THE ROLE OF PROJECTION AND EMPATHIC ACCURACY IN DYADIC PERCEPTION BETWEEN OLDER TWINS

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ABSTRACT

Dyadic perception between 108 older identical and same-sex fraternal twin pairs was examined using three different tasks: (i) an emotional sensitivity task, (ii) a Q-Sort rating of emotion-eliciting situations, and (iii) an assessment of each other's personality traits. Idiographic analyses related judgements of self and co-twin within and between twins. Projection approached the reliability of the judgements and was significantly higher than both empathic accuracy and actual similarity, suggesting that the process of dyadic perception was mainly shaped by projection. Significant correlations between empathic accuracy and projection were caused by the similarity of the twins in self-judgements. Empathic accuracy was much weaker once projection was controlled, indicating that twins had used valid projection to improve accuracy. Similarity-controlled projection was still high and reflected the fact that the twins overestimated their similarity to a large extent. Contrary to expectation but consistent across the three tasks, identical and fraternal twins differed neither in levels of actual similarity, empathic accuracy and projection, nor in similarity-controlled empathic accuracy and projection.

KEY WORDS • dyadic perception • empathic accuracy • projection • social relationships • twins

Empathy serves a fundamental social function in close relationships and is

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defined by different cognitive and emotional processes: taking the situational perspective of the other, recognizing what the other is thinking, detecting the intentions and motivations of the other, and, most importantly, intuitively understanding the emotions of the other. The German philosopher Martin Buber (1923) called this ability the essence of the human condition, rather than bipedalism or the ability to reason. However, the concept of empathy lacks a general scientific definition that would not only conceptually unify its various facets but also clarify its nature, its multiple functions, and, most important, the intra- and interpersonal processes that give rise to it.

Various attempts have been made to conceptualize empathy on different levels, such as accuracy, sympathy, understanding, or as altruistic concern (see Davis, 1994, for a review). Most of these attempts maintained a static view of empathy, as they tried neither theoretically nor methodologically to specify empathy as an ongoing process between two interacting persons. Since the beginning of the 1990s, the attention has shifted away from this static view of empathy towards a perspective of empathy as a measurable and observable social skill within the context of ongoing social interactions. From this perspective, empathy is measured on-line as accuracy, that is, the extent to which one accurately identifies the states or the traits of a specific target. Ickes, Stinson, Bissonette, and Garcia (1990) and Levenson and Ruef (1992) developed procedures to measure empathy as a perceptual process.

Applying the *dyadic interaction paradigm*, Ickes and colleagues investigated perceivers' empathic accuracy in inferring the specific content of another's thoughts and feelings (Hancock & Ickes, 1996; Ickes, 1993, 1997; Ickes et al., 1990; Ickes, Tooke, Stinson, Baker, & Bissonette, 1988). This procedure moves beyond conventional studies of accuracy in that it views empathy as a process and allows the perceiver to generate his or her own inferences about the target. One important result of this research is that accuracy increases with the degree of acquaintance (Stinson & Ickes, 1992), although boundary conditions to this acquaintanceship effect were identified by Hancock and Ickes (1996). Another study examined circumstances under which dating partners anticipate threats to their relationship, which in turn motivates them to empathize inaccurately the feelings and thoughts of the other (Simpson, Ickes, & Blackstone, 1995). Finally, Marangoni, Garcia, Ickes, and Teng (1995) reported, among other important findings, that cross-target consistency revealed stable individual differences in perceivers' empathic ability.

In contrast, Levenson and Ruef (1992) concentrated on the unidimensional assessment of affective sensitivity and its relationship to various physiological measures of autonomic and somatic reactions. Levenson and Ruef (1992) used tapes from a previous study that had employed the *marital interaction paradigm*. Participants in their study were presented with these tapes and asked to rate the feelings of a designated spouse. Physiological linkage was strongly associated with empathic accuracy, especially with regard to negative interaction segments (i.e., the tendency

of the perceiver and target to experience similar physiological reactions at the same time was correlated with the accuracy of the perceiver).

Most important, the research by these groups revealed that measures of observed empathic accuracy in interpersonal perception tasks fail to generate substantial correlations with global self-report measures of dispositional empathy (Ickes et al., 1990; Levenson & Ruef, 1992; Marangoni et al., 1995; Thomas, Fletcher, & Lange, 1997; Stinson & Ickes, 1992). Ickes (1993) concluded that most people do not appear to possess accurate knowledge regarding their own empathic accuracy.

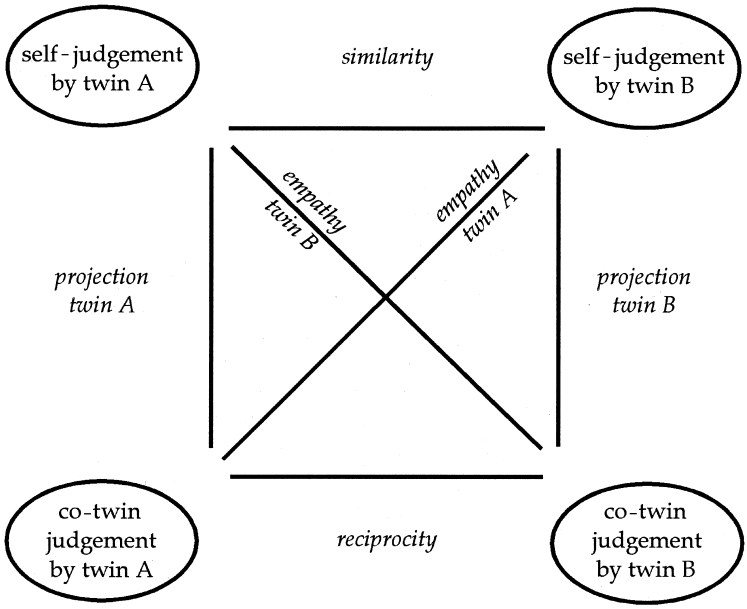
Unlike numerous studies focusing on accuracy between heterosexual partners (e.g., Acitelli, Douvan, & Veroff, 1993, 1997; Levinger & Breedlove, 1966; Sillars, Pike, Jones, & Murphy, 1984; Sillars et al., 1994) and other studies examining on-line empathic accuracy between strangers (Ickes et al., 1990), friends (Stinson & Ickes, 1992), or dating and marriage partners (Simpson et al., 1995; Thomas et al., 1997), we studied dyadic perception between older twins. There are some important features that make relationships between older twins unique. Compared with partnerships whose members are genetically independent (with the exception of possible assortative mating effects), twin relationships in old age can be described by two major characteristics. First, even in old age identical and fraternal twins resemble each other in many psychological characteristics not by chance but for both genetic and environmental reasons (Pedersen, et al., 1991; Plomin, 1986). In most cases, markedly higher psychological similarity is observed in identical twins, because they share 100 percent of their genes as compared with fraternal twins who share about 50 percent of their genes.

Second, because twins are involved in their relationship from birth and it is unlikely that other social relationships last as long, a twin relationship can be viewed as a special type of close relationship. In general, the literature on twinship reveals two different relationship patterns (Vandell, 1990). On the one hand, identical twinship is viewed as leading to harmony, whereas fraternal twinship appears similar to the relationship between siblings in general. On the other hand, identical twins in particular are supposed to face a more critical task than others in defining a unique identity, because they may find it more difficult to differentiate themselves from their co-twin.

Only a few studies in the literature have investigated adult twin relationships. From extensive interviews with adult twins, Schave and Ciriello (1983) and Ainslie (1985) attempted to classify different types of twin relationships. Although small sample sizes and other methodological problems do not allow for generalization, these authors agree that the majority of adult twins successfully developed separate identities while maintaining close relationships. It is assumed that relationships between identical twins in adulthood are characterized by higher familiarity (i.e., higher frequencies of contact, higher levels of relationship closeness) than fraternal twins.

Because twinship is a special case, the study of dyadic perception in twins has to take into account their high similarity and familiarity. The nature of

FIGURE 1
Interpersonal perception between twins (lines indicate possible correlations within or between twins).



dyadic perception in twins is therefore basically idiographic (i.e., twins are likely to perceive each other from their own frames and perspectives rather than from comparing themselves and the co-twin with the average person). Given this condition and the possible relations between both dyad members' views of themselves and the other, we can identify different components of dyadic perception: similarity, reciprocity, empathy, and projection (Figure 1).

Similarity

Similarity between twins in perceiving and viewing themselves may derive (i) from actual similarity for genetic and environmental reasons and (ii) from factors caused by their relationship. Similarity for genetic and environmental reasons constitutes a compositional effect in dyadic perception in terms of Kenny (1994), because this kind of similarity is independent of the actual interaction and the relationship between twins. Beyond this, similarity of twins can be enhanced by their relationship, which itself may be differentially characterized by frequencies of contact, specific relationship contents and qualities, and by the distance they live from one another. This similarity has important implications for dyadic perception. The more twins resemble each other with respect to the experience of a dyadic interaction or in self-judgements of traits and states, the more they can utilize these perceptions for understanding their co-twin. In short, similarity can lead to the use of projection in order to improve understanding.

Reciprocity

For the same reasons the twins resemble each other in self-judgements, they may be similar in their co-twin-judgements. In line with Kenny (1994), we call this similarity in co-twin-perception 'dyadic reciprocity'. For example, reciprocity refers to the question: if twin A judges twin B as particularly angry in a given dyadic interaction, is there evidence that twin B judges his co-twin in the same manner? There is evidence that reciprocity occurs in behaviour between interaction partners as well as in the perception of states. In contrast, trait perception is found to be less reciprocal even between well-acquainted persons (Kenny, 1994; Malloy & Albright, 1990). Because of the similarity of twins, reciprocity should also be substantial and not because of chance.

Empathy

Empathy (or understanding) is usually conceptualized in terms of empathic accuracy, and operationalized by the extent to which a twin can predict the self-judgements of his or her co-twin. Regarding twins, it is very probable that empathy increases with similarity and familiarity. Empathic accuracy may be unique or result from the similarity between twins. The portion of empathic accuracy that is caused by similarity can be achieved through using projection. The portion of empathic accuracy that is unique may result from the specific knowledge that both siblings possess about each other as well as from specific experiences they have shared. This portion of empathic accuracy is independent from similarity and cannot be achieved through projection.

Projection

Projection is the extent to which a twin views the co-twin in the way he or she views him- or herself. The operational definition of projection concerns the extent to which a twin's judgement of the co-twin is predicted by his or her own self-judgement. Although the use of the term projection can be complicated by its psychoanalytic connotations, we prefer it to 'assumed similarity' or 'perceived similarity,' as it reflects a process by which dyadic perception in twins might be shaped, that is, ascribing self-perceptions to the co-twin.

Projection is a well-known feature in interpersonal perception and has often been observed in heterosexual couples (e.g., Acitelli et al., 1993, 1997; Levinger & Breedlove, 1966; Sillars et al., 1984, 1994; Thomas et al., 1997). Though there is no doubt about the power and importance of projection, its functions within the context of dyadic perception are not fully understood. Projection can serve at least two functions. On the one hand, projection may support the process of understanding and improve empathic accuracy, on the other, it can lead to the overestimation of similarity.

From significant correlations between outcome measures of empathic accuracy and projection it is frequently assumed that the two processes are

related. Thomas et al. (1997) found a low but significant correlation between females' use of projection (or assumed similarity) and empathic accuracy. However, Cronbach (1955) argued that significant correlations between these components have no psychological meaning because empathic accuracy scores may contain components of projection and vice versa, which lead both measures to be confounded. This argument is of course reasonable when perceivers judge strangers and the degree of similarity between judges and targets is essentially random. However, because twins are similar not in a random but in a systematic way, empathic accuracy and projection are linked by this similarity. A high correlation between empathic accuracy and projection reflects that both are related at the process level: twins can use their similarity as a tool and project their self-perceptions onto their co-twin in order to subsequently improve empathic accuracy.

Beyond projection that is caused by similarity and contributes to accuracy, there exists 'pure' projection that leads to the overestimation of similarity (Hoch, 1987). The utilization of this kind of projection can be motivated by contrast as well as by assimilation effects. Contrast effects emerge in particular when a twin wants to differentiate him- or herself from the co-twin. Consequently, this twin will demonstrate lower levels of projection. On the other hand, if a twin wants to emphasize his or her resemblance to the co-twin, he or she is likely to be prone to assimilation effects that foster an overestimation of similarity and inflate projection. In general, contrast effects are supposed to be more active in dizygotic twins (DZ), whereas assimilation effects are supposed to be stronger in monozygotic twins (MZ) (Saudino, McGuire, Reis, Hetherington, & Plomin, 1995).

In the present investigation we studied dyadic perception between twins by using three different tasks. First, we adapted the idea of the interaction sequence and its continuous rating from the marital interaction paradigm developed by Levenson and Gottman (1983) and Levenson and Ruef (1992). The moment-by-moment rating of the twin's own and the co-twin's emotional states when watching a videotape from a previous interaction allows for the assessment of empathic accuracy. We did not focus exclusively on negative interactions (e.g., conflicts), but were also interested in interactions with a positive emotional quality. This provided us with the opportunity to compare judgements of interaction segments with different emotional valences. Moreover, this study is the first designed to control for unreliability in on-line ratings by obtaining test–retest reliabilities.

Second, the participants ranked Q-sort items in order to judge the intensity of each other's general emotional reactions in a wide range of social situations. The situations varied in their emotional quality and sociality. With respect to the co-twin-judgement, this task can be accomplished by recalling actual behaviour in identical situations or by inferring probable reactions from behaviour in comparable situations.

Third, twins judged each other's personality traits in terms of the 'Big Five' personality traits (Borkenau & Ostendorf, 1993). The perception of personality is expected to rely on knowledge of each other, as personality

includes stable traits that are consistent across a range of situations. Based on their long relationship, twins should know each other very well. Hence, this task focuses on the knowledge-based judgements of traits.

With respect to the co-twin-judgement, the three tasks may be considered to cover a continuum that ranges from very specific to very broad inferences. The emotional sensitivity task assesses ongoing empathic accuracy for actual affect expression that results from observation and relationship-specific knowledge, whereas the judgement of the co-twins' personality traits rests on knowledge about broad behaviour patterns. The judgement of emotional situations is located in between, because it requires knowledge about the co-twin's emotional reactions in general. Whereas the emotional sensitivity task assesses on-line *empathic accuracy* in its narrowest sense, the Q-sort and personality rating can be considered as a measure of *trait perception* (Ickes, 1993). In order to account for this important distinction, we use the term 'accuracy' when we refer to all three measures at the same time.

Given the basic assumption that similarity for genetic and environmental reasons and their unique familiarity have important implications for the dyadic perception of twins, our study was guided by five hypotheses. (i) As a function of their unique similarity and familiarity, we expected accuracy to be substantial and reach higher levels in MZ than DZ twins. (ii) As twins may use their own states and traits as means to infer those of their co-twin, we also expected strong projection. Because the validity of projection as a mechanism of inference should increase with similarity and familiarity, we assumed that MZ twins would display higher levels of projection than DZ twins. (iii) Because of the similarity and familiarity of twins, we hypothesized that projection and accuracy will covary for meaningful rather than artifactual reasons and that this covariation will reach higher levels in MZ than DZ twins. (iv) We expected accuracy to decrease significantly when controlling for the actual similarity in self-judgements. Given the presumed higher similarity of MZ twins, controlled accuracy was expected to decrease more in MZ than DZ twins. (v) Beyond valid projection in the service of accuracy, we expected twins to overestimate their actual similarity. As a consequence, projection should remain substantial even after controlling for similarity. Because of assimilation effects, MZ twins were expected to present higher levels of similarity-controlled projection, whereas DZ twin pairs were expected to be prone to the contrast effect and to show lower levels of similarity-controlled projection.

Method

Participants

The present study was part of the 'Genetic Oriented Life Span Study on Differential Development' (GOLD) conducted at the Max Planck Institute for Psychological Research in Munich (Weinert, 1997). One subsample consisted of 15 twin pairs from a longitudinal project started in 1937, which was now supplemented by 93 other twin pairs of similar age. These other pairs were

recruited through newspaper articles that described the research project and asked twins to contact our research assistants. Participants were invited to visit the Max Planck Institute for five daily sessions and to participate in an extensive psychological test protocol focusing on various psychological issues such as memory, learning and intelligence, moral attitudes, personality and motivation, and social behaviour. The total sample consisted of 108 twin pairs (75 MZ and 33 DZ), 77 of which (71%) were female. Mean age was 71.0 years ($SD = 4.3$). All participants were retired. As indicated by educational status and the most recent professional position, socioeconomic status was nearly normally distributed.

Procedures and measures

Emotional sensitivity task. For the study of emotional sensitivity, an experimental procedure was developed through extensive pre-tests with older couples. This task consisted of three phases: an interview phase, a social interaction phase, and a scaling phase.

In the interview phase, both twins were interviewed separately about positive and negative events that had happened in their relationship during recent years. Both were unaware that results of the interview would be used to select discussion topics in the subsequent interaction phase. Positive events were defined as situations that were enjoyed by both siblings. Negative events were characterized as situations that had caused conflict or arguments between them. Interviewers were instructed to ask for at least three positive and three negative situations. Additionally, twins were asked to rank the situations according to their subjective importance. After the interview, both experimenters compared the interviews for consensually positive and negative situations in order to present them as topics during the subsequent interaction phase. To avoid ceiling effects, which might occur predominantly for negative conflict-laden situations, interviewers were instructed to choose events of moderate emotional intensity.

The subsequent interaction phase took place in the observation lab. Twins were seated on two chairs 1.5 m apart and at 90° angles to each other. They were told that: 'We would like you to discuss some specific topics and videotape your discussion. First, you may discuss any subject, for example, what you have already done today, or how you feel at this moment. After some time, I will contact you via microphone and give instructions on topics for further discussion.' Immediately after the experimenter left the observation room, the video recording was started and the participants had 3 minutes, for free discussion. After 3 minutes the experimenter gave the instruction for the discussion of the negative issue: 'Now I would like to ask you to discuss a situation that had led to conflict between the two of you, namely, [conflict] … Please note that it is not important to explain anything to us, but to talk together and to explain your position to each other.' After 3 minutes, the experimenter again contacted the twins and gave a similar instruction for the positive interaction phase. Three minutes later, the experimenter returned to the observation room and separated the twins for the subsequent scaling phase.

During the scaling phase, twins worked separately in two different but comparably equipped rooms. Twins were made familiar with the use of a scaling lever that had been developed by Vehrs (1986). The lever allows for a continuous rating of emotional intensity by moving it back (0.0) and forth (1.0) against

the tension of a spring, which draws the lever back to a resting position in the middle of the scale (0.5). The lever position was transformed into electric tension, digitized continuously, and stored in a computer using a sampling rate of 9 Hz. In order to provide participants with feedback about their ratings, the actual position of the scaling lever was simultaneously displayed by a row of lights beside the video screen. As an exercise, participants were presented with a short sequence from a movie and asked to rate continuously the emotional state of one character while the experimenter remained in the room.

After this exercise, they were asked to indicate how good and how bad they felt during the videotaped interaction: 'Now, your task is to rate your emotional state for the whole videotaped session. It is very important to accurately rate every positive or negative change in your feelings and to register this using the lever.' Participants were informed that their co-twin would perform this task simultaneously, and that this self-rating task had to be repeated immediately because we were interested in the precision of this rating. The ratings of the twins were synchronized with the vertical time codes of the videotape, thus allowing for a precise comparison of the self and co-twin-judgements of the twins over time.

The self-rating trials were followed by a 30-minute coffee break. Thereafter, the study continued with the remaining co-twin-rating trials. Participants were given the instruction: 'We will show the video another two times. Your task now is to take the perspective of your co-twin, and rate as accurately as possible by moving the lever how he or she felt during the interaction.' Both trials included the rating of the negative and the positive interaction phases.

Q-sort of emotional situations. To assess the possible emotional reactions to social situations, we developed a Q-sort-procedure in pre-tests with older couples. This Q-sort consists of four series of 15 items focusing on social situations that were expected to trigger (i) anger, (ii) happiness, (iii) pride, and (iv) embarrassment. In order to cover a wide range of situations, each set included five social situations with friends, acquaintances and groups, respectively. Twins were separately interviewed using this Q-sort set and given the instruction: 'We would like to know how you and your co-twin feel in specific situations.' First, each series of 15 items had to be sorted into three blocks of social situations eliciting strong, moderate and weak emotions, respectively. Then the five items in each block were ranked according to the subjective strength of emotion. The aim of the Q-sort procedure was to bring all 15 items into an ipsative rank order. When twins had finished Q-sort ratings of all four series for their own emotional reactions, they were instructed to repeat the sorting procedure from the perspective of their co-twin. Again, they were told that their co-twin would perform the same task. A subsample of 47 pairs repeated the full Q-sort procedure 2 days later in order to check reliability.

Big Five profiles. At the end of their visit to the Max Planck Institute, the twins received a series of questionnaires to work on at home, when they were again separated from each other. They were asked to send the questionnaires back by mail during the 7 days following their visit to the Institute. Among these was the German version of the NEO-FFI (Borkenau & Ostendorf, 1993), which served as the measure for self-judgement and co-twin-judgement on the personality traits. The questionnaire concerning the self-judgement consisted of the original NEO-FFI items. The questionnaire on the co-twin-judgement included the same items, which were reformulated for the co-twin perspective

(e.g., 'My co-twin is not easily worried' versus 'I am not easily worried'). Because the test–retest reliability of the scales has been found to be approximately $r = .80$ over a 2-year-period (Borkenau & Ostendorf, 1993), we did not ask participants to perform this task twice. However, internal consistencies of the subscales for the self-judgement were satisfactory ($\alpha = .80$ for neuroticism, $\alpha = .75$ for extraversion, $\alpha = .62$ for openness, $\alpha = .69$ for agreeableness and $\alpha = .81$ for conscientiousness). The internal consistencies of the co-twin-judgements tended to be slightly higher ($\alpha = .82$ for neuroticism, $\alpha = .73$ for extraversion, $\alpha = .69$ for openness, $\alpha = .82$ for agreeableness and $\alpha = .85$ for conscientiousness).

Relationship measures. A modified 6-item-version of the Relationship Assessment Scale was given to participants to assess relationship satisfaction (Hendrick, 1988). Items were reformulated with respect to the co-twin (e.g., 'How positive is this relationship as compared with others?'). The internal consistency was high ($\alpha = .93$), and relationship satisfaction was highly interdependent between twins ($ICC = .56$, $p < .001$). Frequency of contact was measured by a single item (1 '*daily*' to 7 '*very rarely*'). Whereas frequency of contact did not differ between MZ and DZ twins, MZ twins scored higher in relationship satisfaction ($t(106) = 2.07$, $p < .05$).

Results

Emotional sensitivity task

Idiographic analyses of the rating profiles included the following steps: aggregating data sequences, examining and correcting data for autocorrelation by univariate time-series analyses, testing test–retest reliabilities, and computing indices of dyadic perception by averaging and correlating judgement profiles.

Raw score means were computed for each 5-second-period during the rating procedure, yielding a series of 36 aggregated data points for each interaction phase. Then, the data series were corrected for autocorrelation. Autocorrelation means that there is some statistical dependency between past and current values. This dependency may lead to inflation of correlation coefficients and change confidence intervals, and therefore has to be removed (Gottman, 1981).

For each participant, reliability scores were computed by Pearson correlations between rating profiles of each rating trial. To compute indices of dyadic perception, the standardized residuals of ratings from the first and second scaling trial (after removing autocorrelation) were averaged. Based on these aggregated self- and co-twin-ratings, we computed idiographic correlations representing similarity, reciprocity, empathic accuracy, and projection as shown in Figure 1. After Fisher's *r*-to-*Z*-transformation, the emerging individual-level correlations indicating empathic accuracy, projection, and reliability were tested for statistical interdependence. Intraclass correlations displayed clear interdependencies for empathic accuracy in both the negative interaction ($ICC = .34$, $p < .01$) and the positive interaction phase ($ICC = .81$, $p < .001$), and lower interdependencies for projection in both the negative ($ICC = .26$, $p < .01$) and the positive interaction phase ($ICC = .56$, $p < .001$). Even reliabilities appeared to be interdependent between twins for self as well as co-twin-judgements (ICCs $> .41$, ps $< .001$). MZ and DZ pairs did not differ in these

interdependencies, and individual correlations were averaged across dyad members (Griffin & Gonzalez, 1995; Kenny, 1988).

Correlations between dyadic scores of empathic accuracy and projection were $r = .63$ ($p < .001$) for MZ and $r = .73$ ($p < .001$) for DZ twins in ratings of the negative interaction and $r = .88$ ($p < .001$) for MZ and $r = .80$ ($p < .001$) for DZ twins in ratings of the positive interaction phase. These correlations did not differ between MZ and DZ twins, thus indicating that empathic accuracy and projection were correlated to the same extent in MZ and DZ twins. A mediation analysis revealed that similarity predicted the empathic accuracy in both the negative and positive interaction phase (mean b = .72, *ps* < .001). These effects were partially mediated by projection, in that the effect of similiarity on empathic accuracy was significantly reduced when projection was controlled (mean reduction of b = .23, *Z*s > 4.2, *ps* < .001) (Baron & Kenny, 1986; Kenny, Kashy, & Bolger, 1998). Thus raw empathic accuracy was in part achieved by projection, and required that raw measures be controlled for each other.

To disentangle these effects within dyads, we used a modified version of Wackman's (1973) method of partialling similarity from empathic accuracy, and performed idiographic multiple regression analyses in which the judge's co-twin-perception was predicted simultaneously by the co-twin's self-perception (reflecting empathic accuracy) and the judge's self-perception (reflecting projection). The weight of each predictor was computed controlling for the contribution of the other. We interpret the beta for the co-twin's self-perception as *projection-controlled empathic accuracy* because this measure reflects the portion of empathic accuracy that is not obtained by projection. The beta for the judge's self-perception represents *similarity-controlled projection*, because it reflects the portion of projection that is not caused by similarity. Table 1 shows the results.

First, Table 1 displays mean intrapair test–retest reliabilities for self- and co-twin-ratings. Second, mean indices of interpersonal perception are presented, including the mean reliability of the self- and co-twin-ratings, and the mean idiographic correlations, which reflect levels of similarity, reciprocity, raw empathic accuracy and raw projection. Finally, indices of projection-controlled empathic accuracy and similarity-controlled projection are shown.

All interpersonal perception indices (including reliabilities) were significantly larger for positive interaction ratings (*t*s(106) > 6.0, *p*s < .001). A simple explanation for this finding may be that there was more variation in the positive judgement profiles (*SD* = .20) than in the negative (*SD* = .15). Additionally, within each interaction phase, the co-twin-judgements seemed more reliable than the self-judgements (*t*s(106) > 4.40, *p*s < .001). MZ and DZ pairs did not differ in reliabilities of self- and co-twin judgements.

As Table 1 indicates, projection was strong in both interaction phases and approached the level of mean reliability. Moreover, projection was significantly higher than similarity, reciprocity and empathic accuracy. Empathic accuracy did not significantly exceed reciprocity, and similarity in either interaction phase. Although MZ and DZ twins did not differ with respect to the observed pattern of dyadic perception, they tended to differ to some extent in their levels of dyadic perception scores. However, only reciprocity in ratings of the positive interaction phase yielded significant zygosity differences ($t(106) = 2.02$, $p < .05$).

The control for similarity led to a significant decrease in empathic accuracy

in both MZ (ts(74) > 6.7, ps < .001) as well as DZ twins (ts(32) > 3.5, ps < .01). However, projection-controlled empathic accuracy remained significantly different from zero in MZ (ts(74) > 7.99, ps < .001) as well as in DZ twins (ts(32) > 7.10, ps < .001). Similarly, the similarity-controlled projection decreased significantly in both MZ (ts(74) > 6.1, ps < .001) and DZ twins (ts(74) > 3.7, ps < .001), reflecting that raw projection was to a substantial extent justified by real similarity. Similarity-controlled projection, however, was still substantial and higher than projection-controlled empathic accuracy in MZ (ts(74) > 3.08, ps < .01) as well as in DZ twins (ts(32) > 2.36, ps < .05). Zygosity differences in controlled empathic accuracy and projection were non-significant, and indicated that both groups were equally inclined to overestimate their similarity.

We did not expect that judgements would be influenced by stereotypes in the sense of Cronbach (1955), and tested similarities between the individual rating profiles through polynomial contrasts in the mean rating profile across all participants. We observed similarities between participants' ratings exclusively for the positive interaction phase: the mean rating profile revealed a sudden increase in the positive emotional state, which gradually decreased until the end of interaction. We controlled for stereotypes in each phase by additional analyses: individual rating scores were subtracted from the mean ratings across the sample (Kenny & Acitelli, 1994). In general, this procedure led to a slight decrease in dyadic perception scores. The observed pattern, however, was highly similar to the pattern reported in Table 1.

TABLE 1
Dyadic perception between twins in the emotional sensitivity task

	Negative interaction			*Positive interaction*		
N	**MZ 75**	**DZ 33**	**Total 108**	**MZ 75**	**DZ 33**	**Total 108**
Reliability						
Test–retest reliability of self-judgement	.40	.38	.39	.68	.65	.67
Test–retest reliability of co-twin-judgement	.57	.50	.55	.76	.70	.74
Indices of dyadic perception						
Mean reliability	$.49_{b}$	$.44_{b}$	$.48_{b}$	$.72_{ab}$	$.68_{b}$	$.71_{b}$
Similarity	$.29_{a}$	$.25_{a}$	$.28_{a}$	$.62_{a}$	$.55_{a}$	$.60_{a}$
Reciprocity	$.27_{a}$	$.20_{a}$	$.25_{a}$	$.66_{a}$	$.50_{a}$	$.62_{a}$
Raw empathic accuracy	$.32_{a}$	$.29_{a}$	$.31_{a}$	$.68_{a}$	$.56_{a}$	$.65_{a}$
Raw projection	$.42_{b}$	$.40_{b}$	$.42_{b}$	$.74_{b}$	$.67_{b}$	$.72_{b}$
Corrected indices						
Projection-controlled empathic accuracy	.19	.17	.18	.31	.28	.30
Similarity-controlled projection	.29	.29	.29	.42	.42	.42

Note: Indices of reliability and dyadic perception are means of intrapair correlations computed using Fisher's r-to-Z transformation. Corrected indices of empathic accuracy and projection are standardized betas from regression analyses. Differences among dyadic perception indices were tested by paired t-tests. Dyadic perception indices sharing the same subscript in a given column did not differ significantly (Bonferroni corrected $p > .005$).

Q-sort ratings of emotional situations

As in the emotional sensitivity task, rating profiles of self- and co-twin sortings were correlated within each pair. Dyadic perception indices were again transformed by Fisher's *r*-to-*Z*-transformation. Test–retest reliabilities were satisfactory in a subsample of 47 pairs who repeated the full Q-sort procedure 2 days later. Reliabilities of self- and co-twin-judgements did not differ significantly, with the exception of the Q-sort on anger ($t(46) = 2.34$, $p < .05$).

Individual-level dyadic perception indices appeared to be interdependent within dyads (ranging from $ICC = .24$ to $ICC = .45$, $ps < .01$), except the accuracy for the happiness-triggering situations ($ICC = .13$, ns). These interdependencies did not differ between MZ and DZ pairs and individual scores were again averaged across dyads. Table 2 presents the indices of dyadic perception.

The results show the same picture as for the emotional sensitivity task: the dyadic perception of each of the four Q-sets was primarily based on projection. Moreover, in Q-sorts on anger, pride, and embarrassment, projection was not significantly different from the mean reliability but was significantly higher than accuracy, which itself approached scores of similarity and reciprocity. In the Q-sort on happiness, mean reliability was higher than projection, although projection still significantly exceeded similarity, reciprocity, and accuracy.

Correlations between dyadic scores of unadjusted accuracy and projection were significant ($ps < .001$) for each emotional situation. Higher MZ correlations were observed only for happiness ($r = .52$ versus $r = .20$) and pride ($r = .55$ versus $r = .19$) ($Zs > 1.72$, $ps < .05$), but not for anger ($r = .60$ versus $r = .58$) and embarrassment ($r = .42$ versus $r = .46$). Additional mediational analyses provided evidence that projection partially mediated the effect of similarity on accuracy. In each of the Q-sort tasks, accuracy was significantly predicted by similarity (mean $b = .58$ $ps < .001$). These effects were significantly reduced when projection was controlled (mean reduction of $b = .09$, $Zs > 2.0$, $ps < .05$). These results indicated again the need for the idiographic correction of accuracy and projection.

After controlling for similarity, accuracy decreased significantly in MZ ($ts(74) > 7.1$, $ps < .001$) and DZ ($ts(32) > 2.80$, $ps < .01$) twins, thus showing that projection had improved accuracy to a substantial extent. Similarly, raw projection was to a large extent attributable to similarity, as could be observed by the significant decrease in similarity-controlled projection in MZ ($ts(75) > 7.8$, $ps < .001$) and in DZ twins ($ts(32) > 4.7$, $ps < .001$). Scores of similarity-controlled projection remained significantly higher than scores of projection-controlled accuracy in MZ ($ts(74) > 8.79$, $ps < .001$) and DZ twins ($ts(32) > 3.86$, $ps < .001$), and highlighted again the overestimation of real similarity in both groups. This pattern was observed in both MZ and DZ twins. Compared with MZ pairs, DZ pairs again tended to have lower scores in similarity, reciprocity, raw accuracy, and raw projection, and in indices of controlled accuracy and projection. Contrary to expectations, none of these differences was significant.

Because stereotypes could have influenced self- and co-twin-sortings and inflated correlations, we looked for a 'stereotype' rank order of emotional situations for each of the Q-sort sets, and again used the subtraction method. This procedure decreased dyadic perception indices, but did not change the observed pattern, which was highly similar to the pattern reported in Table 2.

TABLE 2
Dyadic perception between twins in Q-sort on emotion situations

	Anger			Happiness			Pride			Embarrassment		
N	**MZ 75**	**DZ 33**	**Total 108**	**MZ 75**	**DZ 33**	**Total 108**	**MZ 75**	**DZ 33**	**Total 108**	**MZ 75**	**DZ 33**	**Total 108**
Reliability												
Test–retest reliability of self-judgement	.62	.67	.64	.56	.65	.60	.51	.58	.54	.53	.57	.55
Test–retest reliability of co-twin-judgement	.51	.62	.56	.54	.56	.55	.46	.50	.47	.51	.54	.52
Indices of dyadic perception												
Mean reliability	$.57_{b}$	$.65_{b}$	$.60_{b}$	$.55_{b}$	.61	.57	$.49_{b}$	$.54_{b}$	$.51_{b}$	$.51_{b}$	$.55_{b}$	$.53_{b}$
Similarity	$.44_{a}$	$.38_{a}$	$.43_{a}$	$.28_{a}$	$.22_{a}$	$.26_{a}$	$.36_{c}$	$.23_{a}$	$.33_{a}$	$.38_{a}$	$.28_{a}$	$.35_{a}$
Reciprocity	$.41_{a}$	$.36_{a}$	$.39_{a}$	$.29_{a}$	$.15_{a}$	$.25_{a}$	$.31_{ac}$	$.22_{a}$	$.28_{a}$	$.28_{a}$	$.21_{a}$	.26
Raw empathic accuracy	$.39_{a}$	$.37_{a}$	$.39_{a}$	$.24_{a}$	$.19_{a}$	$.23_{a}$	$.27_{a}$	$.28_{a}$	$.27_{a}$	$.32_{a}$	$.28_{a}$	$.31_{a}$
Raw projection	$.65_{b}$	$.61_{b}$	$.64_{b}$	$.49_{b}$	.41	.47	$.55_{b}$	$.51_{b}$	$.54_{b}$	$.62_{b}$	$.52_{b}$	$.59_{b}$
Corrected indices												
Projection-controlled empathic accuracy	.12	.16	.13	.10	.10	.10	.10	.14	.11	.10	.13	.11
Similarity-controlled projection	.53	.50	.52	.40	.35	.39	.44	.43	.44	.50	.44	.48

Note: Indices of reliability and dyadic perception are computed means of intrapair correlations using Fisher's *r*-to-*Z* transformation. Indices of controlled accuracy and controlled projection are standardized betas from regression analyses. Differences among dyadic perception indices were tested by paired *t*-tests. Dyadic perception indices sharing the same subscript in a given column did not differ significantly (Bonferroni corrected $p > .005$).

Big Five profiles

For idiographic analyses of the judgements on the self's and the co-twin's Big Five scales, non-redundant personality rating profiles had to be generated from which potential response set effects were removed. We compiled profiles of self- and co-twin-judgements by using a method suggested by Kraemer (1984).

First, all items per scale were scored consistently to guarantee that inter-item correlations were positive within each profile and measured socially desirable traits. In particular, items on the Neuroticism scale were reverse-coded, thus representing emotional stability. We then carefully analysed items. To avoid content overlap of items within each profile, which could give rise to collinearity problems and subsequent loss of power, redundant items had to be eliminated. Removing redundant items does not necessarily imply discarding information. On the contrary, it removes repetition and minimizes measurement error in intraindividual analyses. Content overlap was examined by the interindividual correlations between items: for each scale, the five items showing the highest interitem correlations were eliminated, leaving seven items for each scale and thus 35 items for the profiles of self- and co-twin-ratings of personality.

We computed intraclass correlations between self- and co-twin-ratings of the Big Five profiles in order to control for mean differences within twin dyads. These idiographic intraclass correlations served as measures of the different components of trait perception. Dyadic scores of projection and accuracy were highly correlated in MZ ($r = .61$, $p < .001$) and DZ twins ($r = .41$, $p < .001$). The difference in correlations was not significant. The similarity in self-judgements significantly predicted accuracy ($b = .70$, $p < .001$). This effect was significantly reduced when projection was controlled for (reduction in $b = .13$, $Z = 2.8$, $p < .001$). Thus, again, projection appeared successful in improving accuracy. Table 3 presents the results.

TABLE 3
Interpersonal perception of Big Five profiles

	MZ	DZ	Total
N	**75**	**33**	**108**
Indices of dyadic perception			
Similarity	$.48_{a}$	$.40_{a}$	$.46_{a}$
Reciprocity	$.57_{b}$	$.41_{a}$	$.53_{ab}$
Raw accuracy	$.48_{a}$	$.50_{a}$	$.48_{ab}$
Raw projection	$.56_{b}$	$.48_{a}$	$.53_{b}$
Corrected indices			
Projection-controlled empathic accuracy	.28	$.33_{c}$	.29
Similarity-controlled projection	.38	$.31_{c}$	.36

Note: Indices of dyadic perception are computed means of intraclass correlations, using Fisher's *r*-to-*Z* transformation. Indices of controlled accuracy and controlled projection are average betas from regression analyses. Differences among dyadic perception indices were tested by paired *t*-tests. Dyadic perception indices sharing the same subscript in a given column did not differ significantly (Bonferroni corrected $p > .008$).
Indices of controlled accuracy and controlled projection sharing the same subscripts in a given column did not differ significantly by paired *t*-tests ($p > .05$).

A similar picture as found in the foregoing tasks emerged: projection was strong and significantly higher than similarity. Although projection did not significantly exceed accuracy and reciprocity, projection appeared again to play an important role in the dyadic perception of enduring personality traits. This basic pattern was, however, not consistently found in MZ and DZ twins. Whereas projection was significantly higher than similarity and accuracy in MZ twins, it did not exceed the other dyadic perception measures in DZ twins. Projection-controlled accuracy and similarity-controlled projection were significantly lower than the raw measures in both MZ (ts(74) > 11.6, ps $< .001$) and DZ twins (ts(32) > 4.1, ps $< .001$). These results show that projection again improved the observed accuracy, though there was still pure projection. In contrast with MZ twins, the controlled measures did not differ significantly in DZ twins. We again performed the correlational analyses with rating profiles that had been corrected for a possible stereotype by the subtraction method and observed a decrease in the correlations. The resulting pattern, however, fully confirmed the previously observed pattern of interpersonal perception.

With the exception of reciprocity ($t(106) = 2.08$, $p < .05$), no zygosity differences appeared. That similarity in self-judgements did not differ between MZ and DZ twins seems to contradict results from behaviour genetic research suggesting higher similarity of MZ twins than DZ twins. We checked the intraclass correlations for each of the original Big Five scales and observed zygosity differences that led to a mean heritability estimation of about $h^2 = .50$. This estimate is consistent with results from numerous twin studies (e.g., McCartney, Harris, & Bernieri, 1990). However, the computation of profiles by using the Kraemer method led to a restricted variance of self-judgements (.26 versus .50 mean variance of the Big Five scales). Although strong zygosity differences appeared by the traditional variable-centred approach, the profiling procedure within our person-centred approach may have reduced the genetic variance, thus diminishing zygosity differences.

Individual differences

From a general perspective, the mean differences observed consistently in each of the three tasks provide strong evidence for a basic pattern of dyadic perception that was common to most twins. The fundamentally different question of consistent individual differences in the ability to accurately perceive the co-twin or to use projection was studied by the intercorrelations between the raw measures of accuracy and projection (see Table 4).

The intercorrelations were computed by using the pairwise correlational approach developed by Griffin and Gonzalez (1995). The correlations were tested by Z-tests that account for their dyadic interdependence, and then corrected for Type I error. Low intercorrelations between raw accuracy measures provided no evidence for consistent individual differences in accuracy. Measures of raw projection were, however, significantly correlated within the more trait-oriented dyadic perception tasks (i.e., Q-sort and personality judgement) and within both profiles of the emotional sensitivity task. Considered as a scale, raw projection in the four Q-sorts and the personality judgement showed a moderate internal consistency ($\alpha = .74$), whereas the internal consistency of raw projection in the emotional sensitivity task was not satisfactory ($\alpha = .43$), which was mainly because of the small number of situations.

The accuracy measures were largely independent of relationship measures, with the exception of accuracy in personality judgements that were significantly

TABLE 4 Pairwise overall intercorrelations between raw accuracy measures and raw projection measures

			1	2	3	4	5	6	7
Q-Sort	Anger	1		.34**	.49**	.40**	.36**	.15	.17
	Happiness	2	.06		.39**	.31**	.32**	.06	−.08
	Pride	3	.22	.11		.38**	.36**	.05	.14
	Embarrassment	4	.22	.04	.15		.31**	.06	.10
Personality		5	.26	.11	.12	.14		.18	.09
Emotional	Negative interaction	6	.13	−.01	−.11	.00	.06		.27**
sensitivity task	Positive interaction	7	.06	−.07	.08	.14	.09	.17	

Note: Values above the diagonal represent intercorrelations between raw projection measures; values below the diagonal represent intercorrelations between measures of raw (empathic) accuracy. Intercorrelations were computed according to the pairwise dyadic approach and tested by *Z*-tests accounting for the within-dyad interdependence of measures (Griffin & Gonzalez, 1995). Significance levels of correlations were corrected for Type-I error using a multistep Bonferroni test proposed by Larzelere and Mulaik (1977);
(**$p < .01$).

correlated with frequency of contact ($r = .19$, $p < .05$) and relationship satisfaction ($r = .34$, $p < .01$). Relationship satisfaction was also related to projection in personality judgements ($r = .42$, $p < .001$), but not to projection in other domains.

Discussion

The overall findings of the present study suggest a basic pattern of dyadic perception: the accuracy of the twins did not exceed their similarity and reciprocal perception, whereas projection was significantly larger and came close to the reliability of measures. This pattern was observed consistently across different tasks and was found, with one exception, for MZ as well as for DZ twin pairs. Thus far, this study replicated for the case of older twins a pattern that has been often observed in studies of heterosexual partners. However, the observed pattern appeared much stronger for twins than it has been observed for other close relationships (e.g., Acitelli et al., 1993, 1997; Levinger & Breedlove, 1966; Sillars et al., 1984, 1994; Thomas et al., 1997).

What was new about the present study was the implementation of a twin design for the study of dyadic perception by three different tasks that covered a continuum from specific on-line empathic accuracy to the broader level of trait accuracy. Projection emerged as a heuristic strategy rather than as an incidental by-product of pure egocentrism, and was in part caused by a reasonable comparison between the judge and his or her co-twin. In light of these findings, Cronbach's (1955) critique on the artifactual nature of projection has to be revised, because it does not apply to judgements of people who are very similar. Because of the similarity of the twins, projection appeared as a necessary determinant of accuracy and not as a statistical artifact. Twins were also consistent in their use of this heuristic for the same target (at least for trait-oriented judgements). However, overestimating their actual similarity led the twins to use projection more than was objectively warranted.

Dyadic perception in the case of older twins

As stated by hypotheses 1 and 2, twins achieved significant levels of accuracy and projection in all three tasks. Surprisingly, raw projection was so strong that it came close to the reliability of measures in the emotional sensitivity task as well as in all four Q-sorts, whereas raw accuracy did not exceed similarity in the self-judgements. This suggests that all participants made nearly the same or very similar ratings when taking the perspective of themselves and their co-twin. These maximal levels of projection included both 'valid' projection serving accuracy and 'pure' projection that led to the overestimation of similarity (Hoch, 1987; Thomas & Fletcher, 1997).

Consequently, hypothesis 3, which claims a substantial covariation between raw accuracy and raw projection scores, was supported. Because

similarity in self-judgements was substantial, a beyond-chance level of covariation was not surprising. However, the level at which this hypothesis was confirmed cannot be explained by a statistical artifact. As a function of similarity, a high significant covariation between both dyadic perception components was found consistently across all three tasks and both groups. In a comparable study of on-line accuracy and projection in younger couples, Thomas et al. (1997) observed a smaller but also significant correlation in female but not male partners. Further mediation analyses revealed that projection partially mediated the effect of similarity on accuracy in each of the three tasks. These mediation effects suggest a causal process of dyadic perception that lead twins to improve accuracy by using projection, because they are so similar.

Hypothesis 4 focused on the specific contribution of similarity to the accuracy in twins. We performed idiographic regression analyses and corrected accuracy in order to determine the unique portion of accuracy that was independent from the similarity and thus not achieved by projection. The projection-controlled accuracy was substantial and not higher in MZ than in DZ pairs. We can conclude that, in dyadic perception between twins, projection is a necessary but not a sufficient source of accuracy.

Hypothesis 5 concerned similarity-controlled projection, which is the portion of projection that is not justified by real similarity. Consistently across the three tasks, twins overestimated their real similarity to a large extent, and MZ and DZ twins did not differ in how much they were motivated to exaggerate the degree of their similarity. With the exception of personality judgements of DZ twins, for both MZ and DZ twins, similarity-controlled projection was significantly higher than projection-controlled accuracy. Thus both groups were prone to assimilation effects rather than to contrast effects.

Although our hypotheses on twin similarity and familiarity had suggested substantial zygosity differences, MZ and DZ twin pairs achieved comparable levels of accuracy and projection. The crucial point seems that consistently across the three tasks MZ and DZ twins did not differ in the similarity of self-judgements, although numerous twin studies have shown that even in old age MZ twins are more similar in many psychological characteristics than DZ twins (e.g., Pedersen et al., 1991; Plomin, 1986). This null result may give rise to a suspicion of selection effects caused by sampling error that may have diminished zygosity differences. Fortunately, this suspicion can be ruled out by measures of the twin relationship and by a heritability estimation of the Big Five scales.

Whereas MZ and DZ twins did not differ in how frequently they were in contact with each other, MZ twins scored significantly higher in relationship satisfaction. These results show that some features of the twin relationship were equivalent for MZ and DZ pairs, while others were different, and replicate some established findings of adult twin relationships (Vandell, 1990). Therefore, the differential familiarity of MZ and DZ twins appeared not to be seriously questioned.

We also checked the similarity of the twins with regard to the Big Five

and calculated heritability estimates for each scale. Because the mean heritability of about 50 percent was consistent with those from numerous twin studies (McCartney et al., 1990), genetically based differences in this twin sample were not biased. The results regarding the Big Five scales, however, seem to contradict the present null findings from the analysis of personality profiles. As far as we know this is the first study of personality resemblance that used an idiographic approach, whereas all previous twin studies rely on the traditional nomothetic approach. It was shown that the computation of profiles according to the method suggested by Kraemer (1984) led to a restricted variance in self-judgements. This profiling procedure may have reduced the genetic variance and thus diminished zygosity differences. Instead of being related to genetic similarity, however, accuracy and projection in personality judgement were positively correlated with frequency of contact and relationship satisfaction of the twins. In other words, the personality perception was more related to differences in the twin relationship than to genetic differences.

The emotional sensitivity task and the Q-sorts on emotional situations are different from the personality judgements because they do not focus on each other's stable traits but on social behaviour either in a very specific situation or in a general fashion. There is some empirical evidence that the variation in social characteristics, such as, for example, love styles, is not related to genetic differences but rather to environmental factors (Waller & Shaver, 1994). This may be because social behaviour is basically relational and may be learned from actual social interactions (e.g., with the co-twin). We therefore suggest that shared experiences, not shared genes, account for the similarities in these measures.

Another reason for the absence of zygosity differences may be that accuracy was not caused by psychological similarity in a broader sense. Instead, accuracy could be related to the knowledge the twins possessed about each other. Because older MZ and DZ twins had both been known to each other since birth and even now showed comparable frequencies of contact, both were likely to have accumulated rich knowledge about their co-twin. Given the dyadic perception tasks of the present study, both MZ and DZ probably possessed more relationship-specific knowledge than was necessary to draw conclusions about each other. In line with this reasoning, Stinson and Ickes (1992) emphasized the importance of relationship-specific knowledge rather than psychological similarity. From the study of accuracy in strangers and friends, these authors found that friends achieved higher levels of accuracy, not because they were more similar than strangers, but because they had more relevant information about each other.

Dyadic perception in different tasks

Dyadic perception was studied from an idiographic approach and by using three different tasks. Following a distinction suggested by Ickes (1993), the emotional sensitivity task assesses on-line empathic accuracy, whereas the Q-sort task and the personality judgement focus on the accuracy regarding social behaviour in general, as well as enduring and stable dispositions.

Accuracy in Q-sort rankings and personality judgements were defined in terms of self–other agreement, although this criterion has often been critically discussed, because self-judgements may not be accurate in the first place and alternative criteria such as others' judgements or behavioural ratings may be more valid (e.g., Kenny & Acitelli, 1994). We believe, however, that the idiographic correlational approach (after the compilation of personality judgement profiles) can avoid at least some of these flaws. Apart from methodological considerations, we feel that the nature of dyadic perception between close associates (such as twins) is basically idiographic (i.e., the dyad members' everyday perceptions of each other are typically made from their own frames and perspectives rather than by comparing the perceptions and evaluations of different people).

Our adaptation of the emotional sensitivity task extended the experimental paradigm of accuracy used by Ickes (1993) and by Levenson and Ruef (1992): test–retest data were provided, interactions of different emotional quality were included, and the perspective of dyadic perception was broadened with respect to the concepts of similarity-controlled projection and projection-controlled empathic accuracy. Self and co-twin ratings in the emotional sensitivity task showed moderate reliability. That the reliability of the co-twin ratings was significantly higher than those of the self-ratings may be because people are accustomed to observing others in order to infer internal states. In contrast, observing oneself on a videotape and judging one's own states may have been unusual to our older participants, which resulted in lower reliabilities. With regard to the Q-sorts, the satisfactory reliabilities of self- and co-twin-judgements did not differ significantly (with one exception), because both judgements focus on their social behaviour in general rather than on a specific interaction. The results on the Q-sort are consistent with the findings of the emotional sensitivity task and confirm the previously observed pattern of dyadic perception.

In the dyadic perception of personality traits, the observed pattern was limited to MZ twins: in DZ twin pairs, projection was not stronger than accuracy. However, because levels of projection were still significant in DZ twins and did not differ significantly from accuracy, these data provide strong evidence that DZ twins also rely to a large extent on self-knowledge when judging the personality of their co-twin. Because DZ twins did not differ in levels of similarity-controlled projection and projection-controlled accuracy, it can be concluded that, at least in personality perception, the DZ twins were somewhat less prone to assimilation effects than were MZ twins.

Because the three tasks were designed to obtain accuracy in different domains, it was not surprising that accuracy measures were not consistently correlated across these tasks, indicating that accuracy is a highly domain-specific construct. In contrast, the raw projection scores were significantly correlated within the four Q-sort tasks and the personality judgements, as well as between both the negative and positive judgement profiles of the emotional sensitivity task. These intercorrelations suggest that there may be consistent individual differences in the tendency to use projection in dyadic perception.

This finding highlights again that projection can be understood as a reasonable heuristic that is used consistently within specific domains of dyadic perception. The moderate consistency in projection also seems reasonable, because projection is logically based on self-perception and self-knowledge, which are always accessible and retrievable for the perceiver. In contrast, accuracy seems to require differential competencies for each task: persons who are accurate in trait perception may not do well in the perception of emotions, and persons who are accurate in encoding positive emotions may not do a good job when they are confronted with negative emotions.

To our knowledge this study is the first that has investigated dyadic perception in twins. In contrast to twins, dyads of genetically unrelated but emotionally related persons (e.g., older couples) are also characterized by high levels of interdependence that makes them similar in certain traits (see Caspi, Herbener, & Ozer, 1992). It would be interesting to find out how and to what extent the utilization of projection by these dyad members improves accuracy, and how this process is related to the development of special features of their relationship (e.g., commitment, conflict, satisfaction). A developmental approach to dyadic perception in other close relationships will permit new insights into the relationship between empathic accuracy and projection.

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