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Influence of warmth and competence on the promotion of safe in-group selection: Stereotype content model and social categorization of faces

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Categorizing an individual as a friend or foe plays a pivotal role in navigating the social world. According to the stereotype content model (SCM), social perception relies on two fundamental dimensions, warmth and competence, which allow us to process the intentions of others and their ability to enact those intentions, respectively. Social cognition research indicates that, in categorization tasks, people tend to classify other individuals as more likely to belong to the out-group than the in-group (*in-group overexclusion effect,* IOE) when lacking diagnostic information, probably with the aim of protecting in-group integrity. Here, we explored the role of warmth and competence in group-membership decisions by testing 62 participants in a social-categorization task consisting of 150 neutral faces. We assessed whether (a) warmth and competence ratings could predict the in-group/out-group categorization, and (b) the reliance on these two dimensions differed in low-IOE versus high-IOE participants. Data showed that high ratings of warmth and competence were necessary to categorize a face as in-group. Moreover, while low-IOE participants relied on warmth, high-IOE participants relied on competence. This finding suggests that the proneness to include/exclude unknown identities in/from one's own in-group is related to individual differences in the reliance on SCM social dimensions. Furthermore, the primacy of the warmth effect seems not to represent a universal phenomenon adopted in the context of social evaluation.

Keywords: Social inference process; Social categorization task; Stereotype content model (SCM); In-group overexclusion effect (IOE); Uncertainty.

Categorization decisions play a pervasive role in social life and are shaped by evolutionary pressures. All social animals must be able to distinguish between friend and foe (i.e., to detect coalitional affiliations) via inferential circuits designed to automatically encode others on the basis of several

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dimensions (e.g., sex, age, race; Cosmides, Tooby, & Kurzban, 2003). Further, both nonhuman primates and preverbal infants are strikingly able to process the social world by evaluating individuals not only during one-on-one interactions (Melis, Hare, & Tomasello, 2006), but also during interactions in which other individuals are present but do not play an active role—that is, third-party indirect interactions (Anderson, Kuroshima, Takimoto, & Fujita, 2013; Hamlin, Wynn, & Bloom, 2007).

Social cognition research (Fiske, Cuddy, & Glick, 2007; Judd, James-Hawkins, Yzerbyt, & Kashima, 2005; Wojciszke, 2005) has defined two fundamental dimensions of social perception—warmth (W) and competence (C)—predicted by perceived interdependence and status, respectively. Warmth and competence represent basic diagnostic dimensions for forming impressions or interpreting behaviour of other individuals. In particular, warmth and competence predict (a) conspecifics' intentions and (b) their ability to enact those intentions, respectively. The warmth dimension captures traits that are related to perceived intent (e.g., friendliness, liking, helpfulness, sincerity, trustworthiness, and morality), while the competence dimension reflects traits that are associated with perceived ability (e.g., intelligence, skill, creativity, respect, and efficacy; Cuddy, Fiske, & Glick, 2008). Together, these two dimensions are able to explain up to 80% of the variance in social perception (Wojciszke, Bazinska, & Jaworski, 1998), at both the individual and the group level. Curiously, warmth and competence are often positively correlated at the individual level (e.g., a friend is a person that is both warm and competent), while they are often negatively related at group domain level (e.g., group stereotypes: Germans are cold and efficient; Fiske, Xu, Cuddy, & Glick, 1999; Yzerbyt, Provost, & Corneille, 2005). The stereotype content model (SCM; Fiske, Cuddy, Glick, & Xu, 2002) subsequently affirms that intergroup stereotypes can be predicted by crossing perceived interdependence (cooperative–competitive) and socioeconomic status (high–low). Specifically, different combinations of these perceived dimensions predict four different group locations on the warmth–competence stereotype map, generating distinct emotional–behavioural consequences (Cuddy, Fiske, & Glick, 2007): high W–high C (admired groups, like the in-group and the aspirational groups); low W–high C (envied groups, like Asians, Jews, and rich people); high W–low C (paternalized groups, like elderly and disabled); low W–low C (derogated social groups, like homeless people, poor people, and immigrants). Accordingly, social and cognitive neuroscience studies show that the insula and the amygdala are activated more when people face extreme out-groups (i.e., low W–low C). This brain pattern is similarly activated while experiencing disgust—that is, the emotion that plays a crucial role in the SCM (Harris & Fiske, 2006, 2007). Thus, out-groups perceived as hostile and incompetent may be perceived as less than human or being dehumanized (Harris & Fiske, 2006, 2007). SCM has received extensive support by studies performed in a wide range of target groups in more than 30 countries across the world (Cuddy et al., 2009; Durante et al., 2013).

Although two-dimensional theories (as SCM, Fiske et al., 2002) put together moral and nonmoral traits within warmth dimension, according to recent literature, the warmth dimension comprises two different components: sociability and morality (Brambilla, Rusconi, Sacchi, & Cherubini, 2011; Brambilla, Sacchi, Rusconi, Cherubini, & Yzerbyt, 2012; Goodwin, Piazza, & Rozin, 2014; Leach, Ellemers, & Barreto, 2007). In more detail, sociability refers to the ability to cooperate and to form relationships with others (e.g., likeability, friendliness), while morality refers to the perceived correctness of others' behaviour (e.g., honesty, sincerity, trustworthiness; Brambilla et al., 2011).

Though both warmth and competence represent core dimensions of social cognition, warmth judgements seem to be overriding compared to competence ones (Cuddy et al., 2008). Several studies have in fact demonstrated the primacy of the socio-affective dimension in social cognition: social perceivers (a) are guided mainly by warmth when forming global impressions of other agents (Wojciszke & Abele, 2008; Wojciszke et al., 1998), (b) identify warmth-related trait words faster than competence-related ones (Ybarra, Chan, & Park, 2001), (c) are able to judge trustworthiness more reliably than competence from faces presented for 100 ms (Willis & Todorov, 2006), and (d) use trustworthiness cues to inform their voting decisions (Little, Roberts, Jones, & DeBruine, 2012). From an evolutionary perspective, the warmth primacy makes sense because it provides information about the valence of other's intents (good vs. bad; Reeder, Kumar, Hesson-McInnis, & Trafimow, 2002). According to the literature, in fact, warmth ratings usually predict the perceived valence of interpersonal evaluations (i.e., positive or negative), while competence ratings predict the associated magnitude (i.e., how positive or negative) and are dependent on warmth information (Cuddy et al., 2008; Wojciszke et al., 1998).

Studies on social categorization traditionally report that prejudiced people (a) are better in detecting out-group faces (e.g., anti-Semitic participants could better locate Jewish faces than could nonprejudiced participants; Dorfman, Keeve, & Saslow, 1971; Pulos & Spilka, 1961) and (b) identify more faces (or names) as out-group (e.g., anti-Semitic individuals label more faces/names as Jewish than less prejudiced individuals; Himmelfarb, 1966; Quanty, Keats, & Harkins, 1975). Two main theoretical accounts have been proposed in order to explain this pattern of results. According to the *vigilance hypothesis* (Lindzey & Rogolsky, 1950), people are alert to out-group members in order to avoid them and thus acquire a better knowledge of out-group features and, consequently, greater detection accuracy. On the contrary, the *response bias hypothesis* (Elliott & Wittenberg, 1955) states that prejudiced people are better at identifying out-groups simply because they put more targets in the out-group category. According to Leyens and Yzerbyt (1992), these two accounts can be merged together in the so-called *in-group overexclusion effect* (IOE; Leyens & Yzerbyt, 1992; Yzerbyt, Leyens, & Bellour, 1995)—that is, the tendency to classify more individuals as out-group members than in-group ones in a categorization task. This overexclusion of the out-group might be based on the in-group's motivation to protect the integrity of his or her own group, thus preventing undesirable outsiders from accessing it. In a study by Leyens and Yzerbyt (1992), participants received positive or negative stereotypical descriptions of two linguistically differentiated groups in Belgium: the Walloon (i.e., in-group) or the Flemish (i.e., out-group). Walloon participants reported more often that the descriptions belonged to the Flemish, and also tended to classify a target described positively as in-group and a target described negatively as an out-group. In addition, participants needed more pieces of information to make a decision when the description was positive or stereotypical of the in-group (Walloon) and less information when the description was negative or stereotypical of the out-group (Flemish). These results suggested that people are more concerned with falsely labelling a person as an in-group member than with falsely categorizing a person as an out-group member (Leyens & Yzerbyt, 1992).

Interestingly, the ambiguity of the stimuli that have to be classified contributes to the difficulty of the decision and, as a consequence, to the emergence of the IOE. In one study (Yzerbyt et al., 1995), Belgian subjects who were either French or Dutch speaking were presented with sentences pronounced by either French-speaking (Walloon) or Dutch-speaking (Flemish) people and had to decide whether the speakers belonged to the group of Walloon or Flemish. Results showed that subjects (a) tended to erroneously classify in-group targets more often than out-group ones, and (b) took longer to make the decision when confronted with an in-group person reading out-group sentences than with an out-group person reading in-group sentences. Again, participants were more cautious only when they had to decide whether to include a person in their own group (Yzerbyt et al., 1995).

Social categorization is also modulated by perceived in-group versus out-group status. In a study by Pettigrew, Allport, and Barnett (1958), members of different ethnic groups living in South Africa (Europeans, White South Africans, Indians, and Blacks) were exposed stereoscopically with pairs of same-race or different-race faces, belonging to these four groups. The racial categorization process varied as a function of the visual stimuli (i.e., European and White South African faces were more identifiable than Indian and Black ones) and the social perceiver's own race. Results showed that Europeans and White South Africans—the most concerned for the racial issues—tended to see a European face much less often than did others. These findings suggest that the high-status groups (i.e., Europeans and White South Africans) are most careful not to judge non-European pairs as European, since they have the most to lose by accepting low-status members in their in-group; Black and Indian people (the lower status groups) are more willing to judge their own pictures or the European pictures as belonging to their in-group, but they never judged their own pictures as Black (the lowest status group). So, when errors are made, they are often congruous with protecting the status of the in-group (Pettigrew et al., 1958).

Also, the level of identification with the in-group affects the categorization process (Castano, Yzerbyt, Bourguignon, & Seron, 2002; Yzerbyt et al., 1995). In a categorization task on faces generated using a morphing computer program (i.e., faces differed for their percentage of northern Italian and southern Italian facial features, on a continuum between 20% and 80%), people who strongly identified themselves with the in-group (high identifiers) tended to classify more targets as southern Italians (i.e., out-group members) than northern Italians (i.e., in-group members), while results for low identifiers did not differ from chance levels (Castano et al., 2002). Finally, the IOE was also elicited in a human/animal categorization task showing that when participants were presented with ambiguous human/ape face stimuli, they were more likely to categorize them as apes. Interestingly, this effect was true only if the human face belonged to the participants' in-group and not if it belonged to the out-group (Capozza, Boccato, Andrighetto, & Falvo, 2009). This supports the fact that the IOE is a tool used to avoid in-group contamination and is not merely a response bias.

Since the warmth and competence dimensions inform intergroup social judgement (Fiske et al., 2007), we intended to assess their role in a social categorization task performed on neutral faces. To our knowledge, no previous study has addressed the role of warmth and competence in group-membership (in-group vs. out-group) decisions. In particular, we aimed to verify whether (H1) the socioaffective (warmth judgements) and the ability (competence judgements) dimensions would both contribute to the categorization of the face as in-group, and whether (H2) participants who showed a higher IOE (i.e., people more prone to exclude the other from their in-group) would show a different employment of these two decision criteria with respect to participants with lower IOE (i.e., people more willing to include the other in their in-group). Concerning H2, we have no specific hypotheses about the directionality of the expected results, and we are not aware of any supporting literature stating that warmth or competence is preferentially used in order to select the in-group. In more detail, we expected that: (H1) A face judged high in both warmth and competence would be categorized as in-group, whereas a face judged low in both warmth and competence would be assigned the out-group status; and (H2) low-IOE and high-IOE people would rely differently on warmth and competence dimensions in order to make their decisions.

EXPERIMENTAL STUDY

Method

Participants

Participants were recruited by posting an invitation to complete two online surveys regarding faces pictured on web-pages used by university students. The study was anonymous, but we requested participants to insert an identification code to verify that the order in which they completed the two surveys was correct. Participants were also asked to insert their personal data (age, gender, nationality, occupation). We recruited 62 subjects (20 males, 42 females; age: $M = 26.92$ years, $SD = 5.76$) who completed both surveys, but we later excluded two participants from the analysis, since too much time elapsed between the two surveys and because of the non-Italian nationality. The data of 60 participants (19 males, 41 females; age: $M = 26.90$ years, $SD = 5.80$) were used for the analyses; all subjects were Italian.

Materials and procedure

The two surveys were both composed of the same 150 face stimuli (size: 400 × 477 pixel), taken from three validated face sets, which were developed using a trustworthiness computer model and generated using the software FaceGen 3.1 (Oosterhof & Todorov, 2008; Todorov, Dotsch, Porter, Oosterhof, & Falvello, 2013; Todorov & Oosterhof, 2011). In particular, stimuli consisted of Caucasian male faces, neutral on the trustworthiness dimension (0 *SD*). We decided to select faces neutral for trustworthiness because it is well established that this trait resembles affiliation (Montepare & Dobish, 2003) and plays a pivotal role in building first impressions during social interactions. Furthermore, this trait is used as an optimal approximation of the valence dimension during face evaluation (Oosterhof & Todorov, 2008). In fact, as the trustworthiness increases, the face appears to express more positive emotions, and, as the trustworthiness decreases, the face seems to express more negative emotions (Todorov & Oosterhof, 2011). Since we were interested in participants' subjective attributions of warmth and competence to noninformative faces, we have selected only the faces judged as neutral in the trustworthiness dimension and those that are consequently not characterized by a positive or negative valence.

At the beginning of both surveys, subjects were asked to rate on various dimensions 150 virtual reconstructions of faces of real people. Survey 1 (S1; group membership) instructions specified that participants would have encountered faces belonging to Italian and Romanian people (specifying that Romanians did not belong to the Gypsy ethnicity), while the Survey 2 (S2; ratings) did not contain this additional information. Survey 1 (S1; group membership) addressed the following question for each face stimulus: "What nationality do you think this person belongs to?", and subjects could choose between two alternatives: Italian (i.e., the in-group) or Romanian (i.e., the out-group). We have chosen the Romanian group as the out-group because, like Italians, they possess characteristics that are both northern and southern European phenotypic features, and thus participants could not rely on physical appearance in order to evaluate faces. The order of the two choice options was randomized throughout the survey. Survey 2 (S2; ratings) addressed three different questions for each face stimulus: (a) "How warm (i.e., affectionate, friendly, and reliable) do you think this person is?" on a 5-point scale (1 = *not at all* to 5 = *extremely*); (b) "How competent (i.e., efficient, intelligent, and knowledgeable) do you think this person is" on a 5-point scale (1 = *not at all* to 5 = *extremely*); (c) "In your opinion, the facial expression of this person is_?", and subjects could choose among three alternatives (*positive, neutral, and negative*). This last question was meant to control that participants' decisions were not valence driven. The order of the questions was randomized throughout the survey. Subjects completed the two different surveys in counterbalanced order: 34 subjects completed the S1 initially and the S2 after, while the other 28 subjects completed the S2 first and the S1 second.

Data analysis

First of all, we recoded the three categorical values concerning the facial expression valence (i.e., positive, neutral, and negative) into continuous positive values (positive = 3; neutral = 2; negative = 1) on a hypothetical "valence distribution", which is a continuum that goes from positive to negative, passing through neutral. In this way, it was possible to have three continuous independent variables (valence, warmth, and competence) and a dichotomous dependent variable (Italian/Romanian).

Data analysis was performed with R, a free software programming language and software environment for statistical computing (R Development Core Team, 2013). We performed a multilevel mixed log–linear regression analysis, a statistical method belonging to the family of linear mixed models (LMM or "mixed-effects models"; Garson, 2013; Pinheiro & Bates, 2000), through the package lme4 Version 1.1–5 (Bates, Maechler, Bolker, & Walker, 2014). Unlike traditional statistical methods, LMM are suitable for (a) analysing hierarchical data structures (i.e., in which not all levels of a categorical factor co-occur in all levels of another categorical factor); (b) analysing the whole data set (not just the mean observations for each subject and condition) to better evaluate the variations of data usually left out in analysis of variance (ANOVA)-style analyses; (c) accounting for the nonindependence of observations with correlated error; (d) separately treating the effects caused by the experimental manipulation (fixed effects) and the ones that were not (random effects) (Pinheiro & Bates, 2000).

In this specific case, a multilevel regression model with one dependent variable (in-group/out-group decision) and three predictor-independent covariates (valence, warmth, competence) was used. The three covariates were scaled between 0 and 1 in order to avoid the different ranges among the covariates (from 1 to 3 or from 1 to 5) affecting the results. We also considered the interaction of the three covariates with the group factor (low-IOE vs. high-IOE); in particular, we divided the sample of subjects in two subsamples through the median split procedure: (a) low-IOE—that is, subjects ($N = 33$) who categorized faces as Romanians less than 50% of the time ($M = 35.92$, $SD = 8.65$), indicating that they tended to include Romanians in their in-group more easily, and (b) high-IOE—that is, subjects ($N = 27$) who categorized faces as Romanians more than 50% of times ($M = 53.83$, $SD = 6.44$), indicating that they were inclined to exclude Romanians from their in-group.

We considered as a priori random factors the scalar effects of: (a) the face stimulus (i.e., by-face stimulus random intercept and random slopes for warmth, competence, and valence) and (b) the subject (i.e., by-subject random intercept and random slopes for warmth, competence, and valence), since (a) each stimulus could have received a different proportion of Italian/Romanian judgements (i.e., some faces were judged by most of the subjects as in-group or out-group)—independently from the subject, and (b) each subject could have a proper decision style (i.e., he/she was more prone to include/exclude the other from his/her in-group)—independently from the face stimulus.

We used the stepwise backwards elimination model selection: We began analysing the *saturated model* (i.e., the model with all the available parameters, factors, and interactions), and progressively we removed one factor/interaction at a time, reaching the *null model* (i.e., the model with the minimum of the available parameters). We determined the best model to fit our data, taking into account: (a) the log-likelihood ratio statistic (Lehmann, 1986), (b) the Akaike Information Criterion (AIC; Sakamoto, Ishiguro, & Kitagawa, 1986) and (c) the Bayesian Information Criterion (BIC; Schwarz, 1978). Given a set of candidate models for the data, the preferred model is the one with the minimum AIC value. The same principle is applied to the BIC index. We used AIC and BIC but also direct model comparisons via log-likelihood. All these three methods have achieved the state of "standard methodology", despite each of them having its own advantages/disadvantages. Therefore, in order to take them into account and to solve a potential disagreement among them, we decided to keep the model in which at least two indexes were in agreement. This is not a standard methodology, but it seemed reasonable to us. However, in the case that this criterion did not work, we used the "parsimony" criterion, or Occam's razor. This is often used in model comparison, see Forster (2001) for an example. The log-likelihood ratio statistics are asymptotically approximated to a χ^2 distribution, allowing the computing of a p-value that reaches the statistical significance if the more complex model fits the data better (Pinheiro & Bates, 2000). If these indices are opposing, we consider as the winning model the one with: (a) the greater number of congruent indices and (b) the most "economic" model (the parsimony principle must be applied, i.e., if two models fit the data in a comparable way, the model with less parameters will be chosen). In this particular case, since the distribution of the dependent variable was binomial, we used the Laplace algorithm (instead of the maximum likelihood or the restricted maximum likelihood) to interpolate data.

Results

On average, 43.98% of the faces were categorized as out-group (see Table 1 for descriptive information and Table 2 for the correlation matrix). In order to test whether in-group/out-group choice is at chance level, we compared the percentage of out-group choice to a chance-level percentage of categorization (50%). Participants' decisions seem not to be biased at all, since their choices are not significantly different from chance (N = 43.98%, P = 50%), p = .2713, confidence interval (95% CI) = [34%, 54%] (exact binomial test, two-tailed). This suggests that our participants were not generally biased toward inclusion or rejection, and there was not an overall in-group overexclusion effect.

To test H1 (i.e., the socioaffective dimension and the ability dimension both contribute to the categorization of a face as in-group), the following predictors were added simultaneously to the model: warmth, competence, and valence. In this way, we treated our covariates as separate observations. As a first step, the so-called *saturated* model was estimated, which is the basic model plus explanatory variables:

$$\frac{\text{in}-\text{group}}{\text{out}-\text{group decision}} = \text{competence} + \text{warmth} + \text{valence} + (\text{competence} + \text{warmth} + \text{valence} \mid \textit{subject}) + (\text{competence} + \text{warmth} + \text{valence} \mid \textit{face stimulus})$$

The stepwise backwards elimination method analysed progressively distinct models, from the more complex to the more restricted one, reaching finally the *null model*. The model that guaranteed the best interpolation with our data comprised warmth ($p < .05$) and competence (p = <.001) (third row of Table 3; the beta values are shown in Table 4), meaning that these two dimensions are predictive regarding the in-group/out-group dynamics; in more explanatory terms, the more a person judged the observed face as high on these two dimensions, the more likely the face was assigned the in-group status (and vice versa: the lower the scores on these dimensions, the more the face was likely to be categorized as out-group; see Table 4). On the contrary, the saturated model did not reach statistical significance ($p > .05$; Table 3), indicating that the valence factor did not contribute at all to the group-membership decision. So, we decided to remove it from the following analyses.

Table 2. *Correlations among warmth, competence, and valence ratings*

Variable	*Warmth*	*Competence*	*Valence*
Warmth	1	.77**	.15
Competence	.77**	1	.02
Valence	.15	.02	1

Not*e: N* = 60.
**$p < .01$, two-tailed pairwise correlation.

To test H2 (i.e., the IOE triggers a different employment of the socioaffective and ability decision criteria), the significant predictors resulting from the previous analysis of the fixed effects (i.e., warmth and competence) were analysed separately for the low-IOE and high-IOE groups:

$$\frac{\text{in}-\text{group}}{\text{out}-\text{group decision}} = \text{warmth} + \text{competence} + (\text{competence} + \text{warmth} + \text{valence} \mid \textit{subject}) + (\text{competence} + \text{warmth} + \text{valence} \mid \textit{face stimulus})$$

For the low-IOE group, the winning model was the model where only warmth was present ($p < .01$,

Table 1. *Mean judgement of participants and faces for warmth, competence, and valence and mean percentage of out-group categorizations*

	Participants (N = *60)*					*Faces* (N = *150)*				
Variable	M	SE	SD	*Min*	*Max*	M	SE	SD	*Min*	*Max*
Warmth	2.57	0.06	0.43	1.40	3.27	2.57	0.03	0.39	1.75	3.75
Competence	2.78	0.04	0.34	1.67	3.55	2.78	0.03	0.31	1.85	3.50
Valence	2.02	0.02	0.15	1.61	2.37	2.02	0.02	0.30	1.30	2.77
Out-group (%)	43.98	1.53	11.81	15.33	74.67	43.98	1.28	15.73	11.67	75.00

Table 3. *Comparison of models*

Model	df	*AIC*	*BIC*	*logLik*	χ^2	df	*Pr* $(>\chi^2)$
Null model	21	11365	11514	−5661.5			
Competence model	22	11351	11507	−5653.4	16.22	1	.000***
Warmth model	23	11347	11511	−5650.6	5.60	1	.018*
Saturated model	24	11347	11517	−5649.5	2.30	1	.129 *ns*

Note: AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; logLik = log-likelihood. Each model was obtained by dropping a main effect or an interaction from the hierarchically superior model. The saturated model was computed using the following equation: in-group/out-group decision = competence + warmth + valence + (competence + warmth + valence | *subject*) + (competence + warmth + valence | *face stimulus*). The model warmth equation was in-group/out-group decision = competence + warmth + (competence + warmth + valence | *subject*) + (competence + warmth + valence | *face stimulus*). The model competence equation was in-group/out-group decision = competence + (competence + warmth + valence | *subject*) + (competence + warmth + valence | *face stimulus*). The null model used was in-group/out-group decision = 1 + (competence + warmth + valence | *subject*) + (competence + warmth + valence | *face stimulus*).
**p* < .05. ****p* < .001. *ns*: *p* > .05.

second row, Table 5) since the saturated model was not significantly better than the warmth model ($p > .05$; Table 5). Interestingly, the warmth model also proved to be better than the null model ($p < .01$; Table 5). On the other hand, the saturated model was better than the model where only competence was present ($p < .05$), which in turn was better than the null one ($p < .05$; Table 6).

For the high-IOE group, the saturated model was better than the warmth model ($p < .01$), which in turn was predictive compared to the null model ($p < .01$; Table 7). Importantly, the saturated model was not significantly better than the model where only competence was present ($p > .05$, Table 8). The competence model also proved to be better than the null one ($p < .001$), proving to be the best fit for the data (Table 8).

In summary, data suggest that while the low-IOE group participants rely more on the warmth rating during in-group/out-group categorization decisions (Table 9; Figure 1), for the high-IOE group participants the opposite is true, and the competence rating plays a major role in taking group membership decisions (Table 9; Figure 2). In more detail, higher ratings of warmth predicted in-group categorization in the low-IOE group (and vice versa, lower ratings of warmth predicted out-group categorization), while higher ratings of competence predicted in-group categorization in the high-IOE group (and vice versa, lower ratings of competence predicted out-group categorization). This finding suggests that the proneness to include/exclude unknown identities in/from one's own in-group is related to individual differences in relying on SCM social dimensions.

Table 4. *Beta values for the best fitting model*

Predictor	*Estimate*	SE	z	*Pr* $(>\|z\|)$
Intercept	−0.18	0.15	−1.24	.216 *ns*
Competence	0.66	0.21	3.20	.001**
Warmth	0.51	0.21	2.42	.015*

Note: The line of best fit for this kind of decision was $y = -0.18 + (competence \times 0.66) + (warmth \times 0.51)$.
**p* < .05. ***p* < .01. *ns*: *p* > .05.

Discussion

In this study we tested whether warmth and competence judgements of neutral faces could predict the assignment of these identities to an in-group or an out-group category (H1). Furthermore, we explored whether the use of these two criteria differed in participants who were more conservative (i.e., more prone to exclude the identity from the in-group category) or inclusive (i.e., more prone to include the identity in the in-group category) in making such decisions (H2). Our data confirmed both H1 and H2.

Table 5. *Comparison of models for low-IOE group (warmth)*

Model	df	*AIC*	*BIC*	*logLik*	χ^2	df	*Pr* $(>\chi^2)$
Null model (low-IOE)	21	6139.3	6276.0	−3048.7			
Warmth model (low-IOE)	22	6134.2	6277.4	−3045.1	7.10	1	.008**
Saturated model (low-IOE)	23	6133.4	6283.1	−3043.7	2.84	1	.092 *ns*

Note: IOE = in-group overexclusion effect; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; logLik = log-likelihood. The saturated model was computed using the equation: in-group/out-group decision = competence + warmth + (competence + warmth + valence | *subject*) + (competence + warmth + valence | *face stimulus*). The model warmth equation was in-group/out-group decision = warmth + (competence + warmth + valence | *subject*) + (competence + warmth + valence | *face stimulus*). The null model equation was in-group/out-group decision = 1 + (competence + warmth + valence | *subject*) + (competence + warmth + valence | *face stimulus*).
$^{**}p < .01$. *ns*: $p > .05$.

In particular, we found evidence that, in general, people use both warmth and competence criteria to categorize a face as in-group. This is not surprising, since several studies have shown that people tend to rate their reference group (the one with which they identify themselves better, e.g., US citizen for Americans) as higher in both warmth and competence dimensions (Cuddy et al., 2007; Fiske et al., 2002). This phenomenon is part of the in-group favouritism effect, according to which people would tend to favour the evaluation of the in-group over the out-group (Hewstone, Rubin, & Willis, 2002). Interestingly, while in all the previous studies participants were asked to evaluate in-groups (e.g., Americans, white people) and out-groups (e.g., Jews, poor people, gay men) on the warmth and competence dimensions, here we tested whether warmth and competence dimensions could predict the assignment of neutral identities to an in-group/out-group category. Thus, while all of the previous studies demonstrated that the stereotypes of defined social categories can be partitioned under the warmth and competence dimensions, our data suggest that, at least when perceptual/reputational cues are not available, these dimensions can affect even first-glance social categorization.

Concerning the reciprocal influences between in-group/out-group categorization and the social dimensions ratings, our results did not allow us either to exclude that the warmth/competence judgement is determining the in-group/out-group categorization, or that an implicit group assignment is biasing the warmth/competence judgement. Probably, participants formed an "implicit preference" able to bias both judgements all together (i.e., the subjects could have created an implicit impression of a single face at a glance able to bias both the warmth/competence and the in-group/out-group categorization judgements or vice versa). This could be in agreement with well-known phenomena underlying intuitive judgements, such as the "halo effect" (a judgemental bias that operates at the implicit level and for which attractive/preferred individuals are

Table 6. *Comparison of models for low-IOE group (competence)*

Model	df	*AIC*	*BIC*	*logLik*	χ^2	df	*Pr* $(>\chi^2)$
Null model (low-IOE)	21	6139.3	6276.0	−3048.7			
Competence model (low-IOE)	22	6135.5	6278.7	−3045.8	5.80	1	.016*
Saturated model (low-IOE)	23	6133.4	6283.1	−3043.7	4.14	1	.042*

Note: IOE = in-group overexclusion effect; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; logLik = log-likelihood. The model competence equation used was in-group/out-group decision = competence + (competence + warmth + valence | *subject*) + (competence + warmth + valence | *face stimulus*).
$^{*}p < .05$.

Table 7. *Comparison of models for high-IOE group (warmth)*

Model	df	*AIC*	*BIC*	*logLik*	χ^2	df	*Pr* ($>\chi^2$)
Null model (high-IOE)	21	5301.7	5434.1	−2629.8			
Warmth model (high-IOE)	22	5293.6	5432.4	−2624.8	10.06	1	.001**
Saturated model (high-IOE)	23	5287.0	5432.1	−2620.5	8.60	1	.003**

Note: IOE = in-group overexclusion effect; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; logLik = log-likelihood. The saturated model used was in-group/out-group decision = competence + warmth + (competence + warmth + valence | *subject*) + (competence + warmth + valence | *face stimulus*). The warmth model equation was in-group/out-group decision = warmth + (competence + warmth + valence | *subject*) + (competence + warmth + valence | *face stimulus*). The null model equation was in-group/out-group decision = 1 + (competence + warmth + valence | *subject*) + (competence + warmth + valence | *face stimulus*).

$^{**}p < .01$.

attributed with positive traits on many personal facets and are treated more positively as well (Langlois et al., 2000; Moore, Filippou, & Perrett, 2011; Verhulst, Lodge, & Lavine, 2010) or the "anchoring heuristic" (a psychological heuristic that influences the way people intuitively assess probabilities, starting with an implicitly suggested reference point—the "anchor"—and then making adjustments to it to reach their estimate; Tversky & Kahneman, 1974). As a general behavioural trend, the two phenomena (i.e., the higher the ratings on warmth and competence, the higher the probability of in-group categorization) covaried, but future studies will be needed in order to disentangle the exact timing of these events.

Furthermore, we reported a differential employment of these two distinct decision criteria in participants who tend to include or exclude new members from their in-group; in particular, the inclusive participants (low-IOE) used a warmth-centred criterion in order to label the unknown identities as in-group or out-group (i.e., the more a face was evaluated as warm, the more it was categorized as in-group and, vice versa, the less a face was evaluated as warm, the more it was categorized as out-group), whereas the conservative participants (high-IOE) used a competence-centred criterion in order to label the unknown identities as in-group or out-group (i.e., the more a face was evaluated as competent, the more it was categorized as in-group, and, vice versa, the less a face was evaluated as competent, the more it was categorized as out-group).

Previous research demonstrated that moderating variables such as the level of prejudice (Blascovich, Wyer, Swart, & Kibler, 1997) and the level of identification (Castano et al., 2002; Yzerbyt, Castano, Leyens, & Paladino, 2000; Yzerbyt et al., 1995) play a major role in the phenomenon of the in-group overexclusion effect (Leyens & Yzerbyt, 1992). Here, we suggest that also individual differences on SCM social dimensions reliance might play a role in this group-serving mechanism.

Despite the fact that both warmth and competence are known to be fundamental dimensions of

Table 8. *Comparison of models for high-IOE group (competence)*

Model	df	*AIC*	*BIC*	*logLik*	χ^2	df	*Pr* ($>\chi^2$)
Null model (high-IOE)	21	5301.7	5434.1	−2629.8			
Competence model (high-IOE)	22	5287.8	5426.5	−2621.9	15.88	1	.000***
Saturated model (high-IOE)	23	5287.0	5432.1	−2620.5	2.78	1	.095 *ns*

Note: IOE = in-group overexclusion effect; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; logLik = log-likelihood. The model competence equation used was in-group/out-group decision = competence + (competence + warmth + valence | subject) + (competence + warmth + valence | face stimulus).

$^{***}p < .001$. *ns*: $p > .05$.

Table 9. *Beta values for the best fitting models*

	Low-IOE group				*High-IOE group*			
Predictor	*Estimate*	SE	z	*Pr (>z)*	*Estimate*	SE	z	*Pr (>z)*
Intercept	0.44	0.15	2.88	.004**	−0.60	0.13	−4.50	.000***
Warmth	0.73	0.26	2.80	.005**	—	—	—	—
Competence	—	—	—	—	1.01	0.21	4.83	.000***

Note: IOE = in-group overexclusion effect. For the low-IOE group (left panel) the line of best fit is $y = 0.44 + (warmth \times 0.73)$, while for the high-IOE group (right panel), the line of best fit is $y = -0.60 + (competence \times 1.01)$.
$^{**}p < .01$. $^{***}p < .001$.

social perception, people seem to be more sensitive to warmth than competence information. In fact, warmth has been shown to be more cognitively accessible (Ybarra et al., 2001), more heavily weighted in evaluative judgements (Fiske et al., 2007; Wojciszke et al., 1998), and more predictive of affective-behavioural reactions (i.e., approach-avoidance tendencies; Caccioppo, Gardner, & Berntson, 1997; Peeters, 2002) than competence.

Perceived competence is also important, as it informs us about whether the person will be able to accomplish his/her goals (both positively or negatively valenced). Minimal time exposure (1000 ms) to political candidates' faces is sufficient time for participants to make inferences about their competence, predicting the outcomes of U.S. congressional election better than chance (Todorov, Mandisodza, Goren, & Hall, 2005). Warmth and competence seem to actually exert opposite effects on voting behaviours: perceived ability is positively related to a candidate's chances of winning, whereas perceived sociability is negatively related to a candidate's electoral success (Castelli, Carraro, Ghitti, & Pastore, 2009), at least during wartime (Little et al.,

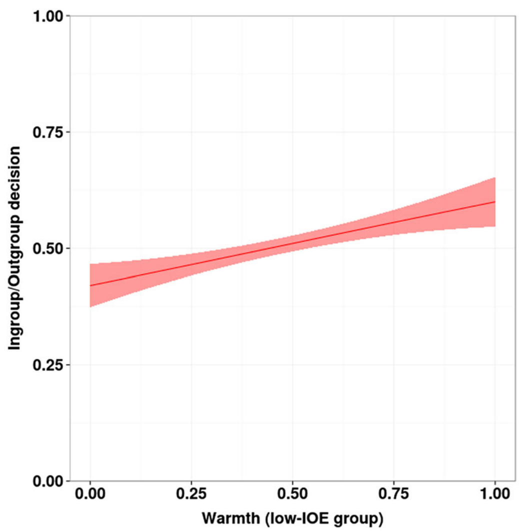

Figure 1. *Predicted probability of the in-group over the out-group decision when using a warmth-centred decision criterion in the low-IOE group. Predictions are based on estimates shown in Table 9; the shaded bands represent 95% confidence intervals. IOE = in-group overexclusion effect.*

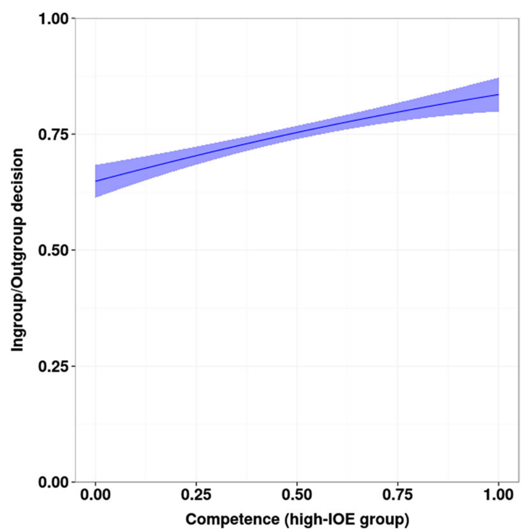

Figure 2. *Predicted probability of the in-group over the out-group decision when using a competence-centred decision criterion in the high-IOE group. Predictions are based on estimates shown in Table 9; the shaded bands represent 95% confidence intervals. IOE = in-group overexclusion effect.*

2012). Additionally, chimpanzees (*Pan troglodytes*) are able to use their social experience to identify and recruit more effective collaborative partners (Melis et al., 2006), thus indicating that the ability to make competence-efficacy judgements could have been developed as a result of evolutionary selection.

Warmth and competence are asymmetrically processed during the information gathering process in person perception; in particular, social perceivers seem to search for information that confirms others' competence and that disconfirms others' warmth (Cuddy et al., 2008; Skowronski & Carlston, 1987). With regard to the competence dimension, it is worth noting that people are more sensitive to confirming information; in essence, they place more weight on efficient behaviours than inefficient ones (i.e., the positivity bias in the competence domain; Crocker, Fiske, & Taylor, 1984; Skowronski & Carlston, 1987; Wojciszke, Brycz, & Borkenau, 1993). Thus, a positive judgement about competence is considered highly stable and diagnostic. Specifically, on one hand, a few incompetent behaviours from a generally competent person do not change the perception of that person's ability. On the other hand, when considering the warmth dimension, people are more sensitive to disconfirming information (i.e., the negativity bias; Reeder & Spores, 1983; Skowronski & Carlston, 1989; Wojciszke et al., 1993); for example, they place more emphasis on what is perceived as "cold" behaviour versus "warm" behaviour. Thus, a negative judgement on the warmth dimension is very stable and diagnostic such that sporadic friendly behaviours from a generally untrustworthy person will not change the perception of that person's sociability (Cuddy et al., 2008; Mende-Siedlecki, Baron, & Todorov, 2013). The social diagnosticity of warmth and competence also depends on their capacity to be controlled; in fact, warm behaviour is highly controllable by the social agent, and so it is less diagnostic, while competent behaviour is not dependent on individual control, and so it is more difficult to deceive on it (Cuddy et al., 2008).

According to this view, high-IOE participants tend to rely on highly diagnostic and controllable competence-related cues, not affording the risk to include unknown others in their in-group, as evidenced by their risk-averse decision style (i.e., they categorized faces as out-group more than 50% of the time). This is in line with the finding that competence is especially diagnostic when the other is perceived as immoral and untrustworthy (Peeters, 2001) and when social distance is low (as in the case of a potential in-group) since the weight of competence in interpersonal evaluations is greater for close others than for distant ones (Abele & Wojciszke, 2007; Wojciszke & Abele, 2008). On the other hand, low-IOE participants tend to rely on warmth-related cues, affording the risk to include a potentially dangerous individual in their in-group, as evidenced by their more risk-prone decision-style (i.e., they categorized faces as out-group less than 50% of the time). In the context of social uncertainty, where individuals cannot rely on perceptual information (i.e., emotional expression of the face, race, etc.) or on "reputational" cues (i.e., previous knowledge about the individual), high-IOE participants, by setting a higher criterion (i.e., the threshold for deciding whether to accept or reject someone oversteps the chance level) end up identifying more often the "swindlers", and this mechanism highly reduces the risk to make a false positive (i.e., categorizing a dangerous out-group as an in-group).

In sum, our results suggest that in a perceptually ambiguous environment, people use both warmth and competence judgements to identify their in-group. Importantly, not all individuals seem to be guided by warmth. In fact, the primacy of the warmth phenomenon has been described as peculiar of particular kinds of social perceivers, such as women (Abele, 2003; Wojciszke et al., 1998) and people from collectivistic cultures (Wojciszke, 1997), suggesting that it is not a universal mechanism and that it can probably be modulated by individual differences (Cohrs, Asbrock, & Sibley, 2012) and by situational factors (e.g., self-related vs. other-related perspective; Wojciszke et al., 1998). Recent theorizing suggests in fact that warmth and competence probably belong to different domains of human social cognition and that they are processed from different cues, on different contexts, and often from different perspectives (Abele & Wojciszke, 2014). Our study supports this view, by evidencing that warmth is more predictive than competence for low-IOE participants' decisions, but, interestingly, warmth seems to be actually less predictive than competence for high-IOE participants' choices.

In more detail, people who are influenced by the competence judgement in making group categorization decisions become more conservative, suggesting that the use of competence-related cues lowers decision makers' acceptance decision threshold (making them more risk averse). Otherwise, people who are influenced by the warmth judgement in making such decisions become more inclusive, implying that the use of warmth-related cues raises people's decision threshold (making them more risk prone).

On the one hand, this result could be explained by a latent variable, which explains why some people are less able to rely on such judgements and thus become more cautious in selecting their in-group. On the other hand, the inverse mechanism is also possible: people who need to adopt a safer social categorization mechanism might have learned to inhibit warmth judgements (which could be misleading since warm behaviour is highly controllable and so less diagnostic; Cuddy et al., 2008) and rely only on competence (which is more reliable since competent behaviour is not dependent on individual control; Cuddy et al., 2008).

Although this study cannot disentangle the two hypotheses, we believe that it provides important innovative evidences about: (a) the use of the warmth and competence judgements during first-sight social categorization, and (b) the existence of differential decision styles in people more or less prone to the in-group overexclusion. Future studies should investigate whether the differential reliance on warmth and competence of low-IOE versus high-IOE participants could be related to individual differences in personality, identification with the in-group, level of prejudice against the out-group, and so on.

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