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Explaining the Secondary Transfer Effect: The Role of Personality Factors

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ABSTRACT

The secondary transfer effect (STE) is based on the idea that contact with a primary outgroup may shape attitudes towards secondary outgroups uninvolved in the contact setting. Most research has investigated attitudes towards the primary outgroup as a mediator of the STE. We conducted one correlational and one three-wave longitudinal study with Italian participants (Total $N = 912$), to test whether the secondary transfer effect can be explained at least partly by personality change. Specifically, we tested agreeableness and openness to experience as two facets of the five-factor model of personality as possible mediators of the STE. Main findings across the two studies are that the quality of contact with immigrants (primary outgroup) is indirectly associated with attitudes towards dissimilar secondary outgroups (gay people, individuals with disabilities) via greater agreeableness and greater openness to experience (in Study 2, STE effects emerged at the within-person level for openness only); effects for quantity of contact were inconsistent across studies. In general, the present findings show that (changes in) personality can underlie the STE. Implications of these findings for our understanding of the STE are discussed.

Social psychologists agree that intergroup contact represents an effective strategy to improve intergroup relations (Hodson and Hewstone 2013; Paluck et al. 2019; Pettigrew and Tropp 2006; Vezzali and Stathi 2021). Recent research found that contact effects can extend beyond the outgroup one has contact with, as initially proposed by the classic contact hypothesis (Allport 1954). Specifically, contact with members of a group (primary outgroup) can improve attitudes towards groups uninvolved in the contact situation (secondary outgroups), an effect that Pettigrew (2009) labelled the 'secondary transfer effect' (STE). This type of generalisation supports the relevance of contact in reducing prejudice across society at large, by showing that the effects of contact with specific outgroups can spread widely across social groups (for reviews, see Boin et al. 2021; Lolliot et al. 2013; Vezzali et al. 2021; Vezzali and Stathi 2021).

Research on the STE suffers, however, from some limits, mostly related to the identification of underlying processes. Vezzali et al. (2021) differentiated mediators of the STE into three categories: those related to the outgroup, to the ingroup, and to the self. While researchers have focused primarily on the first category, the last category has to date largely been neglected. In addition, research on mediators related to the outgroup has mostly focused on attitude generalisation as the mediating process. A potential alternative and complementary explanation, which would fall into the category of the mediators related to the self, is based on changes in personality. Specifically, becoming more open towards others may result in people holding more positive attitudes towards a wide range of outgroups, not only the outgroup they have personally met. In a similar vein, becoming more cooperative, kind, empathetic, and trusting—or, in other

words, more 'agreeable'—may analogously increase positivity towards a wide range of outgroups (involved and/or uninvolved in the contact experience).

Nonetheless, evidence that personality change can drive the STE is only preliminary (e.g., Shook et al. 2016, found that the STE was allowed by shifts in social dominance orientation, an ideological variable partly dependent on personality; Pratto et al. 2006). A further limitation is that, paralleling larger contact research, most studies on the STE are correlational. Vezzali et al.'s (2021) review only located seven longitudinal studies, none of which tested mediation processes with more than two waves.

Drawing on research showing that contact is associated with changes in personality factors as identified by the five-factor model of personality (FFM; e.g., McCrae and Costa 1999), we aimed to evaluate whether agreeableness and openness to experience (two facets of the FFM) would analogously drive the STE. To test this hypothesis, we conducted one correlational study with an adult sample and a three-wave longitudinal field study with high-school students. Below we summarise research on the STE and its underlying mediators, and in doing so explicate how our studies expand on existing research.

1 | The Secondary Transfer Effect

Pettigrew (1998) first proposed that contact effects may not be limited to the outgroup one has contact with. Instead, they can generalise to improved attitudes towards outgroups uninvolved in the contact situation (Pettigrew 2009). Although Pettigrew and Tropp (2006) were only able to identify tests from 12 studies on the STE for their meta-analysis, research has since expanded. In their recent review, Vezzali et al. (2021) (see also Vezzali and Stathi 2021, Chapter 6) located 43 tests of the STE. In line with the broader contact literature, evidence was mainly correlational (e.g., Schmid et al. 2012; Unver et al. 2022; Vezzali et al. 2020, 2023), followed by experimental (e.g., Jasinskaja-Lahti et al. 2021; Shook et al. 2016) and longitudinal evidence (e.g., Eller and Abrams 2004; Tausch et al. 2010, Study 4).

Importantly, evidence of the STE holds consistent across a variety of contexts and methodological approaches. In one influential article, Pettigrew (2009) presented two correlational studies, showing that Germans' contact with foreigners was associated with improved attitudes towards a variety of secondary outgroups, including gay people and homeless people. An especially powerful demonstration of the STE was provided by Tausch et al. (2010), via one longitudinal and three correlational studies. They investigated three different intergroup contexts (United States, Northern Ireland, Cyprus), a variety of intergroup relationships and over 4000 participants. In their longitudinal study (Study 4), for instance, they considered a sample of Catholics and Protestants from Northern Ireland. Using a two-wave design, they found that contact with the other religious group was longitudinally associated (approximately one year later) with attitudes towards racial minorities. Using a quasi-experimental approach, Shook et al. (2016) found that first-year university students assigned to live with a different-race roommate revealed more positive interracial attitudes towards other race groups at the end of the semester, compared with students assigned to a same-race roommate.

Despite this encouraging evidence, caution is needed. Kauff et al. (2023) recently conducted a series of longitudinal studies aimed at testing the STE. While supportive evidence was found in two three-wave longitudinal studies (Studies 1a and 1b), the other two-wave studies did not reveal evidence for the STE (Studies 2 and 3). Given the small number of studies investigating the STE longitudinally (e.g., Eller and Abrams 2004, Studies 1 and 2; Henschel and Kotting 2023; Kauff et al. 2023; Mähönen and Jasinskaja-Lahti 2016; Tausch et al. 2010, Study 4; Van Laar et al. 2005), it is important to replicate and extend current evidence by showing that contact is associated with prejudice reduction towards a variety of secondary outgroups over time.

2 | Underlying Processes: Personality as a Mediator

Research conducted so far has placed strong attention on mediators of the STE. However, according to Vezzali et al. (2021), most tests have focused on mediators related to the outgroup (48 tests from 30 studies), for example emotions towards or perceived threat posed by the outgroup. The most investigated factor was represented by attitudes towards the primary outgroup (21 tests): contact is generally associated with more positive attitudes towards the primary outgroup, which generalise to improved attitudes towards the secondary outgroup(s). Conceptually, this finding may be related to the construct of generalised prejudice, which implies that prejudices towards a wide variety of groups are at least partly related to one another, as parts of a universal factor underlying ethnocentric attitudes (Adorno et al. 1950; Akrami et al. 2011; LeVine and Campbell 1972; Sumner 1906). Therefore, changing attitudes towards one group also partly changes attitudes towards other groups.

However, as highlighted in Vezzali et al.'s (2021) review, there may be complementary qualitatively different processes that contribute to explaining the STE. In the present study, we focus on personality as a potential mediator of the STE. Although personality is rather stable, there is evidence that life events and experiences, including quality of relationships or experiences at work, can contribute to shaping it (Neyer and Lehnart 2007; Roberts et al. 2003; Specht et al. 2011). Personality as an underlying process was classified in Vezzali et al.'s (2021) review within mediators related to the self, the most neglected category, with only three studies previously conducted. In one correlational study, Schulz and Taylor (2018) found that both attitudes towards the primary outgroup and dispositional empathy mediated the effects of contact between Catholics and Protestants in Northern Ireland on attitudes towards Syrian refugees as the secondary outgroup. Two further studies relied on the construct of social dominance orientation (SDO), consisting of the preference for social hierarchies (Sidanius and Pratto 1999). In a sample of Italian children, Vezzali, Di Bernardo, et al. (2018) found that SDO and attitudes towards the primary outgroup mediated the association between contact with immigrants and attitudes towards children with disabilities; mediation effects however did not emerge in a sample of immigrant children who had contact with Italians. Strong experimental evidence was provided

by Shook et al.'s (2016) study described earlier, showing that STE was mediated by changes in SDO over time (for additional experimental evidence that contact can change SDO, see Dhont et al. 2014).

Although SDO depends at least in part on personality (Pratto et al. 2006), it can be better understood as an ideological orientation rather than a true personality variable (Sibley and Duckitt 2008). In the present article, we focus on two 'true' personality factors as identified by the Five-Factor Model of personality (FFM; McCrae and Costa 1999), and specifically on agreeableness and openness to experience. Agreeable individuals are empathic, inclined to help other people and cooperative. Individuals high in openness to experience are creative, enjoy engaging in novel things, and are more adventurous.

The choice to investigate these two specific factors lies on multiple reasons. On the one hand, the effect of contact on openness and agreeableness can be framed within the self-perception theory (Bem 1967), according to which individuals make inferences about their personality by observing their own behaviour. Concerning openness to experience, contact can expose individuals to (for instance) ethnic diversity and multicultural experiences, allowing them to learn new things about other groups and develop a less provincial view of the ingroup and its customs (Pettigrew 1998; Verkuyten et al. 2022). This way, individuals may speculate that they are persons open to new experiences and cultures (Sparkman et al. 2016). Intergroup experiences may also arouse anxiety and can be cognitively taxing (Shelton et al. 2006; Stephan 2014): by making an effort to be pleasant during these interactions, despite the difficulties caused by intergroup (vs. intragroup) interactions (Shelton et al. 2009; Towles-Schwen and Fazio 2006), individuals may infer that they are characterised by the agreeableness trait.

On the other side, preliminary evidence that contact is associated with these personality factors already exists. J. W. Jackson and Poulsen (2005) conducted two correlational studies, showing that openness to experience and agreeableness were associated with greater contact quality and in turn more positive outgroup attitudes (but see Turner et al. 2014, who found in two correlational studies that the two factors were not associated with a measure of cross-group friendships). Diehl (2020) showed cross-sectionally that only agreeableness was associated with greater interracial contact, while none of the personality traits identified by the FFM was associated with interracial friendships. Vezzali, Turner, et al. (2018) conducted a two-wave longitudinal study with majority (Italians) and minority (immigrants) high-school students. Results revealed that more quality of contact was associated with higher agreeableness and openness to experience over time; and the relationship was found to be bi-directional as well, such that also the two personality factors predicted higher contact quality over time. Unexpectedly, quantity of contact was negatively associated with agreeableness over time.

Finally, with respect to the association between personality and prejudice, there is consistent evidence that a variety of factors associated with personality predict greater prejudice; this includes low agreeableness and low openness (Duckitt and Sibley 2017). Consistently, past research found a negative relationship between these two factors and generalised prejudice (Ekehammar and Akrami 2003), with persons characterised by these traits paying also more attention to stereotype-disconfirming information (Flynn 2005). The association between the two personality factors and prejudice is further supported by a meta-analysis (> 22,000 participants) conducted by Sibley and Duckitt (2008).

3 | The Present Research

We conducted two studies to test the primary hypothesis that (changes in) personality, and specifically (changes in) agreeableness and openness to experience of the FFM, can mediate the effects of contact on both primary and secondary outgroups, thus allowing the STE to emerge. We focus on the relationship between majority (Italians) and minority (immigrants), from the perspective of the majority group.

3.1 | Study Design

In the first study, we aimed to provide preliminary correlational evidence for our hypotheses with a sample of adults. However, given the scarce research validating over time associations between contact and personality, and between personality and prejudice, we conducted a second, three-wave longitudinal study with first-year high school students. We decided to focus on this sample because the period between adolescence and young adulthood is especially suited to document personality changes (e.g., Bleidorn et al. 2014, 2022; Roberts et al. 2006). As stated by social investment theory, this period is characterised by experiencing themselves in new social roles, like starting a new school and becoming more independent from the family (Roberts et al. 2005). Positive and negative experiences such as social rewards or punishments for how these roles are interpreted are at the basis of the developing personality (Bleidorn 2015; Lüdke et al. 2011; Roberts and Jackson 2008).

As secondary outgroups, to provide a more stringent test of our hypotheses, we focused on two outgroups that can be considered substantially different from the primary outgroup (immigrants): gay people and individuals with disabilities. Previous research has shown that the STE also occurs for dissimilar secondary outgroups (e.g., Harwood et al. 2011; Vezzali and Giovannini 2012; but see Kauff et al. 2023, Study 3; Zezelj et al. 2020). However, it has not fully clarified why this occurs. We argue that changes in personality stemming from contact can explain attitude change towards a wide variety of groups. In other words, becoming more open to experiences and agreeable should reflect on a range of outgroups, independent of the outgroup one has contact with. For this reason, in the present studies we test attitudes towards primary and secondary outgroups as dependent variables at the same level (in Study 1 we also test attitude generalization from primary to secondary outgroups), as we posit that contact has a primary effect on individuals (in terms of personality), reflecting then on their attitudes.

As measures, to foster comparability with previous research, we focused on two typical contact indicators: quantity and quality of contact (intended as the frequency and positivity of contact experiences, respectively). Similarly, we focus on the general

evaluation scale as a commonly employed measure to assess outgroup attitudes on contact research (Lolliot et al. 2015). We relied on a classic measure to assess personality traits, the Big-Five Inventory (John et al. 1991).

3.2 | Methodology: The Importance of Differentiating Between-Person and Within-Person Effects

In line with recent recommendations (Friehs et al. 2024), the hypotheses were tested by fitting a random-intercept multilevel mediation model. A noteworthy advantage of this statistical approach is that it—just like random-intercept, cross-lagged mediation models—allows us to separate variance into two components: a stable 'between-person' component (represented by the random intercept) and a time-varying 'within-person' component. The two types of effects reflect different aspects. Between-person effects reflect the extent to which individuals scoring high (or low) in contact and outgroup attitudes at one wave also score higher (or lower) on the two constructs in later waves, this way speaking to the stability of effects. Between-person effects however are not informative about intra-individual variation, which is instead provided by within-person effects, and which reveals whether a person who has contact shows individual changes in outgroup attitudes in later waves. The rationale behind the contact hypothesis likely rests more on within-person effects, with the idea that contact can change individuals' attitudes; in other words, within-person effects may reflect the 'true' contact effect. However, as we will also discuss in the General Discussion, we believe that both types of effects are relevant to the test of contact effects: by speaking to the stability (between-person) and variation (within-person) of the effects of contact, full evidence for contact effectiveness can only be provided by considering them both. Most previous contact research used conventional cross-lagged models which do not differentiate between within-person and between-person effects, being therefore unable to provide clear answers about the intra-individual effects of contact (Hamaker et al. 2015). By contrast, multi-level mediation models are able to distinguish between within-person and between-person relationships, and can thus inform us about the presence of 'true' contact effects in longitudinal data.

Only a few contact studies have investigated within-person effects, obtaining mixed results. Indeed, some studies found that contact produced intra-individual variation in outgroup attitudes (Boin et al. 2024; Górska and Tausch 2022; some weaker evidence was also found by McKeown et al. 2025), while other studies found no evidence for significant within-person effects (Bohrer et al. 2019; Friehs et al. 2024; Hodson and Meleady 2024; Sengupta et al. 2023). It is worth noting that such debate also applies to STE research specifically. Henschel et al. (2025) conducted three longitudinal studies and found STE for between-person but not within-person effects.

3.3 | Hypotheses

To summarise, our main hypothesis is that contact will be indirectly associated with more positive attitudes towards primary and secondary outgroups, via changes in agreeableness and openness to experience. In particular, we expect that contact will be associated with increased agreeableness and openness to experience, which will in turn be associated with more positive attitudes towards primary and secondary (dissimilar) outgroups. To keep in line with STE literature, in Study 1 we will include a further path from attitudes towards the primary outgroup to attitudes towards secondary outgroups (resulting in sequential mediation: contact > personality > attitudes towards the primary outgroup > attitudes towards the secondary outgroup). The rationale lies in the fact that attitudes towards the primary outgroup are a main mediator of the STE (cf. Vezzali et al. 2021); also note that such a test allows us to test personality as a mediator by controlling for a popular mediator of the STE, providing a more strict test of hypotheses. The path between attitudes towards the primary outgroup and attitudes towards the secondary outgroup will not be included in Study 2: this is consistent with our overarching hypothesis that a change in personality underlies attitudes towards outgroups in general (be they primary and/or secondary); also, to properly test longitudinal sequential mediation, four waves would be necessary.

Importantly, we do not make differential predictions for quantity and quality of contact; however, given the greater role of quality of contact in predicting lowered prejudice (Firat and Ataca 2022; Voci et al. 2016), we anticipate that effects may be smaller for quantity than for quality of contact.

With specific reference to Study 2, we do not make distinctions for between-person and within-person effects.

4 | Study 1

4.1 | Method

4.1.1 | Participants

Participants were 470 Italian majority adults aged 18–86 years ($M = 32.57$ years, SD = 15.34; 59.6% females). Most participants had a higher secondary school degree (60.2%), 11.3% had a lower degree, and 27.9% had a bachelor or master degree; only 0.6% had a PhD. Additionally, 45.76% were workers, 29.8% were students, 14.5% were both students and workers (other type of occupation: 9.8%). They were recruited by university students in exchange for credit compensation. Sample size was determined by participant availability. Power sensitivity simulations revealed that, given the observed parameter estimates and assuming standard criteria ($\alpha = 0.05$), this sample size yielded approximately 80% to detect indirect effects (through personality) of size $\beta = 0.16–0.19$.

4.1.2 | Procedure and Measures

Participants filled in an online questionnaire. The study was presented as research on social attitudes. The questionnaire included the following measures, all showing satisfactory internal consistency (alpha values ranging from 0.74 to 0.92; see Table 1 for reliability coefficients, means, standard deviations, and correlations among the measures).

TABLE 1 | Mean scores, standard deviations and bivariate correlations (Study 1, $N = 470$).

Variable	α	*M*	SD	1.	2.	3.	4.	5.	6.	7.
1. Quantity of contact	0.82	2.27	1.00	—						
2. Quality of contact	0.90	3.83	0.87	0.30***	—					
3. BFI_A	0.74	3.65	0.63	−0.04	0.34***	—				
4. BFI_O	0.81	3.72	0.67	0.10*	0.35***	0.38***	—			
5. Attitudes towards immigrants (primary outgroup)	0.91	3.50	0.74	0.36***	0.64***	0.24***	0.28***	—		
6. Attitudes towards gay people (secondary outgroup)	0.92	3.87	0.81	0.10*	0.41***	0.26***	0.17***	0.62***	—	
7. Attitudes towards individuals with disability (secondary outgroup)	0.92	4.09	0.76	0.08	0.23***	0.19***	0.07	0.47***	0.69***	—

Abbreviations: BFI_A, Big Five Inventory Agreeableness; BFI_O, Big Five Inventory Openness.
*$p < 0.05$.
***$p < 0.001$.

4.1.2.1 | **Quantity of Contact With the Primary Outgroup.** We used four items to assess the quantity of contact with immigrants/Italians (Vezzali, Turner, et al. 2018). Participants were asked to report the amount of contact with immigrants in general, at home, at school, during free time, on a 5-point scale (1 = *none*, 5 = *very much*).

4.1.2.2 | **Quality of Contact With the Primary Outgroup.** We measured the quality of contact with immigrants/Italians using four bipolar scales (e.g., hostile/friendly; competitive/cooperative; Capozza et al. 2013). On the 5-point scale, 1 was the negative and 5 was the positive pole.

4.1.2.3 | **Personality Factors.** As in Vezzali, Turner, et al.'s (2018) study, personality traits were assessed with the Big-Five Inventory (BFI; John et al. 1991). In the original scale, 9 items are used to assess agreeableness, and 10 items are used to assess openness. In the present study one item from the openness factor was erroneously omitted from the questionnaire; thus both agreeableness and openness were measured with nine items. For each item, participants were asked to what extent the described characteristic applied to them. Responses were given on a 5-point scale (1 = *strongly disagree*, 5 = *strongly agree*).

4.1.2.4 | **Attitudes Towards Primary and Secondary Outgroups.** Attitudes towards the primary outgroup (i.e., immigrants) and the secondary outgroups (gay people and individuals with disabilities) were assessed with six bipolar items adapted from Wright et al.'s (1997) General Evaluation Scale (e.g., cold/warm). Responses were given on a 5-point scale (1 represented the negative pole, 5 the positive pole).

4.2 | Statistical Analyses and Results

4.2.1 | Statistical Analyses

After computing means, standard deviations and bivariate correlations, we tested a path analysis model in LISREL 8.8 (Jöreskog and Sörbom 2006). The model included quantity and quality of contact as predictors, agreeableness and openness as mediators of contact effects on attitudes towards the primary (immigrants) and the secondary outgroups (gay people and individuals with disability); moreover, attitudes towards the primary outgroup were tested as a mediator of contact effects on attitudes towards the secondary outgroups. Model goodness-of-fit was evaluated using the chi-square statistic ($\chi 2$), the comparative fit index (CFI), the root-mean-square error of approximation (RMSEA), and the standardised root-mean-square residual (SRMR). The model fit is acceptable with a CFI value ≥ 0.95, an RMSEA value ≤ 0.06, an SRMR ≤ 0.08 (Hu and Bentler 1999). Mediation effects were tested with bootstrap confidence intervals (5000 resamples) in LISREL.

4.2.2 | Main Findings

Although RMSEA was higher than the expected value. the overall fit of the path analysis model was acceptable: $\chi 2\ (4) = 19.46$, $p = 0.00$; CFI = 0.99; RMSEA = 0.09; SRMR = 0.028. Results showed that quantity of contact was significantly associated with lower agreeableness (see Figure 1). Quality of contact showed a positive and significant association with both agreeableness and openness. Both quantity and quality of contact were significantly related to more positive attitudes towards immigrants. Agreeableness was significantly linked with more positive attitudes towards secondary outgroups (gay people and individuals with disabilities). Unexpectedly, openness was significantly associated with less positive attitudes towards individuals with disability. Finally, attitudes towards immigrants were significantly associated with more positive attitudes towards both secondary outgroups.

Estimates of indirect effects and bootstrapped confidence intervals are shown in Table 2. Results showed that contact quantity was associated with less positive attitudes towards the secondary outgroups through lower agreeableness, while contact quality was linked with more positive attitudes towards the secondary outgroups through higher agreeableness. Moreover, openness significantly mediated the effects of contact quality on (more negative) attitudes towards people with disability. When considering attitudes towards the primary outgroup as a

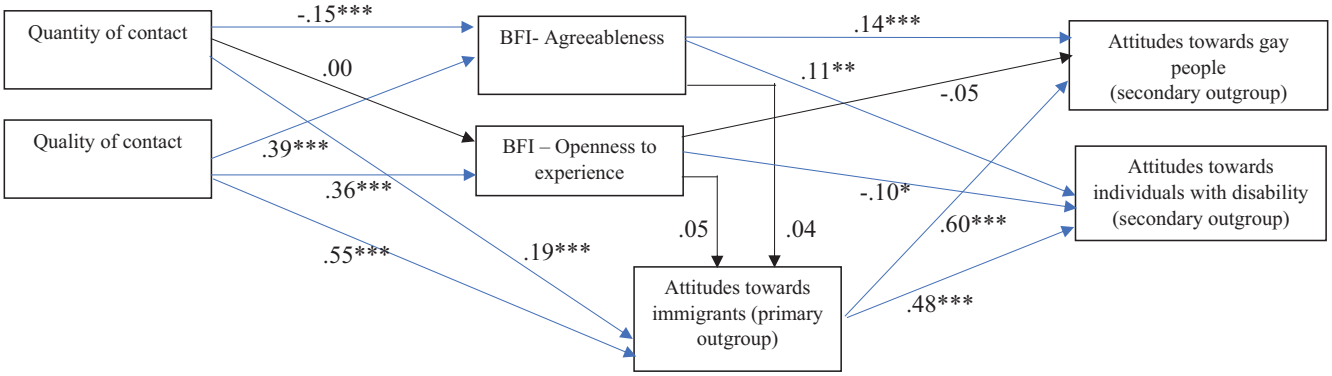

FIGURE 1 | Path analysis (Study 1, $N = 470$). Blue lines are part of significant mediation pathways. *$p < 0.05$. **$p < 0.001$. ***$p < 0.001$.

mediator, results showed that it significantly and positively mediated the relationship between contact (quantity and quality) and attitudes towards the two secondary outgroups.

4.3 | Discussion

Findings from Study 1 provide preliminary, albeit somewhat mixed, evidence for our main hypothesis: quality of contact is indirectly associated with more positive attitudes towards secondary outgroups via greater agreeableness. In line with larger STE literature, attitudes towards the primary outgroup also mediated the effects of contact on attitudes towards secondary outgroups.

Contrary to predictions, quantity of contact was indirectly associated with *less* positive attitudes towards secondary outgroups, via lower agreeableness. Although apparently surprising, this finding mirrors what emerged in Vezzali, Turner, et al. (2018); we will return to this effect in the General Discussion. Moreover, another unexpected effect concerned openness to experience, which was associated negatively with one secondary outgroup, and did not reveal significant associations with the other outgroups. We do not have a clear explanation for this finding, also because openness to experience was positively correlated with attitudes towards immigrants and gay people (Table 1). If anything, it speaks to possible inconsistencies and variability of effects of this variable, and its lower relevance to outgroup attitude formation (see General Discussion).

The main limit of Study 1 rests on its correlational nature. Study 2 therefore adopted a three-wave longitudinal design to examine whether between-person and within-person changes in contact experiences are indeed associated with changes in agreeableness, and hence, changes in outgroup attitudes.

5 | Study 2

5.1 | Method

5.1.1 | Participants

The overall sample included 492 students from six high schools located in a Northern Italian city. Of these, 49 participants self-identified as non-Italians and were therefore excluded from analyses, and one participant was deleted because we could not match the identification code across the three waves of data collection. The final sample consisted of 442 participants (206 females and 233 males, 3 missing data; M at T1 = 14.29 years, SD = 0.72), who self-identified as Italians. Sample size was determined by participant availability. Power sensitivity simulations revealed that, given the observed parameter estimates and assuming standard criteria ($\alpha = 0.05$), this sample size yielded approximately 80% to detect indirect effects (through personality) of size $\beta = 0.01–0.02$.

5.1.2 | Procedure and Measures

Participants filled in a questionnaire at three time points (T1, T2, and T3) with a time interval of six months between T1 and T2 and of one year between T2 and T3. The questionnaire was completed during regular school time. As for Study 1, the research was presented as a study on social attitudes. The questionnaire included the same measures as in Study 1, except for openness, for which the complete set of 10 items was used. Reliabilities for the measures at the three time points are reported in Table 3 (along with means, standard deviations, and correlations among the variables). All measures showed satisfactory internal consistency, with alpha values ranging from 0.73 to 0.94; only the reliability of agreeableness in the three waves was suboptimal, with alpha values ranging between 0.61 and 0.64 in the three waves.

5.2 | Statistical Analyses and Main Findings

5.2.1 | Statistical Analyses

We tested for attrition in the data by comparing respondents who dropped out of the study after Time 1 ($N = 71$) and respondents who dropped out after Time 2 ($N = 213$) with respondents who completed the questionnaire at all three time points ($N = 220$). We used the chi-square test to test for gender differences and multivariate analysis of variance (MANOVA) to test for differences related to age and to the six constructs under investigation.

We computed the means, standard deviations and bivariate correlations.

As anticipated, following recent recommendations (Bohrer et al. 2019; Friehs et al. 2024; Hodson and Meleady 2024), the hypotheses were tested by fitting a random-intercept longitudinal mediation model.

TABLE 2 | Bootstrap estimates of confidence intervals (5000 resamples), mediation effects (Study 1, $N = 470$).

Predictor variable	Mediating variable	Outcome variable	95% BCa CI		Estimate of the mediation effect
			Lower bound	Upper bound	
Quantity of contact	BFI-agreeableness	Attitudes towards immigrants (primary outgroup)	−0.018	0.003	−0.0042
Quantity of contact	**BFI-agreeableness**	**Attitudes towards gay people (secondary outgroup)**	**−0.041**	**−0.008**	**−0.0171**
Quantity of contact	**BFI-agreeableness**	**Attitudes towards individuals with disability (secondary outgroup)**	**−0.042**	**−0.004**	**−0.0132**
Quantity of contact	BFI-openness to experience	Attitudes towards immigrants (primary outgroup)	−0.008	0.002	−0.0002
Quantity of contact	BFI-openness to experience	Attitudes towards gay people (secondary outgroup)	−0.005	0.004	0.00003
Quantity of contact	BFI-openness to experience	Attitudes towards individuals with disability (secondary outgroup)	−0.007	0.008	0.0002
Quantity of contact	**Attitude towards immigrants**	**Attitudes towards gay people (secondary outgroup)**	**0.058**	**0.132**	**0.0942**
Quantity of contact	**Attitude towards immigrants**	**Attitudes towards individuals with disability (secondary outgroup)**	**0.044**	**0.105**	**0.0707**
Quality of contact	BFI-agreeableness	Attitudes towards immigrants (primary outgroup)	−0.014	0.041	0.0122
Quality of contact	**BFI-agreeableness**	**Attitudes towards gay people (secondary outgroup)**	**0.024**	**0.088**	**0.0502**
Quality of contact	**BFI-agreeableness**	**Attitudes towards individuals with disability (secondary outgroup)**	**0.007**	**0.076**	**0.0383**
Quality of contact	BFI-openness to experience	Attitudes towards immigrants (primary outgroup)	−0.008	0.042	0.0150
Quality of contact	BFI-openness to experience	Attitudes towards gay people (secondary outgroup)	−0.049	0.056	−0.0164
Quality of contact	**BFI-openness to experience**	**Attitudes towards individuals with disability (secondary outgroup)**	**−0.082**	**−0.007**	**−0.0336**
Quality of contact	**Attitude towards immigrants**	**Attitudes towards gay people (secondary outgroup)**	**0.247**	**0.375**	**0.3101**
Quality of contact	**Attitude towards immigrants**	**Attitudes towards individuals with disability (secondary outgroup)**	**0.184**	**0.2919**	**0.2321**

Note: Significant effects in bold.
Abbreviations: BCa CI, Bias-Corrected and accelerated Confidence Interval; BFI, Big Five Inventory.

5.2.2 | Attrition Analyses

Results of attrition analyses showed that the gender composition of participants who dropped out after T1 was not significantly different from that of participants who completed questionnaires at the three time points: χ^2 (1) = 0.39, $p = 0.54$. Moreover, in the MANOVA the multivariate difference was not significant: $F(9,281) = 0.91$, $p = 0.51$, $\eta_p{}^2 = 0.03$. At the univariate level, differences in mean scores between the two groups were all nonsignificant ($ps \geq 0.165$), except for contact quantity, which showed a marginally significant difference: $F(9,281) = 3.42$, $p = 0.07$, $\eta_p{}^2 = 0.01$. Similarly, the comparison

TABLE 3 | Mean scores, standard deviations and bivariate correlations (Study 2, N = 442).

Variable	α	*M*	SD	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Quantity of contact T1	0.75	2.69	0.96	—										
2. Quality of contact T1	0.80	3.82	0.75	0.52***	—									
3. BFI_A T1	0.61	3.52	0.58	0.09†	0.26***	——								
4. BFI_O T1	0.73	3.37	0.64	0.09†	0.15**	0.21***	—							
5. Attitudes towards immigrants T1	0.84	3.29	0.68	0.30***	0.50***	0.17***	0.15***	—						
6. Attitudes towards gay people T1	0.81	3.36	1.00	0.03	0.12**	0.13**	0.20***	0.21***	—					
7. Attitudes towards individuals with disability T1	0.87	4.00	0.75	0.11*	0.18***	0.21***	0.22***	0.34***	0.36***	–				
8. Quantity of contact T2	0.86	3.07	1.07	0.37***	0.25**	0.10*	0.02	0.18***	0.04	0.05	—			
9. Quality of contact T2	0.85	3.79	0.77	0.23**	0.37***	0.26***	0.16***	0.29***	0.18***	0.19***	0.54***	—		
10. BFI_A T2	0.64	3.40	0.55	0.00	0.21***	0.51***	0.14**	0.13**	0.00	0.10*	0.06	0.30***	—	
11. BFI_O T2	0.76	3.35	0.61	0.10*	0.09	0.08	0.52***	0.12**	0.11*	0.10*	0.13**	0.24***	0.20***	—
12. Attitudes towards immigrants T2	0.87	3.28	0.70	0.13**	0.19***	0.07	0.06	0.36***	0.10*	0.16***	0.36***	0.53***	0.25***	0.18***
13. Attitudes towards gay people T2	0.94	3.34	1.09	0.03	0.10*	0.15***	0.26***	0.12***	0.74***	0.31***	0.05	0.17***	0.07	0.21***
14. Attitudes towards individuals with disability T2	0.90	4.01	0.76	0.00	0.12**	0.24***	0.09†	0.22***	0.31***	0.57***	0.05	0.22***	0.17***	0.12*
15. Quantity of contact T3	0.78	2.71	0.87	0.40***	0.34***	0.09†	0.16***	0.24***	−0.04	0.02	0.45***	0.39***	0.07	0.15***
16. Quality of contact T3	0.87	3.66	0.83	0.28***	0.42***	0.20***	0.22***	0.38***	0.31***	0.33***	0.31***	0.48***	0.15***	0.18***
17. BFI_A T3	0.63	3.40	0.52	0.05	0.20***	0.50***	0.07	0.16***	0.01	0.13***	0.05	0.26***	0.56***	0.06
18. BFI_O T3	0.75	3.35	0.58	0.16**	0.08	−0.03	0.47***	0.07	0.24***	0.16***	0.06	0.19***	0.11*	0.54***
19. Attitudes towards immigrants T3	0.84	3.25	0.61	0.17***	0.27***	0.19***	0.20***	0.52***	0.22***	0.31***	0.15**	0.27***	0.12*	0.18***
20. Attitudes towards gay people T3	0.94	3.37	1.07	0.10*	0.24***	0.28***	0.25***	0.17***	0.58***	0.35***	0.05	0.29***	0.16***	0.16***
21. Attitudes towards invididuals with disability T3	0.90	4.05	0.73	0.08	0.21***	0.26***	0.08	0.20***	0.26***	0.50***	−0.02	0.21***	0.18***	0.04

Variable	α	*M*	SD	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.
1. Quantity of contact T1	0.75	2.69	0.96										
2. Quality of contact T1	0.80	3.82	0.75										
3. BFI_A T1	0.61	3.52	0.58										
4. BFI_O T1	0.73	3.37	0.64										
5. Attitudes towards immigrants T1	0.84	3.29	0.68										

(Continues)

TABLE 3 | (Continued)

Variable	α	*M*	SD	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.
6. Attitudes towards gay people T1	0.81	3.36	1.00										
7. Attitudes towards individuals with disability T1	0.87	4.00	0.75										
8. Quantity of contact T2	0.86	3.07	1.07										
9. Quality of contact T2	0.85	3.79	0.77										
10. BFI_A T2	0.64	3.40	0.55										
11. BFI_O T2	0.76	3.35	0.61										
12. Attitudes towards immigrants T2	0.87	3.28	0.70	—									
13. Attitudes towards gay people T2	0.94	3.34	1.09	0.15**	—								
14. Attitudes towards individuals with disability T2	0.90	4.01	0.76	0.18***	0.37***	—							
15. Quantity of contact T3	0.78	2.71	0.87	0.24***	0.01	0.03	—						
16. Quality of contact T3	0.87	3.66	0.83	0.34***	0.31***	0.28**	0.50**	—					
17. BFI_A T3	0.63	3.40	0.52	0.17***	−0.01	0.13**	0.09	0.25**	—				
18. BFI_O T3	0.75	3.35	0.58	0.08	0.26***	0.13**	0.10*	0.30**	0.10*	—			
19. Attitudes towards immigrants T3	0.84	3.25	0.61	0.29***	0.24***	0.24**	0.32**	0.48**	0.22**	0.14**	—		
20. Attitudes towards gay people T3	0.94	3.37	1.07	0.12*	0.72***	0.48**	0.08	0.47**	0.16**	0.32***	0.30***	—	
21. Attitudes towards invididuals with disability T3	0.90	4.05	0.73	0.08	0.22***	0.59**	0.06	0.43**	0.29**	0.17***	0.32***	0.53***	—

Abbreviations: BFI_A, Big Five Inventory Agreeableness; BFI_O, Big Five Inventory Openness; T1, Time 1; T2, Time 2; T3, Time3.
$^{\dagger}p < 0.06$.
$^{*}p < 0.05$.
$^{**}p < 0.01$.
$^{***}p < 0.001$.

between respondents who dropped after T2 and those who took part in all the three time points of data collection showed no difference in the gender composition of the two groups: $\chi^2(1) = 0.70$, $p = 0.40$. However, the multivariate difference in the MANOVA was significant: $F(9,425) = 2.37$, $p = 0.013$, $\eta_p^2 = 0.05$. Inspection of the univariate differences showed that participants who dropped after T2 reported more quantity of contact at T1 ($M = 2.79$) and slightly less agreeableness ($M = 3.47$) compared to participants who completed the questionnaires at the three time points (contact quantity: $M = 2.60$, agreeableness: $M = 3.57$): $F(1,435) = 4.53$, $p = 0.03$, $\eta_p^2 = 0.01$, for contact quantity, and $F(1,435) = 4.47$, $p = 0.06$, $\eta_p^2 = 0.01$, for agreeableness. However, these effects were small; therefore we retained all the participants and replaced missing data with the EM algorithm (Schafer and Graham 2002).

5.2.3 | Main Findings

As shown in Figure 2a, the results of our multilevel mediation analyses revealed that within-person changes in quality of contact were positively associated with within-person changes in agreeableness ($\beta = 0.13$ (SE = 0.04), 95% CI = [0.06, 0.20], $p < 0.001$), which, in turn, were positively related to within-person changes in attitudes towards the primary outgroup (i.e., immigrants; $\beta = 0.11$ (SE = 0.03), 95% CI = [0.04, 0.17], $p = 0.001$). The entire mediation effect was significant ($\beta = 0.014$ (SE = 0.006), 95% CI = [0.003, 0.025], $p = 0.015$).

Likewise, within-person changes in the quality of contact were positively associated with within-person changes in openness ($\beta = 0.16$ (SE = 0.03), 95% CI = [0.09, 0.22], $p < 0.001$), which, in turn, were positively related to within-person changes in attitudes towards (the secondary outgroup) people with disability ($\beta = 0.12$ (SE = 0.03), 95% CI = [0.06, 0.19], $p < 0.001$). The entire mediation chain was significant ($\beta = 0.019$ (SE = 0.007), 95% CI = [0.006, 0.033], $p = 0.005$). No other significant primary or secondary transfer effects emerged (all ps > 0.138)—see Figure 2a and Table 4a.

We also observed two significant, indirect between-person effects (Figure 2b). That is, we found a quality of contact > agreeableness > attitudes towards gay people between-person association ($\beta = -0.167$ (SE = 0.081), 95% CI = [−0.326, −0.009], $p = 0.040$), and a quality of contact > openness > attitudes towards gay people between-person association ($\beta = 0.088$ (SE = 0.027), 95% CI = [0.036, 0.140], $p = 0.001$) (see Figure 2b and Table 4b). Note that these relationships mainly reflect stable between-person differences. For example, the latter between-person indirect effect indicates that individuals with higher quality of contact levels across all time points also scored higher on openness across all time points ($\beta = 0.38$ (SE = 0.10), 95% CI = [0.17, 0.58], $p = 0.001$), and hence, held more positive attitudes towards gay people across all time points ($\beta = 0.23$ (SE = 0.06), 95% CI = [0.11, 0.35], $p < 0.001$), compared with individuals with low stable contact levels.

5.3 | Discussion

Study 2 used a longitudinal design, a naturalistic sample, and a state-of-the-art data-analytical technique to identify within-person and between-person contact effects over time. Main results are that (1) changes in contact quality were indirectly and positively associated with changes in attitudes towards the primary outgroup, immigrants via shifts in agreeableness. Somewhat surprisingly, no within-person longitudinal STE effects associated with changes in agreeableness were found.

Supporting the STE via personality factors, we also observed that (2) within-person changes in contact quality were indirectly and positively associated with changes in attitudes towards people with disability via shifts in openness to experience. Further noteworthy findings were found at the between-person level: (3) indirect effects of quality of contact on attitudes towards gay people emerged for agreeableness (but the effect was negative) and openness to experience. Finally, we did not find mediation effects neither at the within-person nor at the between-person for quantity of contact.

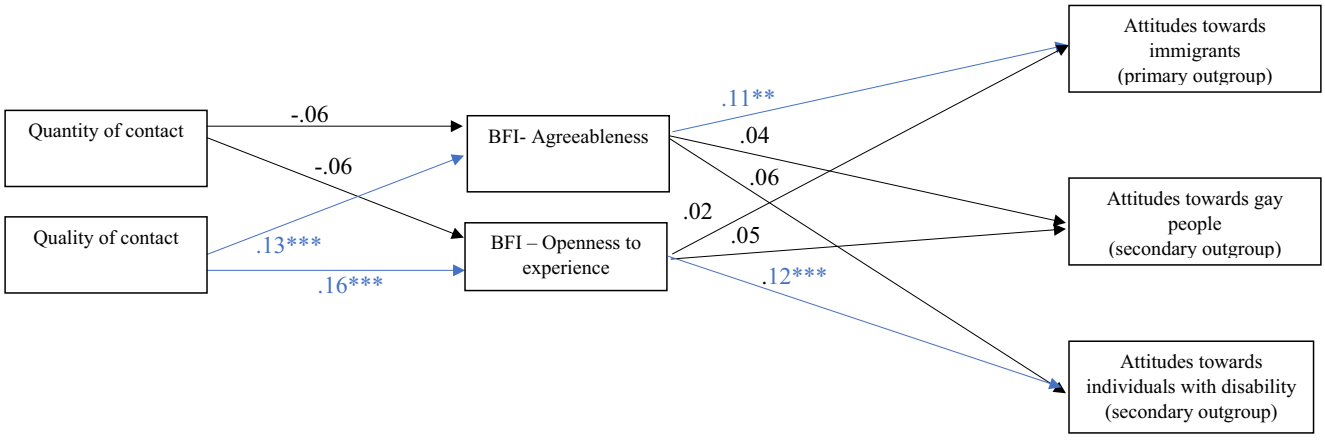

FIGURE 2a | Output of multilevel mediation analysis (Study 2, $N = 442$): Graphic overview of within-person effects. Blue lines are part of significant mediation pathways. All coefficients represent standardized estimates. Residual direct relationships among the predictors and the outcome variables are not reported in the Figure, but they were estimated in the model. Results showed that both quantity ($\beta = 0.13$, $p < 0.001$), and quality ($\beta = 0.29$, $p < 0.001$) of contact, significantly predicted attitudes towards immigrants (primary outgroup). No significant effects of either quantity ($\beta = 0.02$, $p = 0.59$) or quality of contact ($\beta = 0.04$, $p = 0.33$) were found for attitudes towards gay people (secondary outgroup). Similarly, quantity ($\beta = 0.06$, $p = 0.11$) and quality of contact ($\beta = 0.06$, $p = 0.09$) did not predict attitudes towards individuals with disability (secondary outgroup).

TABLE 4a | Overview of within-person mediation effects (Study 2, $N = 442$).

Predictor variable	Mediating variable	Outcome variable	β (SE)	95% CI	p
Quantity of contact	BFI-agreeableness	Attitudes towards immigrants (primary outgroup)	−0.006 (0.004)	[−0.014, 0.002]	0.139
Quantity of contact	BFI-agreeableness	Attitudes towards gay people (secondary outgroup)	−0.002 (0.003)	[−0.007, 0.003]	0.343
Quantity of contact	BFI-agreeableness	Attitudes towards individuals with disability (secondary outgroup)	−0.003 (0.003)	[−0.009, 0.002]	0.234
Quantity of contact	BFI-openness to experience	Attitudes towards immigrants (primary outgroup)	−0.001 (0.002)	[−0.005, 0.003]	0.622
Quantity of contact	BFI-openness to experience	Attitudes towards gay people (secondary outgroup)	−0.003 (0.003)	[−0.008, 0.002]	0.281
Quantity of contact	BFI-openness to experience	Attitudes towards individuals with disability (secondary outgroup)	−0.007 (0.005)	[−0.016, 0.025]	0.160
Quality of contact	**BFI-agreeableness**	**Attitudes towards immigrants (primary outgroup)**	**0.014 (0.006)**	**[0.003, 0.025]**	**0.015**
Quality of contact	BFI-agreeableness	Attitudes towards gay people (secondary outgroup)	0.005 (0.005)	[−0.004, 0.015]	0.271
Quality of contact	BFI-agreeableness	Attitudes towards individuals with disability (secondary outgroup)	−0.003 (0.003)	[−0.009, 0.002]	0.234
Quality of contact	BFI-openness to experience	Attitudes towards immigrants (primary outgroup)	0.003 (0.005)	[−0.007, 0.012]	0.605
Quality of contact	BFI-openness to experience	Attitudes towards gay people (secondary outgroup)	0.008 (0.006)	[−0.003, 0.019]	0.150
Quality of contact	**BFI-openness to experience**	**Attitudes towards individuals with disability (secondary outgroup)**	**0.019 (0.007)**	**[0.006, 0.033]**	**0.005**

Note: Significant effects are printed in bold.
Abbreviation: BFI, Big Five Inventory.

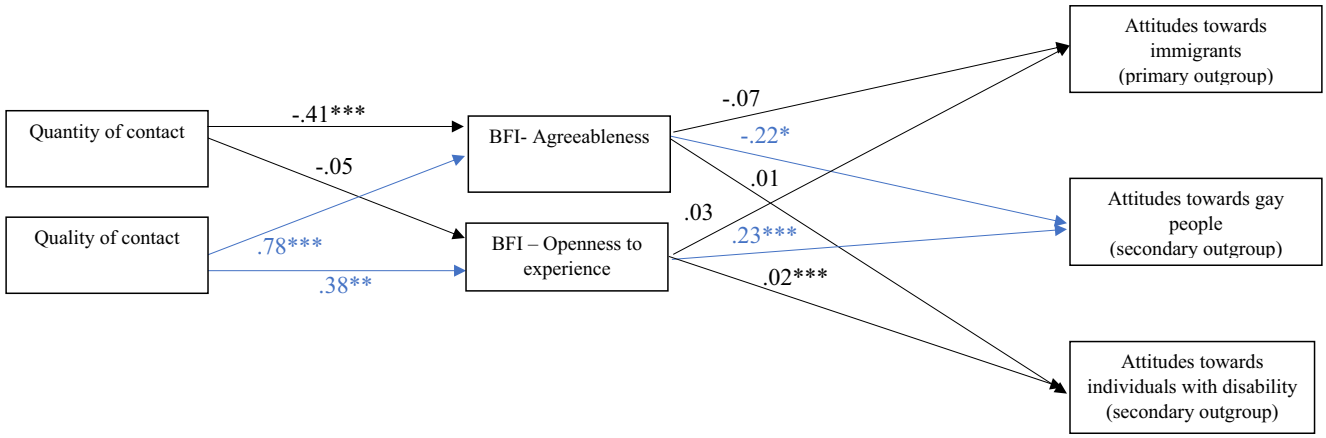

FIGURE 2b | Output of multilevel mediation analysis (Study 2, $N = 442$): Graphic overview of between-person effects. Blue lines are part of significant mediation pathways. All coefficients represent standardized estimates. Residual direct relationships among the predictors and the outcome variables are not reported in the Figure, but they were estimated in the model. Results showed that quality of contact ($\beta = 0.87$, $p < 0.001$), but not quantity ($\beta = -0.17$, $p = 0.17$), significantly predicted attitudes towards immigrants (primary outgroup). Significants effects were also found for quantity ($\beta = -0.64$, $p < 0.001$) and quality of contact ($\beta = 0.94$, $p < 0.001$) on attitudes towards gay people (secondary outgroup). Similarly, quantity ($\beta = -0.61$, $p < 0.001$) and quality of contact ($\beta = 0.91$, $p < 0.001$) significantly predicted attitudes towards individuals with disability (secondary outgroup).

TABLE 4b | Overview of between-person mediation effects (Study 2, $N = 442$).

Predictor variable	Mediating variable	Outcome variable	β (SE)	95% CI	p
Quantity of contact	BFI-agreeableness	Attitudes towards immigrants (primary outgroup)	0.030 (0.036)	[−0.042, 0.101]	0.417
Quantity of contact	BFI-agreeableness	Attitudes towards gay people (secondary outgroup)	0.088 (0.050)	[−0.011, 0.187]	0.081
Quantity of contact	BFI-agreeableness	Attitudes towards disabled people (secondary outgroup)	−0.004 (0.035)	[−0.074, 0.065]	0.900
Quantity of contact	BFI-openness to experience	Attitudes towards immigrants (primary outgroup)	−0.001 (0.004)	[−0.008, 0.006]	0.752
Quantity of contact	BFI-openness to experience	Attitudes towards gay people (secondary outgroup)	−0.010 (0.025)	[−0.060, 0.039]	0.681
Quantity of contact	BFI-openness to experience	Attitudes towards individuals with disability (secondary outgroup)	−0.001 (0.003)	[−0.007 0.005]	0.781
Quality of contact	BFI-agreeableness	Attitudes towards immigrants (primary outgroup)	−0.056 (0.066)	[−0.186, 0.074]	0.400
Quality of contact	**BFI-agreeableness**	**Attitudes towards gay people (secondary outgroup)**	**−0.167 (0.081)**	**[−0.326, −0.009]**	**0.040**
Quality of contact	BFI-agreeableness	Attitudes towards disabled people (secondary outgroup)	0.008 (0.068)	[−0.124, 0.141]	0.901
Quality of contact	BFI-openness to experience	Attitudes towards immigrants (primary outgroup)	0.010 (0.023)	[−0.035, 0.055]	0.669
Quality of contact	**BFI-openness to experience**	**Attitudes towards gay people (secondary outgroup)**	**0.088 (0.027)**	**[0.036, 0.140]**	**0.001**
Quality of contact	BFI-openness to experience	Attitudes towards disabled people (secondary outgroup)	0.007 (0.024)	[−0.041, 0.055]	0.773

Note: Significant effects are printed in bold.
Abbreviation: BFI, Big Five Inventory.

6 | General Discussion

We conducted one correlational and one three-wave longitudinal study to investigate the STE and, specifically, to examine personality (agreeableness, openness to experience) as its underlying process.

6.1 | Main Findings

Results, obtained in both adult (Study 1) and adolescent (Study 2) samples, provided some support for the hypotheses, showing that changes in personality stemming from contact with a primary outgroup are associated with changes in attitudes towards secondary outgroups. Specifically, quality of contact was indirectly associated with attitudes towards secondary outgroups via greater agreeableness (both studies, but in Study 2 only at the between-person level and the effect was negative) and via openness (only in Study 2, at both within-person and between-person levels). Unexpectedly, quantity of contact was associated with less positive attitudes towards secondary outgroups, via lower agreeableness, but only in Study 1; in Study 2, consistent with the generally more relevant role played by contact quality, we did not find indirect effects of contact quantity. In Study 1, in line with broader STE research, attitudes towards the primary outgroup also mediated the STE.

6.2 | Theoretical Contribution

These results replicate and extend previous research on the STE, providing correlational and longitudinal evidence that contact with a primary outgroup can contribute to changing attitudes towards outgroups uninvolved in the contact setting. The findings also extend previous research. First, they contribute to emerging literature on the association between contact and personality (Birtel et al. 2024; Turner et al. 2014; see Turner et al. 2020, for a review), showing that contact is longitudinally associated with agreeableness and openness to experience (Vezzali, Turner, et al. 2018). Second, they provide the first longitudinal evidence that the STE—but also the improvement of attitudes towards the primary outgroup (we obtained a within-person effect of contact quality on attitudes towards the primary outgroup via agreeableness in Study 2)—occurs via personality, and specifically that contact quality is associated with improved attitudes towards (primary and) secondary outgroups at least in part because it makes individuals more agreeable and open to experience. It is worth noting that differences emerged between

Studies 1 and 2 with respect to the specific personality factor involved. In Study 1, quality of contact was indirectly associated with more positive attitudes towards secondary outgroups via greater agreeableness (while indirect negative effects emerged for the quantity of contact, because of its negative association with agreeableness). In Study 2, agreeableness also emerged as a mediator of the quality of contact at the within-person level, but only with respect to attitudes towards the primary outgroup (nonetheless showing that shifts in personality predict corresponding changes in outgroup attitudes). In contrast, in Study 2, openness to experience mediated the associations of the quality of contact with one secondary outgroup at the within-person level. Differences between studies may depend on a number of factors, including the sample, consisting of adults in Study 1 and adolescents in Study 2. In particular, adolescents may be more subject to personality change (e.g., Bleidorn et al. 2014, 2022; Roberts et al. 2006), which may explain the positive longitudinal association of quality of contact with both factors at the within-person level. Also, it is possible that the absence of the STE associated with agreeableness at the within-person level in Study 2 depends on contextual aspects. Indeed, this finding reflects not the absence of an association between contact and agreeableness, but the nonsignificant associations of agreeableness with the two secondary outgroups (in contrast to literature showing that agreeableness is a predictor of outgroup attitudes; e.g., Duckitt and Sibley 2017). Nonetheless, the broad message—consistent across studies—is that the quality of contact is associated with the STE through shifts in personality.

In terms of Vezzali et al.'s (2021) classification, these findings show that contact contributes to changing the individuals' self, and this inner change can explain shifts in attitudes towards groups dissimilar from the primary outgroup. Indeed, if a person becomes more agreeable or open, the specific experiences contributing to this change (e.g., contact) become less important; what is important is that agreeable persons tend to have a more positive orientation towards other people and groups (but note that agreeableness was negatively associated with attitudes towards gay people at the between-person level in Study 2). It is worth noting that we are not disputing the stability of personality traits; instead, we emphasise the relevance of certain social experiences, and in particular intergroup contact, in contributing to shaping personality.

Inconsistent with predictions, quantity of contact revealed negative associations with agreeableness in both studies, also resulting in negative indirect STE. It is worth noting that these findings are consistent with longitudinal effects by Vezzali, Turner, et al. (2018).

We argue that findings showing negative associations between contact quantity and agreeableness (but only at the between-person level in Study 2) may depend at least in part on the measure used. Being focused on contact frequency, our measure potentially captured both positive and negative intergroup experiences. Possibly, when completing this measure, individuals included a comparatively higher number of negative than positive experiences, this way explaining the negative associations of contact quantity with agreeableness. If this is the case, then individuals engaged in greater negative than positive contact may have speculated to be less agreeable. Future studies are needed to properly test this possibility. More generally, given scarce research, it is important to conduct studies testing the STE of negative in addition to positive contact (Henschel and Derksen 2023; Jasinskaja-Lahti et al. 2021; Kauff et al. 2023; Lissitsa and Kushnirovich 2018; Meleady and Forder 2019).

We note that, to not further complicate the model, differing from classical tests of STE, attitudes towards the primary outgroup in Study 2 were tested as a dependent variable at the same level as attitudes towards secondary outgroups (note that Study 1 provided preliminary evidence for mediation by both attitudes towards the primary outgroup and agreeableness). Importantly, this choice reflects our conceptual argumentation: once personality changes occur, attitudes towards a variety of outgroups should change as a consequence. This is also consistent with the concept underlying the STE; namely, that contact with a primary outgroup affects attitudes towards secondary outgroups (Pettigrew 2009). Mediation by outgroup attitudes is merely a way to investigate this transfer.

6.3 | The 'Liberalisation' Function of Contact

Importantly, our results can also be viewed as an advancement in research on the role of deprovincialization in STE. Pettigrew (1998); see also (Verkuyten et al. 2022) proposed the construct of deprovincialization, whereby individuals acquire with contact a more open perspective about diversity and the importance of other cultures (Boin et al. 2020; Lucarini et al. 2023; Verkuyten et al. 2010). Research has investigated whether the STE could be attributed at least in part to deprovincialization produced by contact, with mixed findings (see Vezzali et al. 2021). Although indirectly, the present research supports the idea that individuals deprovincialize as a function of contact, at least at a personal level, revealing greater agreeableness and openness to experience.

The fact that contact was longitudinally associated with personality change is also consistent with the idea that contact has a cognitive liberalisation function, broadening and liberalising minds, with effects that go beyond intergroup relations, referred to as the 'tertiary transfer effect' (Boin et al. 2021; Hodson et al. 2018; Meleady et al. 2020). Hodson et al. stated that 'contact can serve as a cognitive liberalizing agent, relevant not only to shaping the content or valence of intergroup attitudes but how people think about, approach, and deal with the world' (2018, p. 524). We intend this conceptualization broadly, incorporating all the effects of contact *beyond* intergroup outcomes in the tertiary transfer effects. To better understand the potential of contact, we believe that research should investigate the breadth of contact effects. At the same time, research should connect findings relating to intergroup relations (i.e., primary and secondary transfer effects) with the cognitive liberalisation function, to shed light on the processes underlying the liberalising function of contact. This is precisely what we did. We argue that the present findings contribute to research on the tertiary transfer effect, combining evidence for secondary (contact effects generalise to attitudes towards secondary outgroup) and tertiary (contact relates with personality change, which is not strictly an intergroup variable) transfer effects. Specifically, it connects the two effects, showing that the liberalising effects that contact has on personality can contribute to explaining attitude change

towards outgroup which can also be dissimilar (like in the present studies).

6.4 | Between-Person and Within-Person Effects: Two Complementary Facets?

We believe a noteworthy contribution of the present work consists in the separation of between-person from within-person contact transfer effects. Results revealed evidence for within-person effects, that is, evidence for intra-individual variation in personality and attitudes following contact, showing that changes in contact are related to changes in individual attitudes as well as to changes in relatively stable constructs like personality factors. That being said, we somehow also want to fuel the current debate about the evidential value of between-person effects for the contact hypothesis. That is, unlike recent contributions arguing that between-person associations 'provide limited support for the contact hypothesis' (Friehs et al. 2024, p. 126) because they do not reflect within-person changes in attitudes following changes in contact, we nonetheless advance the argument here that also between-person effects are directly relevant to the support of the contact hypothesis. First, by reflecting the stability of associations over time, they provide evidence for the durability of contact effects, such that individuals with more contact in the first wave may continue to display better outgroup attitudes (and personality factors, in our specific case) over time. Indeed, we believe that findings illustrating the stability of contact effects are also relevant for the contact hypothesis, as short-term contact effects may make contact irrelevant.

Second, as argued by Friehs et al. (2024), who relied on the asymptotic model of contact (MacInnis and Page-Gould 2015; Page-Gould et al. 2022), contact effects may occur in early stages, and long time lags between waves may not be sufficiently sensitive to detect them. Shulman et al. (2024) conducted three longitudinal studies, using short time spans (up to 1 month), with evidence mostly for between-person rather than within-person effects. To explain the relative absence of within-person effects, the authors suggested that contact effects may eventually be cumulative or stemming from major events, rather than (solely) from short contact experiences. We add that such hypotheses and theorizations likely do not sufficiently consider the role of quality of contact, which has been shown to be primarily relevant to contact effects (e.g., Hodson and Hewstone 2013). Possibly, intra-individual variation can be captured by a combination of aspects, like quantity and quality of contact, and/or positive and negative contact (Árnadóttir et al. 2018), also heavily depending on specific contextual aspects (e.g., newly initiated rather than long-term contact, prevailing norms, optimal conditions, etc.).

In sum, we argue that the absence of between-person *or* within-person effects does not falsify per se the contact hypothesis; in other words, between-person effects are not necessarily 'secondary' to within-person effects, and the specificity of each study should be taken into account. It is instead important to consider their interplay. For instance, the absence of between-person effects may indicate that contact effects faded over time; the absence of within-person effects may suggest an inability to capture intra-individual variation. In other words, we thus propose that effects at each level explain different parts of the contact 'puzzle', and studies obtaining only significant between-person *or* within-person effects in our opinion thus provide distinct and incomplete but nonetheless valuable types of support for the contact hypothesis. In this light, we believe that our second study represents rather strong evidence for the contact hypothesis and the STE. Although effects slightly varied between between-person and within-person, they nonetheless provide converging support to our broad hypothesis that STE effects can depend at least in part on shifts in personality.

6.5 | Limitations

We believe that a strength of this article is the longitudinal nature of our second study, spanning approximately two years, and being the second study testing the STE with longitudinal mediation with at least three waves (for another example, Kauff et al. 2023). Even so, we must acknowledge as a limitation that waves of our study were not equally distributed in time: Wave 1 was administered at the beginning of the first school year, Wave 2 was administered at the end of the same school year, Wave 3 was administered at the beginning of the following school year. However, it is also worth noting that we strategically planned these waves to capture key moments relevant for our hypothesis: the beginning of the first school year is a 'zero-contact' moment; the end of the first school year is a moment where students had sufficient time to engage in contact; the end of the following school year is a moment where students further corroborated their engagement in contact. Moreover, although the time interval between Wave 2 and Wave 3 might be larger in terms of months, it should be also noted that when excluding school holidays (during which students do not go to school and generally have fewer regular contacts with classmates), the time interval between Wave 1 and Wave 2 was approximately equal to that between Wave 2 and Wave 3.

Additionally, given the nature of our mediator, a further potential limit is that we examined a relatively short time span, with waves separated by some months, while personality change may need more time to occur. It should be noted that theories like self-perception theory (Bem 1967) or social investment theory (Roberts et al. 2005) do not refer to a minimum period required for personality to change. Studies showing that personality can change as a function of specific events (e.g., Specht et al. 2011) support the idea that personality change does not necessarily necessitate extensive time periods (for evidence of personality change in a period of a few months, see J. J. Jackson et al. 2012). In particular, the present longitudinal study complements research showing that social relationships can change personality (e.g., Neyer and Lehnart 2007), focusing on the relevance of diversity experiences, and specifically prolonged experiences of intergroup contact in adolescence. Future studies should however consider longer time spans to increase the likelihood of personality change.

In the present research we only focused on two personality traits as defined by the FFM (McCrae and Costa 1999), relying on research showing their relevance for prejudice (Sibley and Duckitt 2008) and for contact (Turner et al. 2014; Vezzali, Turner,

et al. 2018). However, research has shown that other variables related to personality and individual dispositions (both negative and positive) can be relevant predictors of prejudice. Examples include the dark triads (Machiavellianism, narcissism, psychopathy), or ideological orientations that are determined at least in part by personality like SDO (Hodson et al. 2009), but also dispositional mindfulness (Fuochi et al. 2023). Future research should include a wider range of traits, isolating those that most contribute to the STE.

A final potential limit is that we did not control for contact with the secondary outgroups, as the tested model was already complex. Previous studies have shown that the STE is generally robust, also when controlling for contact with the secondary outgroups (Vezzali et al. 2021). Finally, we only included dissimilar secondary outgroups; future studies should also include similar secondary outgroups, to evaluate whether the strength of the STE via personality differs among these categories.

7 | Conclusion

We conducted two studies showing that the STE occurs at least in part because of shifts in personality. These findings demonstrate that contact can have a pervasive effect at the level of the self, in turn contributing to explaining its attitudes towards a wide variety of groups. In line with the tertiary transfer effect (Hodson et al. 2018), the STE may therefore reflect a broader experience for individuals, rather than being 'merely confined' to intergroup relations. In light of these results, we encourage researchers and practitioners to work to create opportunities for positive contact that may benefit individuals at the level of the self and their social relations.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. casp70197-sup-0001-Supinfo.pdf.