frequencies for binary variables are reported in the text.

preference. In addition, the majority of participants reported regular positive contact with gay people ($n = 12{,}579$; $n = 2165$ did not). Similarly, most had a gay friend ($n = 12{,}623$; $n = 2121$ did not). The number of participants with a gay family member ($n = 7052$) and those without ($n = 7692$) was roughly equal. Being older, female, and more educated was negatively associated with intergroup bias against gay people, while being more politically conservative was associated with greater intergroup bias (a consistent pattern was observed across both measures of intergroup bias).

2.5 | The Moderating Role of Contact With Gay People

We examined each form of intergroup contact with gay people as a moderator of the significant relationship between intolerance of uncertainty and intergroup bias, while controlling for age, sex, education and political orientation, using the PROCESS macro for R (Model 1; Hayes 2013). For significant interactions, we unpacked the uncertainty–intergroup bias relations among those with or without contact. (See Table 2 and Figure 2).

2.5.1 | Regular Positive Contact

Positive contact on a regular basis moderated the relationship between intolerance of uncertainty and ingroup warmth bias and ingroup preference. The relationship between intolerance of uncertainty and both measures of intergroup bias was weaker among those who reported regular positive contact compared to those who did not.

2.5.2 | Friendship Contact

The relationship between intolerance of uncertainty and ingroup warmth bias was moderated by friendship contact. As with positive contact, among those who reported having a gay friend, the relationship between intolerance of uncertainty and ingroup warmth bias was significantly weaker compared with those who did not have a gay friend. However, friendship contact did not significantly moderate the relationship when intergroup bias was measured with the ingroup preference item.

2.5.3 | Family Contact

The relationship between intolerance of uncertainty and ingroup warmth bias was moderated by family contact. Among those who had a gay family member, the relationship between intolerance of uncertainty and ingroup warmth bias was weaker compared with those who did not have a gay family member. However, as with friendship contact, the interaction effect was not significant when intergroup bias was measured by ingroup preference.

To summarise, among heterosexual participants, the positive relationship between intolerance of uncertainty and ingroup warmth

TABLE 2 | The relationship between intolerance of uncertainty and ingroup warmth bias (left) and ingroup preference (right) in favour of heterosexual versus gay people, as moderated by different types of contact with gay people, controlling for socio-demographic variables (Sample 1).

	DV: Ingroup warmth bias				DV: Ingroup preference			
	Moderator: Regular positive contact (pos. contact)							
	b	**SE**	***t***	***p***	***b***	**SE**	***t***	***p***
Intolerance of uncertainty	0.19	0.03	6.97	< 0.001	0.13	0.01	9.25	< 0.001
Pos. contact	−0.59	0.02	−29.50	< 0.001	−0.27	0.01	−25.54	< 0.001
Interaction	**−0.12**	**0.03**	**−4.50**	**< 0.001**	**−0.04**	**0.01**	**−2.69**	**0.007**
Conditional effects								
Does not have pos. contact	**0.31**	**0.05**	**6.24**	**< 0.001**	**0.17**	**0.03**	**6.51**	**< 0.001**
Has pos. contact	**0.07**	**0.02**	**3.27**	**0.001**	**0.09**	**0.01**	**8.49**	**< 0.001**
	Moderator: Friendship contact							
	b	**SE**	***t***	***p***	***b***	**SE**	***t***	***p***
Intolerance of uncertainty	0.18	0.03	6.75	< 0.001	0.12	0.01	8.76	< 0.001
Friendship contact	−0.56	0.02	−27.83	< 0.001	−0.28	0.01	−26.52	< 0.001
Interaction	**−0.10**	**0.03**	**−3.68**	**< 0.001**	**−0.02**	**0.01**	**−1.59**	**0.111**
Conditional effects								
Does not have friendship contact	**0.28**	**0.05**	**5.69**	**< 0.001**	—	—	—	—
Has friendship contact	**0.08**	**0.02**	**3.99**	**< 0.001**	—	—	—	—
	Moderator: Family contact							
	b	**SE**	***t***	***p***	***b***	**SE**	***t***	***p***
Intolerance of uncertainty	0.13	0.02	6.46	< 0.001	0.15	0.03	4.68	< 0.001
Family contact	−0.12	0.01	−8.23	< 0.001	−0.13	0.02	−8.64	< 0.001
Interaction	**−0.05**	**0.02**	**−2.71**	**0.007**	**−0.02**	**0.02**	**−1.02**	**0.307**
Conditional effects								
Does not have family contact	**0.18**	**0.03**	**6.68**	**< 0.001**	—	—	—	—
Has family contact	**0.08**	**0.03**	**2.71**	**0.007**	—	—	—	—

Note: Bolded statistics for intolerance of uncertainty × contact interaction ("interaction") and conditional effects ("Has [specific type of] contact" and "Does not have [specific type of] contact"). Pos. contact represents regular positive contact.

bias was consistently weaker for those who reported having positive contact with gay people on a regular basis, having a gay friend, or having a gay family member, compared to those who did not. When intergroup bias was measured using an ingroup preference scale, having regular positive contact moderated the effect of intolerance of uncertainty on intergroup bias, but having a gay friend or gay family member did not. This overall pattern suggests that intergroup contact attenuates the relationship between intolerance of uncertainty and intergroup bias, and suggests that regular positive contact might be particularly impactful for breaking this link.

2.6 | Sample 2 (Cis-Gender/Transgender Intergroup Context)

Descriptive statistics and correlations between the key variables and demographics are presented in Table 3. Consistent with Sample 1, there was a significant association between intolerance of uncertainty and intergroup bias. In this Sample, a majority of participants did not report regular positive contact with transgender people ($n = 1200$ reported having regular positive contact; 1565 reported not having regular positive contact) and nor did they have a transgender friend ($n = 1625$ did not have a transgender friend, $n = 1144$ did have a transgender friend). The vast majority of participants did not have a transgender family member ($n = 339$ did have a transgender family member; $n = 2428$ did not). Being older and more educated was associated with stronger ingroup preference, but there was no significant association between these variables and ingroup warmth bias. Similar to Sample 1, being female was negatively associated with both measures of bias against transgender people, and being politically conservative was positively associated with expressing such bias.

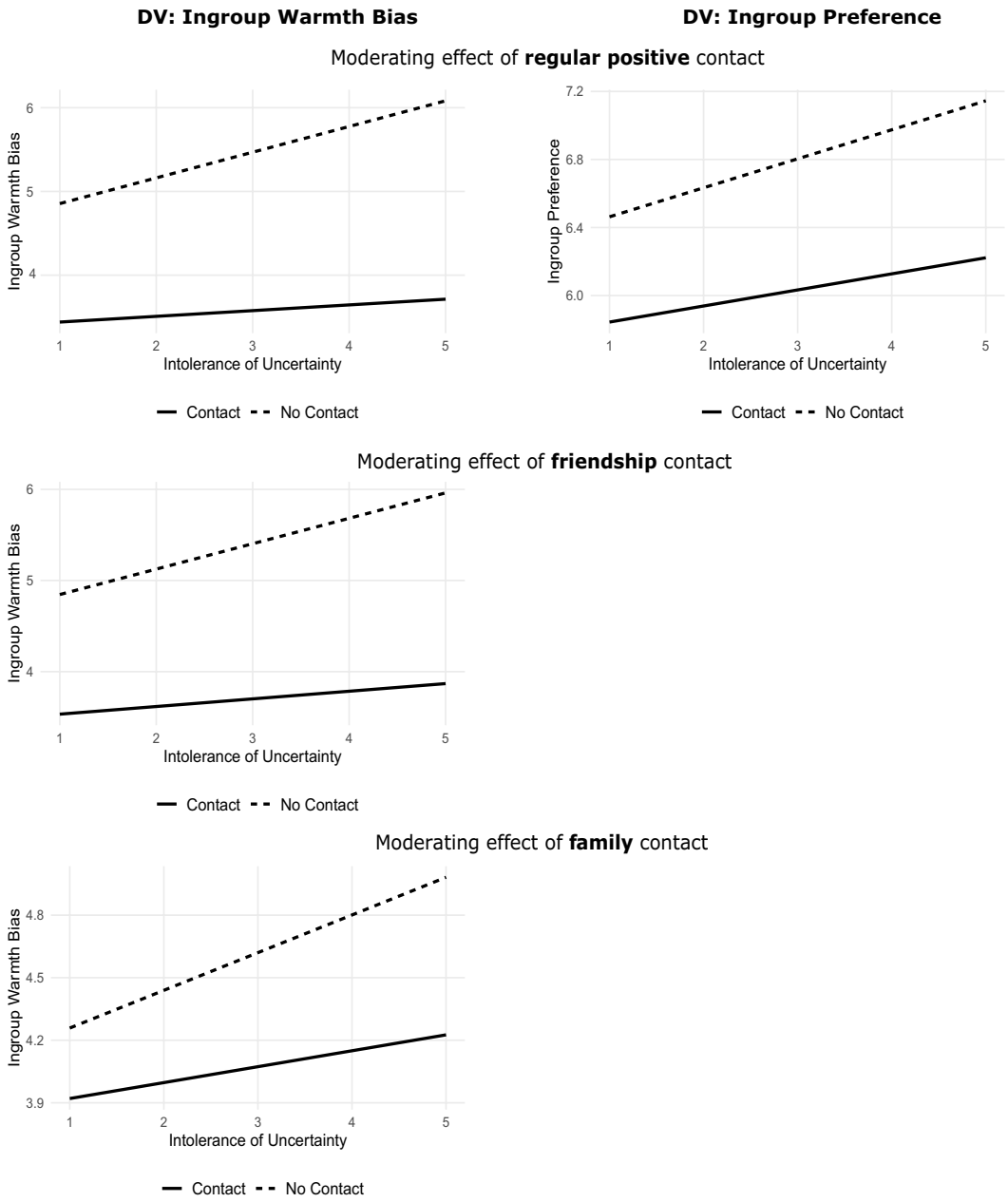

FIGURE 2 | The interaction between intolerance of uncertainty and contact with gay people in predicting intergroup bias, controlling for sociodemographic variables (Sample 1). The ingroup warmth bias scale is from −10 to 10. The ingroup preference scale is from 1 to 7. Higher bias scores in both measures reflect bias in favour of the ingroup (heterosexual people) over the outgroup (gay people).

2.7 | The Moderating Role on Contact With Transgender People

We tested each type of intergroup contact with transgender people as a moderator of the significant relationship between intolerance of uncertainty and intergroup bias in favour of cisgender people vs. transgender people, while controlling for age, sex, education, and political orientation (See Table 4 and Figure 3).

2.7.1 | Regular Positive Contact

The interaction between intolerance of uncertainty and having frequent positive contact with transgender people on ingroup warmth bias was just beyond the threshold for significance of ($p = 0.056$). Given the p value was only slightly above the conventional threshold of $p < 0.05$, we further explored the conditional effects. Consistent with our hypothesis, we found that the positive relationship between intolerance of uncertainty and ingroup warmth bias was significant among those who did not have regular positive contact, but there was no such association among those who did have regular positive contact. The interaction between intolerance of uncertainty and having regular positive contact with transgender people on ingroup preference was significant. Again, we found a significant positive association between intolerance of uncertainty and ingroup preference among those who did not have regular positive contact, but not among those who had regular positive contact.

TABLE 3 | Means, standard deviations, and correlations in Sample 2 (cis-gender/transgender intergroup context).

Variable	*M*	SD	1	2	3	4	5	6	7	8	9
1. Intolerance of uncertainty	2.41	0.74									
2. Ingroup warmth bias	0.49	2.19	0.05*								
3. Ingroup preference	4.53	1.03	0.05**	0.66**							
4. Regular positive contact	—	—	−0.02	−0.24**	−0.22**						
5. Friendship contact	—	—	0.02	−0.26**	−0.23**	0.50**					
6. Family contact	—	—	0.00	−0.07**	−0.05**	0.19**	0.17**				
7. Age	34.94	14.13	−0.24**	0.01	0.06**	−0.01	−0.03	0.10**			
8. Sex (+Female)	—	—	0.04*	−0.14**	−0.13**	0.09**	0.06**	0.05*	−0.01		
9. Education	6.82	1.87	−0.10**	−0.01	0.06**	−0.01	−0.05**	0.03	0.50**	0.04*	
10. Political ideology (+ Conservative)	2.78	1.67	−0.03	0.39**	0.38**	−0.18**	−0.22**	−0.01	0.06**	−0.14**	−0.11**

Note: M and SD represent mean and standard deviation, respectively. * indicates $p < 0.05$. ** indicates $p < 0.01$. Frequencies for binary variables are reported in the text.

2.7.2 | Friendship Contact

Having a transgender friend significantly moderated the relationship between intolerance of uncertainty and intergroup bias, both ingroup warmth bias and ingroup preference. Among those who did not have a transgender friend, the relationship between intolerance of uncertainty and intergroup bias was significant, whereas it was not significant among those who did have a transgender friend.

2.7.3 | Family Contact

Having a transgender family member did not moderate the effect of intolerance of uncertainty on either measure of intergroup bias.

In Sample 2, we found that having regular positive contact with transgender people, or having a transgender friend, attenuated the relationship between intolerance of uncertainty and intergroup bias in favour of cis-people. In other words, intolerance of uncertainty was only associated with intergroup bias when participants lacked regular positive contact/friendship with transgender individuals, suggesting that such contact can mitigate the effects of uncertainty intolerance on bias.

There was no moderation by contact when we considered family contact, unlike in Sample 1. This could be because Sample 1 was more balanced, with roughly equal numbers of participants with and without gay family members. In contrast, Sample 2 had a highly unbalanced distribution, with only 12% of participants reporting having a transgender family member. Moreover, family relationships can vary substantially in their quality and frequency of interaction. For example, family contact could reflect a close relationship or a relative with whom one rarely, if at all, interacts. Indeed, asking about having an outgroup family member is a less conventional way of measuring intergroup contact, perhaps due to the variability of experiences this may entail. Unlike friendship or regular positive contact, which typically involve positive and sustained interaction, family contact does not guarantee the kind of engagement that may be required for reliably reducing the effect of intolerance of uncertainty on intergroup bias.

2.8 | Sample 3 (Non-disabled/Disabled Intergroup Context)

Descriptive statistics and correlations between the key variables and demographics are presented in Table 5. Again, there was a significant positive association between intolerance of uncertainty and intergroup bias. More than half of the participants ($n = 4343$) indicated they had a friend or family member with a disability (which we classify as having close contact), while the remaining participants ($n = 3181$) reported they did not have such a relationship. Being older, female, and politically conservative was generally negatively associated with intergroup bias against people with disabilities, though the significance of the relationship varied by intergroup bias measure.

2.9 | The Moderating Role of Close Contact With People With Disabilities

Close contact moderated the effect of intolerance of uncertainty on intergroup bias measured with the ingroup warmth bias

TABLE 4 | The relationship between intolerance of uncertainty and ingroup warmth bias (left) and ingroup preference (right) in favour of cisgender vs. transgender people, as moderated by different types of contact with transgender people, controlling for socio-demographic variables (Sample 2).

	DV: Ingroup warmth bias				DV: Ingroup preference			
	Moderator: Regular positive contact (pos. contact)							
	b	**SE**	***t***	***p***	***b***	**SE**	***t***	***p***
Intolerance of uncertainty	0.15	0.05	2.96	0.003	0.10	0.03	4.02	< 0.001
Pos. contact	−0.37	0.04	−9.70	< 0.000	−0.16	0.02	−8.56	< 0.001
Interaction	**−0.10**	**0.05**	**−1.91**	**0.056**	**−0.08**	**0.02**	**−3.26**	**0.001**
Conditional effects								
Does not have pos. contact	**0.25**	**0.07**	**3.61**	**< 0.001**	**0.18**	**0.03**	**5.39**	**< 0.001**
Has pos. contact	**0.06**	**0.08**	**0.763**	**0.445**	**0.02**	**0.04**	**0.588**	**0.556**
	Moderator: Friendship contact							
	b	**SE**	***t***	***p***	***b***	**SE**	***t***	***p***
Intolerance of uncertainty	0.18	0.05	3.43	< 0.001	0.11	0.02	4.34	< 0.001
Friendship contact	−0.39	0.04	−9.91	< 0.001	0.15	0.02	−7.88	< 0.001
Interaction	**−0.10**	**0.05**	**−1.96**	**0.050**	**−0.05**	**0.02**	**−2.02**	**0.044**
Conditional effects								
Does not have friendship contact	**0.28**	**0.07**	**4.04**	**< 0.001**	**0.16**	**0.03**	**4.77**	**< 0.001**
Has friendship contact	**0.08**	**0.08**	**1.05**	**0.295**	**0.06**	**0.04**	**1.63**	**0.102**
	Moderator: Family contact							
	b	**SE**	***t***	***p***	***b***	**SE**	***t***	***p***
Intolerance of uncertainty	0.11	0.08	1.47	0.142	0.09	0.04	2.41	0.016
Family contact	−0.19	0.06	−3.31	0.001	−0.07	0.03	−2.65	0.008
Interaction	**−0.18**	**0.15**	**−1.17**	**0.244**	**−0.03**	**0.04**	**−0.76**	**0.447**

Note: Bolded statistics for intolerance of uncertainty × contact interaction ("interaction") and conditional effects ("Has [specific type of] contact" and "Does not have [specific type of] contact"). Pos. contact represents regular positive contact.

measure and ingroup preference measure. Unpacking these effects for ingroup warmth bias, we found that among those who did not have close contact with people with disabilities, intolerance of uncertainty predicted intergroup bias; however, intolerance of uncertainty did not predict intergroup bias among those who had close contact. For the ingroup preference measure, intolerance of uncertainty predicted preference for the ingroup both among those who had contact and among those who did not have close contact, but the association was significantly weaker among those who had contact (See Table 6 and Figure 4). Altogether, having contact with a person with disabilities via family or friendship consistently attenuated the relationship between intolerance of uncertainty and ingroup bias favouring non-disabled people, replicating the pattern of results from the previous samples.

3 | General Discussion

The current research examined whether individuals who report having (vs. not having) intergroup contact differ in their reliance on intergroup bias as a strategy for managing intolerance of uncertainty, providing evidence of contact's liberalising effect on cognitive processes. Using three large-scale datasets, we investigated whether the relationship between intolerance of uncertainty and bias towards gay people, transgender people, or people with disabilities is attenuated for majority group members who experience intergroup contact. We found that in these three different intergroup contexts, the relationship between intolerance of uncertainty and bias was generally weaker among those who experience contact. A similar pattern of results emerged with two measures of intergroup bias, further increasing the robustness of our results. In Samples 1 and 2, participants responded to three different contact items as separate predictors (regular positive contact, friendship contact, and family contact) and we were thus able to test which kind of contact moderated the effects. Our results indicate that regular positive contact and friendship tended to moderate the effect of intolerance of uncertainty on intergroup bias. In Sample 3, close contact was measured, and this too moderated the effect of intolerance of uncertainty on intergroup bias.

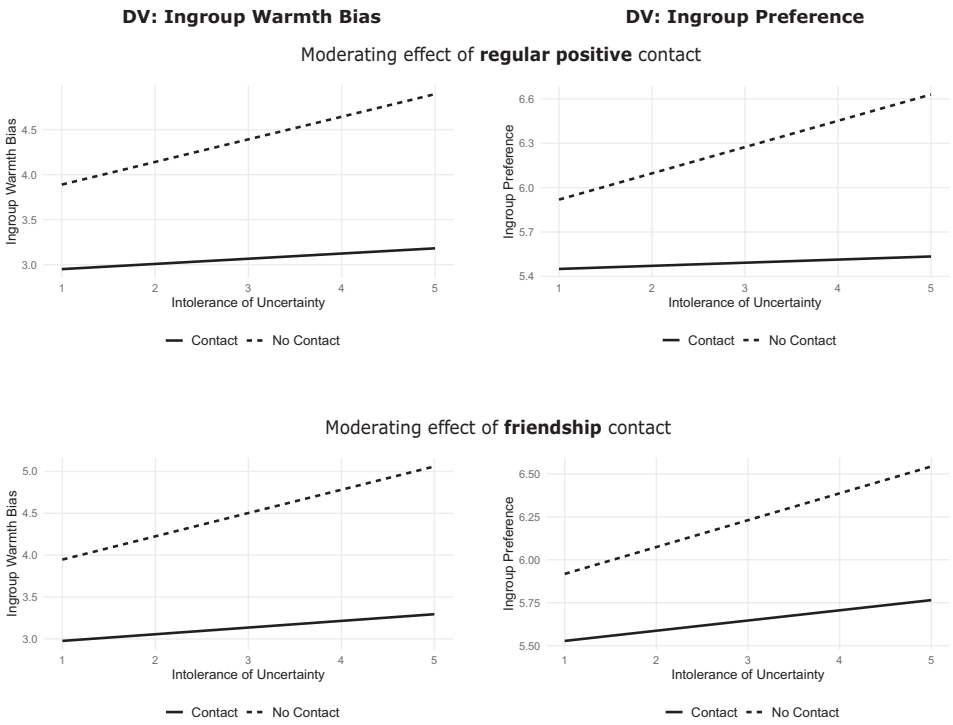

FIGURE 3 | The interaction between intolerance of uncertainty and contact with transgender people in predicting intergroup bias, controlling for socio-demographic variables (Sample 2). The ingroup warmth bias scale is from −10 to 10. The ingroup preference scale is from 1 to 7. Higher bias scores in both measures reflect a preference for the ingroup (cis-gender people) over the outgroup (transgender people).

TABLE 5 | Means, standard deviations, and correlations in Sample 3 (non-disabled/disabled intergroup context).

Variable	*M*	SD	1	2	3	4	5	6	7
1. Intolerance of uncertainty	2.40	0.73							
2. Ingroup warmth bias	−0.06	1.55	0.03*						
3. Ingroup preference	4.35	0.83	0.07**	0.40**					
4. Close contact with people with disabilities	—	—	−0.02	−0.09**	−0.12**				
5. Age	33.61	13.71	−0.23**	−0.06**	0.00	0.06**			
6. Sex (+ Female)	—	—	0.06**	−0.03**	−0.05**	0.11**	−0.02		
7. Education	6.84	1.80	−0.10**	0.01	0.01	0.00	0.43**	0.05**	
8. Political Ideology (+ Conservative)	3.23	1.66	−0.05**	0.00	−0.02*	−0.00	0.01	−0.07**	−0.13**

Note: M and SD are used to represent mean and standard deviation, respectively. *indicates $p < 0.05$. **indicates $p < 0.01$. Frequencies for binary variables are reported in the text.

Our findings suggest that frequent, positive, and close contact can help people regulate feelings of uncertainty, so that intergroup bias is a less useful strategy to manage these feelings. This work supports the notion that contact is associated with liberalising properties. Research has found intergroup contact can be a powerful tool for fostering cognitive flexibility (Boin et al. 2021; Fuochi et al. 2024; Hodson et al. 2018; Meleady et al. 2019), and the unique role of contact in this respect makes sense. Experiences of diverse and differentiated intergroup contact are fundamental to cognitive growth (Crisp and Turner 2011), encouraging people to inhibit their habitual responses and reliance on schemas, and instead think more flexibly. Research also suggests that those who are more intolerant of uncertainty functionally use ingroup-outgroup distinctions as a way to regulate this uncertainty; providing a clear guide as to how one should think, feel, and behave, and better predict how others will behave in a world that feels full of unmanageable uncertainty (Hogg 2007). Our results suggest that contact plays a key role in reducing intergroup bias because it attenuates this functional role of bias.

Although we conceptualised intergroup contact as moderating the intolerance of uncertainty-intergroup bias relationship, these findings also suggest that contact's effectiveness

TABLE 6 | The relationship between intolerance of uncertainty and ingroup warmth bias (left) and ingroup preference (right) in favour of non-disabled versus disabled people, as moderated by close contact with people with disabilities, controlling for socio-demographic variables (Sample 3).

	DV: Ingroup warmth bias				DV: Ingroup preference			
	Moderator: Close contact with people with disabilities							
	b	**SE**	***t***	***p***	***b***	**SE**	***t***	***p***
Intolerance of uncertainty	0.05	0.03	1.80	0.071	0.10	0.01	7.00	< 0.001
Close contact	−0.13	0.02	−7.40	< 0.001	−0.10	0.01	−9.86	< 0.001
Interaction	**−0.05**	**0.02**	**−2.03**	**0.043**	**−0.04**	**0.01**	**−2.87**	**0.004**
Conditional effects								
Does not have close contact	**0.10**	**0.04**	**2.54**	**0.011**	**0.13**	**0.02**	**6.60**	**< 0.001**
Has close contact	**0.00**	**0.03**	**−0.13**	**0.899**	**0.06**	**0.02**	**3.23**	**0.001**

Note: Bolded statistics for main effect of intolerance of uncertainty effects ("Intolerance of uncertainty" row) and moderation effects ("Interaction" row) and conditional effects ("Has close contact" and "Does not have close contact").

FIGURE 4 | The interaction between intolerance of uncertainty and close contact with people with disabilities in predicting intergroup warmth bias and ingroup preference, controlling for socio-demographic variables. The feeling thermometer difference score scale is from −10 to 10. The explicit self-report scale is from 1 to 7. Higher scores reflect bias in favour of the ingroup ("non-disabled") over the outgroup ("disabled").

in reducing bias varies based on people's intolerance of uncertainty. This aligns with prior research showing that those who are more cognitively rigid tend to be more influenced by intergroup contact experiences (Dhont et al. 2011) and adds to work showing that contact does not have a uniform effect on reducing bias but instead interacts with individual differences (Hodson 2011; Hodson et al. 2013; Kteily et al. 2019; Turner et al. 2020). Moreover, we would argue that flipping the interaction in this way—considering how the effect of contact may depend on an individual's intolerance of uncertainty—reinforces and strengthens, rather than diminishes, our argument. As seen in Figures 2–4, intergroup contact reduces bias more strongly for people higher in intolerance of uncertainty. This is because people lower in intolerance of uncertainty *already* express extremely low levels of bias. In other words, contact appears to have less of an impact for people lower in intolerance of uncertainty, while it has a bias-reducing effect for people higher in intolerance for uncertainty—which is what one would expect if contact did indeed attenuate the association between intolerance of uncertainty and bias.

3.1 | Limitations and Future Directions

It should be noted that we analysed cross-sectional data in addressing this question. Although our findings illustrate that the relationship between intolerance of uncertainty and intergroup bias is weaker among respondents who experience intergroup contact than those who do not, the findings cannot establish a temporal sequence or confirm that intolerance of uncertainty *causes* bias. Experimental work suggests that subjective uncertainty can lead to intergroup bias (e.g., Federico et al. 2013; Grieve and Hogg 1999; Hodson and Sorrentino 2001) and we are not aware of any evidence supporting the reverse causal direction. However, longitudinal or experimental work would be necessary to demonstrate a causal process (see Groyecka-Bernard et al. 2021; Shulman et al. forthcoming).

In this research, the contact measures were all binary—participants either reported having had contact or not having had contact (see also Earle et al. 2021). Although these measures may have avoided some of the challenges of recalling contact

(e.g., estimating how many hours of contact one has had over a specific time period), binary measures reduce the ability to capture the nuances of contact experiences; for example, we could not test whether there was a difference between those who have a moderate amount of contact and a great deal of contact, or the difference between people who have one outgroup friend or several. As such, we suspect that our findings (using binary measures) may have underestimated contact-moderation effects relative to methods that would employ continuous measures.

In addition, the moderating role of having a family member belonging to the stigmatised group is less clear because family contact only moderated the association between intolerance of uncertainty and intergroup bias in one out of four tests in Samples 1 and 2 (where it was tested). This may be because, in Sample 2, only a small minority of respondents had a transgender family member or because having a gay or transgender family member does not necessarily represent frequent or close contact. Intimate and frequent contact is richer, more varied, and therefore more cognitively challenging, likely leading to more cognitive growth (Fuochi et al. 2024), which may be essential for attenuating the impact of intolerance of uncertainty on bias. Indeed, in the broader contact literature, direct contact with outgroup members is typically measured through friendships or regular acquaintances (Lolliot et al. 2015).

It should also be noted that Project Implicit data are not representative of the US population (Ratliff and Smith 2025). In this research, the samples had more females compared with males and were skewed towards a more liberal demographic, particularly in Sample 2. Given that women and liberals typically demonstrate lower levels of explicit bias, at least towards gay and transgender populations (MacInnis and Hodson 2015; Nagoshi et al. 2008; Prusaczyk and Hodson 2020), our findings may not generalise to the broader population. However, the moderating influence of contact may even be more pronounced among a more conservative and male sample if there are higher baseline levels of bias to be attenuated.

One avenue for future research is to test whether the role of contact in attenuating the effect of intolerance of uncertainty on ingroup bias would be stronger when contact challenges stereotypic expectations. Meleady et al. (2019) proposed that tertiary transfer effects are enhanced when there is a higher semantic distance between the outgroup target with which one has contact and the outgroup prototype. This is because contact with individuals who are less representative of their group tends to be more cognitively demanding on the perceiver. In such situations, people cannot easily rely on pre-existing stereotypes or category-based assumptions to guide their interactions and instead are required to inhibit these automatic, category-based responses and engage in a more deliberate, individualised evaluation of the person (Fiske and Neuberg 1990). With repeated exposure to these cognitively challenging encounters, the mind becomes more adept at flexible thinking and less likely to rely on group-based categories to manage the social world. Therefore, we expect that contact characterised by higher semantic distance will have a strong attenuating effect on the relationship between intolerance of uncertainty and intergroup bias, as it enhances tertiary transfer effects (i.e., broader cognitive liberalisation following contact), whereas contact characterised by lower semantic distance will have a lesser impact.

An open question remains as to whether intergroup contact would also moderate the effect of intolerance of uncertainty on other intergroup outcomes, such as intentions to engage in collective action on behalf of the outgroup. Our findings provide strong evidence that among people who are more intolerant of uncertainty, intergroup contact encourages a move away from "us vs. them" thinking within the same intergroup domain. In other words, contact with outgroup X moderates the relationship between intolerance of uncertainty and ingroup bias against outgroup X. Would contact with one outgroup similarly moderate the relationship between intolerance of uncertainty and ingroup bias against *other* groups? Research in intergroup contact has identified *secondary transfer effects*, in which positive evaluations following contact extend beyond the group that one has had contact with to other outgroups (Pettigrew 1997, 2009). Similarly, contact might influence the relationship between intolerance of uncertainty and ingroup biases towards other third-party groups, by increasing more flexible thinking about group-based categories in general. Another question is whether contact could influence the relationship between intolerance of uncertainty and extremist ideology, which has been established in the literature (Hogg et al. 2013). For example, subjective-uncertainty was associated with support for suicide bombings among Palestinians and for aggressive military action among Israelis (Hogg and Adelman 2013). If contact also weakens these relationships, this would point to even broader cognitive growth and more widespread tertiary transfer effects.

The practical significance of our findings is highlighted by recent trends: a cross-temporal meta-analysis revealed that people's perceived ability to psychologically handle uncertainty is declining over time (Carleton et al. 2019). By demonstrating that positive intergroup contact can attenuate the relationship between intolerance of uncertainty and intergroup bias, we offer a promising avenue for intervention. Our findings provide a foundation for developing targeted interventions that leverage intergroup contact to promote cognitive flexibility and reduce bias, even in the face of subjective uncertainty.

4 | Conclusions

In three large samples we find evidence that intergroup contact attenuates the relationship between intolerance of uncertainty and intergroup bias. Among those without frequent positive contact, friendship, or close contact, greater intolerance of uncertainty is associated with greater intergroup bias. This association was generally weaker among those who experience such contact. This moderation effect suggests that contact does not simply reduce intergroup bias but helps individuals manage their uncertainty in a way that diminishes the functional 'need' for intergroup bias as a way of managing uncertainty. This shift towards more flexible and less biased thinking is indicative of cognitive liberalisation, as individuals move away from relying less on defensive coping mechanisms towards more open, inclusive ways of processing social dynamics, and provides an important first step in elucidating the theoretical mechanisms underlying these so-called tertiary transfer effects.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are openly available on the Open Science Framework (OSF) platform at https://osf.io/eskzr, https://osf.io/wabzy; and https://osf.io/7qnra.

Endnotes

[1] Implicit biases are thought to reflect subconscious preferences that individuals may not even be aware of or consciously endorse (but note some researchers argue that the IAT does not measure bias, but rather reflects cultural knowledge and environmental associations e.g., Karpinski and Hilton 2001). We did not expect *implicit* bias to be used to regulate conscious intolerance of uncertainty. Supporting our expectation, although there was a consistent correlation between intolerance of uncertainty and explicit ingroup bias (see Tables 1, 3 and 5), there was not a consistent correlation between intolerance of uncertainty and implicit bias, including among those who reported not having outgroup contact (see details in Supporting Information). Thus, there was no association between intolerance of uncertainty and implicit bias to be attenuated by contact.

[2] The vast majority of participants responded to at least 80% of the intolerance of uncertainty scale (99.29% in Sample 1, 98.92% in Sample 2, 99.52% in Sample 3).

[3] In Sample 1, there were separate feeling thermometers for gay men and for lesbians, and for straight men and straight women. We subtracted the average score of positive affect towards the stigmatised outgroup (the mean of the feeling thermometers for gay men and lesbians) from the average score of positive affect towards the ingroup (the mean of the feeling thermometers for straight men and straight women).

[4] There was also the question "Have you ever met a [gay/transgender person]" with a binary yes/no response option in Samples 1 and 2. However, only one respondent reported having never met a gay person and only 304 reported never having met a transgender person. Therefore, we did not use this measure in our analyses.

[5] The original education variable had 14 response categories, but values 9 to 14 represented various levels of advanced education without a clear progression. We recoded the education variable into a 9-point scale, with all graduate/advanced degrees assigned a value of 9, ensuring that higher values reflected increasing levels of education on a continuous scale.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.

Appendix A

Short scale for Intolerance of Uncertainty (IUS-12; Carleton et al. 2007).

Items are scored on a 5-point Likert scale ranging from 1 (not at all characteristic of me) to 5 (entirely characteristic of me).

1. Unforeseen events upset me greatly.
2. It frustrates me not having all the information I need.
3. One should always look ahead so as to avoid surprises.
4. A small, unforeseen event can spoil everything, even with the best of planning.
5. I always want to know what the future has in store for me.
6. I can't stand being taken by surprise.
7. I should be able to organise everything in advance.
8. Uncertainty keeps me from living a full life.
9. When it's time to act, uncertainty paralyses me.
10. When I am uncertain I can't function very well.
11. The smallest doubt can stop me from acting.
12. I must get away from all uncertain situations.