Modulation of preference for abstract stimuli following competence-based social status primes

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Abstract

In the present study, we measured whether competence-related high and low social status attributed to two unknown individuals affects participants' implicit reactivity to abstract stimuli associated to the identity of the same individuals. During a status-inducing procedure, participants were asked to play an interactive game with two (fake) players coded as high vs low status based on their game competence. Before and after the game, a modified version of the Affective Misattribution Procedure (AMP) was administered in which the players' faces were used as primes. The evaluation target, as is typical to AMP, was a Chinese ideogram. There were two different presentation timings for the prime image: 75 ms and 17 ms. After the status-inducing procedure, the evaluation targets preceded by the High Status prime (i.e. best player's face) were rated as more pleasant than those preceded by the Low Status prime (i.e. worst player's face). This effect was only found, however, for the 75 ms lasting prime. Moreover, explicit ratings of the primes showed that the High Status player was rated as more intelligent, competent and dominant than the Low Status one. These results indicate that implicit preference and explicit evaluation of unacquainted individuals is rapidly modulated by competence-based social status attribution, thus hinting at the plastic nature of social categorization and, relatedly, the malleability of visual preference.

Keywords: Social Status, implicit preference, affect misattribution procedure

Introduction

Social status is defined as an individual's relative position within a group. From military ranks to workplace roles, hierarchy is a fundamental characteristic of human groups and societies, and the ability to infer the status of our conspecifics, which is essential for successful social interactions, seems to be hard-wired in the human brain. Indeed, studies have shown that high-status individuals receive greater attention (Cheng et al., 2013; Dalmaso et al., 2012; Foulsham et al., 2010; Liuzza et al., 2011; Porciello et al., 2016) and are easier to recognize (Ratcliff et al., 2011). In addition, they seem to elicit stronger event-related potentials associated with person perception (Santamaria-Garcia et al., 2013), face processing (Santamaria-Garcia et al., 2015) and social evaluation (Gyurovski et al., 2018). Social status was found to modulate neural activity in brain regions involved in social evaluation, reward, salience and attention such as the ventromedial and dorsolateral prefrontal cortex (Cloutier et al., 2014; Zink et al., 2008; Marsh et al., 2009). Status has also been used to study the impact of social dimensions on implicit behavioral measures such as automatic imitation (Farmer et al., 2016), evaluative priming (Mattan, et al., 2019) and implicit associations (Shariff & Tracy, 2009). Less studied are the affective reactions elicited by high or low status targets. Studies from social psychology suggest that high-status individuals are (explicitly) evaluated more positively than low-status individuals (Varnum, 2013; Jost and Burgess, 2000; Cheng et al., 2013) and that they are also more admired and respected (Fiske, Cuddy et al., 2002; Huo and Binning, 2008). Although it is generally accepted that high-status individuals are evaluated more positively than low-status ones, some important exceptions have been reported in the literature. For example, Cloutier and Gyurovsky (2014) found a preferential activation of ventral medial prefrontal cortex (a region associated with person evaluation) when observing high moral status targets compared to low ones. Beside this quite predictable result, they also found the same activation in response to low financial status targets compared to high ones, which suggests that similar neural responses may be associated to high- or low-status individuals evaluation depending on the (negative or positive) social dimension from which status is inferred (e.g. financial vs moral). Similar results were obtained in an EEG study, where the P300 component (the amplitude of which has been associated with the intensity of negative evaluation) was higher for targets high in financial

status and low in moral status (Gyurovsky et al., 2018). Similarly, at a subjective level, Fragale and colleagues (2011) found that members of occupations associated with high-power and low-status (e.g. bill collectors or immigration officers) are evaluated negatively (i.e. more dominant and colder). Moreover, members of high-status competitive groups such as Asians and, again, rich people are evaluated as low in warmth (Fiske et al., 2002). This variety of results is extremely informative, as it seems to suggest that different dimensions of status may, indeed, lead to even opposite results in terms of personal evaluation while sharing similar neural responses. We would like to propose that status-based evaluation of individuals is highly dependent on the degree to which the person's status is perceived as functional to the well-being of the group and on the strategies adopted to attain status.

While status achievement in non-human primates is strictly related to dominance (Morgan et al., 2000), humans can use both dominance (i.e. use of force and intimidation) and competence (i.e. demonstration of superior skills and abilities) to gain a privileged position within a group (Cheng et al., 2013). Relevant for the present study is that people who attain status by displaying higher competence are more appreciated by group members than those who adopt a dominance strategy (Cheng et al., 2013). Previous studies that have investigated the impact of social status on implicit preference have mainly focused on groups rather than on individuals. Interestingly, many of these studies found a dissociation between implicit and explicit measures so that while members of high-status groups (e.g. white people, heterosexuals) are more likely to show in-group favoritism on implicit than explicit measures, the opposite pattern is observed for members of low-status groups (e.g. African-Americans, homosexuals) (Jost and Burgess, 2000; Jost and Banaji, 1994; Jost, Banaji and Nosek, 2004) which show implicit out-group favoritism. These results likely reflect a phenomenon known as system justification, namely the implicit, but not explicit, tendency for members of disadvantaged groups to legitimate the existing (hierarchical) social order (Jost et al., 2004). More importantly, these results highlight the value of implicit measures for the study of human attitudes and preferences. Indeed, they show that measuring preferences and attitudes with explicit or implicit methods might lead to even opposite results. As matter of fact, explicit measures can be biased by social desirability and adherence to social norms such as expressing support to

78 own disadvantaged group (in the case of African-Americans) or avoiding been seen as
79 discriminatory (in the case of white people), while implicit measures might reflect stronger, culture-
80 based associations. In view of this, implicit measures are generally preferred over explicit ones
81 since they can minimize the occurrence of strategic responding. It should also be noted that
82 preferences measured with implicit methods can better predict subsequent behaviour than those
83 measured with explicit methods (Green et al., 2007; Stanley et al., 2008; Greenwald et al., 2009).
84 With this in mind, we designed an experiment to investigate whether high- and low-competence-
85 based hierarchical status acquired through an interactive cooperative game can modulate
86 participants' implicit and explicit evaluation of two previously unacquainted individuals. We used a
87 modified version of the Affect Misattribution Procedure (AMP Payne et al., 2005) in order to capture
88 the implicit nature of this effect. The AMP has been widely used in social psychology research to
89 test implicit preference or bias toward homosexual couples (Cooley et al., 2014), black people
90 (Greenwald et al., 2009), Jews (Imhoff and Banse, 2009) and overweight people (Pryor et al.,
91 2013). In a typical AMP trial, participants are presented with a prime picture which can have either a
92 positive or negative valence, immediately followed by a neutral target stimulus, usually a Chinese
93 ideogram. The participant is then asked to rate the neutral stimulus as pleasant or unpleasant. The
94 task's rationale is based on the concept of affect misattribution, whereby affective reaction to the
95 prime is misattributed and transferred to the (neutral) target (Murphy and Zajonc, 1993, Payne et al.,
96 2005), leading to a valence-congruency effect (i.e. targets following positive primes are evaluated
97 as more pleasant than targets following negative primes).
98 We modified the AMP by using the photos of the two players' faces (high or low status) as primes.
99 Our participants completed two AMP sessions, one before and one after the cooperative game. In
100 each session, participants performed two blocks, one with the prime being presented for 17 ms and
101 the other for 75 ms. The 17 ms timing was selected on the basis of previous studies (e.g. Murphy
102 and Zajonc 1993) as sufficiently short to prevent the conscious processing of the image and
103 effective in influencing the subsequent evaluation of neutral stimuli (when the primes consisted of
104 emotionally charged images). The 75 ms timing was selected from Payne and colleagues (2005)
105 where this timing is used as a standard timing for the AMP (although their Experiment 3

demonstrated that the misattribution effect also occurs at longer presentation timings). This timing has also been used to measure implicit social attitudes like implicit anti-black prejudice (Inzlicht et al., 2012). While the misattribution effect in the original version of the AMP (Murphy and Zajonc, 1993) was only found under short prime presentation time (where only implicit processing is likely to take place), subsequent studies have shown the effect to occur with long presentation times as well (Payne et al., 2005; Chiesa et al., 2015; Rohr et al., 2015). Moreover, Ponsi and colleagues (2017) found that subliminal and supraliminal presentation of emotional primes have opposite effects on autonomic reactivity during a social categorization task.

Previous findings have shown that high status individuals are evaluated more positively than low status individuals (Anderson & Kilduff, 2009a; Varnum, 2013). Thus, we expected that the pleasantness ratings of the target stimuli associated with the High Status player would be higher than those associated with Low Status. In addition to the implicit task, however, we also measured explicit ratings of Competence, Intelligence, Dominance and (as a control measure) Attractiveness. Here, too, we expected the High Status player to be explicitly rated as more competent and intelligent than the Low Status one.

Methods

Participants

Thirty-five male students with no knowledge of the Chinese language were recruited from Sapienza University of Rome. Each gave their written informed consent for participation in the study. Five participants were excluded because they did not believe the cover story and four were excluded for technical problems during the experiment (i.e. data partially not recorded). Thus, our final sample was comprised of 26 participants (M = 24 years, SD = 4.19). All had normal or corrected-to-normal vision and were naive to the real purpose of the experiment. The experimental protocol was approved by the ethics committee of the Fondazione Santa Lucia and was carried out in accordance with the ethical standards of the 1964 Declaration of Helsinki.

Procedure

Participants were told that the study had two unrelated aims, namely to investigate their time estimation ability and to test a new software for interactive games. Participants were told they were to play a virtual game with two partners in other rooms of the Psychology building. In reality, these partners were confederate actor models. A procedure was adopted so that participants would consider each game partner as High vs. Low Status (see below). Participants were assigned to one of two experimental actor-status combinations: Actor A as “High Status” and Actor B as “Low Status” (Combination 1), or vice versa (Combination 2).

The experiment was structured as follows: participants began by completing the first AMP session (Session 1). They then participated in the status-inducing procedure, i.e. the interactive game before completing the second AMP session (Session 2). Worth noting is that there was no status associated to the game partner in Session 1, as this session was meant to index any possible automatic preference for one of the two players (see Fig. 1)

Insert Fig.1 here

Affect misattribution procedure.

We used two different versions of the task, one with a short presentation (17 ms) of the prime and one with a long presentation (75 ms). While a 17 ms presentation timing is considered to be under the perceptual threshold, implying that the image is processed at an implicit level (see for example Killgore and Yurgelun-Todd 2001), a 75 ms presentation timing is considered to be sufficient for a fully conscious processing of the stimulus (Payne et al., 2005, Inzlicht et al., 2012). The AMP tasks were delivered using E Prime 2.0 (Psychology Software Tools, Pittsburgh, PA).

Each AMP session (Session 1 and Session 2) included both AMP tasks, i.e. the ‘short’ (AMP_SP) and the ‘long’ presentation (AMP_LP). During the AMP_SP, 19 Chinese characters (on a grey background, 512 x 384 pixels) were used as target stimuli. Prime stimuli were two photos (292 x 400 pixels) of the two male confederates’ faces (Actor A and Actor B), while the masks were two identically-sized, scrambled versions of the original pictures created with Matlab (Mathworks, Cherborn, MA, USA). Each trial started with a fixation cross for 1000 ms, after which a forward mask was presented for 100 ms, followed by the prime image (identity) for 17 ms, a backward mask

(identical to the forward mask) for 100 ms and the target (ideogram) for 1000 ms (as in Era et al., 2015). Following each target, the sentence “How much do you like this image?” appeared on the screen. Below it was a vertical Visual Analogue Scale (VAS, height 10 cm) with the words “Extremely” and “Not at all” written at its top and bottom respectively. This screen composition lasted until the question was answered (Fig 2, A). Participants were told that they would see one image and then a second one, a Chinese ideogram. They were asked to ignore the first image and rate the pleasantness of the ideogram by clicking with the mouse on the VAS point that corresponded to their judgment.

Insert Fig. 2 here

Each target image appeared twice in each of the two 19-trial blocks, once preceded by the face prime of Actor A (unacquainted in Session 1 and either High or Low Status in Session 2) and once by the face prime of Actor B (unacquainted in Session 1 and either Low or High Status in Session 2, the opposite of Actor A). The AMP_LP procedure was the same as AMP_SP, apart from two differences: the prime image being presented for 75 ms and the mask being presented only after the prime, as in the classical version of the AMP (Payne et al., 2005) (Fig. 2, B). The order of short and long presentation AMP was kept constant during the task, with AMP_SP always preceding AMP_LP. Although we do acknowledge that randomizing the order would control for any sequence effect, we reasoned that presenting the 75 ms block before the 17 ms might make participants aware of the presence of the prime pictures and thus more sensitive to them. Participants might thus become able to perceive the prime pictures even at 17 ms. To rule out the possibility that an order effect might influence the results, we ran a Status (High vs Low) x Block (Short vs Long presentation) x Session (before vs after the manipulation) ANOVA on the raw data, and show that the results of main interest do not seem to be determined by an order effect (see Supplementary Materials).

Status-inducing procedure.

The status-inducing procedure was adapted from Boksem and colleagues (2012). Participants were informed that they were to play a cooperative time estimation game with two other players and that the score obtained by each individual player would be added to a shared score. They were also informed that, at the end of the game, the collective score would be split into three equal parts and distributed to each player in the form of candy. While participants could win actual money in some of the studies using a similar paradigm (e.g. Boksem et al., 2012; Zink et al., 2008), other studies indicate that the manipulation is effective with virtual rewards (e.g Santamaria-Garcia et al., 2013; 2015), suggesting that even low stake rewards can work with this kind of manipulation. Between the end of the first AMP session and the start of the status inducing procedure, the experimenter pretended to call a colleague on the phone in order to synchronize the start of the game. We did this to make the cover story more plausible.

The time estimation task was administered with E-Prime 2.0 (Psychology Software Tools, Pittsburgh, PA). Each trial started with the presentation of a blue circle that turned green after a random time interval (ranging between 1500-3500 ms). Participants were required to press the space bar exactly 1 second after the circle had changed color (Fig. 3). To avoid ceiling effects, we adopted a staircase-like procedure: at the start of the task, the 'win' threshold for the response time was set at 1 second +/- 550 ms. If the participant's response fell within this threshold (i.e. if he pressed the space bar after 1 second +/- 550 ms), he scored 5 and the threshold was reduced of 50 ms. Again, on the following trial a response falling within 1 second +/- 500 ms would result in a score of 5 and in a further 50ms threshold reduction, and so on. Otherwise, if the response fell outside the threshold value, the participant scored 0 and the threshold was increased by 50ms. This procedure, which was implemented throughout the whole experiment, ensured the task to be enough challenging while keeping participants' score in the desired range, although participants always received a feedback that was coherent with their actual performance. In addition to the score, visual feedback was provided at the end of each trial: a smiley face for correct responses and a sad face for errors. In each trial, participants were only able to see their own result and their individual score.

Insert Fig. 3 here

Participants completed eight blocks of ten trials each. At the end of each block, a feedback slide (Fig. 4) was presented in which the photos of the three players (those of the two partners and that of the participant) were displayed, each one framed by a distinct color. The individual score was displayed below each picture, along with a number of stars that varied according to performance (3 stars for the best player, 2 for the middle and 1 for the worst). In the top right corner of the slide was a square containing three bars in different colors matching those of the participant's pictures frames. The width of each colored bar increased during the game according to the player's score in order to highlight the differences between their respective contributions. A progress bar was also displayed, indicating how far along the group was in the task.

Insert Fig. 4 here

Player ratings changed in each block for the first four blocks, with the participant moving through the first (block 1), second (block 2) and third (blocks 3 and 4) positions. From block 5 to 8, however, the ranking remained the same, with the experimental subject occupying the middle position. While the participant's displayed score reflected his real performance, we covertly manipulated the scores of the two fake players so that one always ranked first ("High Status") and the other last ("Low Status") in blocks 5 to 8. At the end of the task we presented a slide displaying the final ranking and the collective score. On each block of the Time Estimation task, the High and Low Status players' scores were determined in advance. To make sure that the participants' score would reflect their actual position in the hierarchy, we initially estimated on a separate sample the maximum and minimum scores that could be achieved in each block (the staircase procedure ensured that these boundaries could not be overcome) and we set two other players' scores accordingly. The distance between the High and Low Status players remained the same for all participants, as these two scores were set in advance. Similarly, the distance between the participant and the two other

players varied very little from one participant to another. However, for all participants the distance between the participant and the High status was not equal to the distance between the participant and the Low status (HS-Participant mean difference = 118.46, sd = 6.89, LS-Participant mean difference = 46.53, sd = 6.89 – t value = 26.59, $p < 2.2e-16$). We therefore decided to investigate whether this might have influenced the results by running additional analyses and show that this difference does not invalid our results (see Supplementary Materials).

Explicit ratings concerning the game partners

Following the status inducing procedure, participants were requested to rate the two other players in terms of attractiveness, intelligence, competence and dominance by pressing a number from 1 to 9 on the keyboard. Immediately after, they completed the second AMP session (Session 2). They were then debriefed. Contrary to the implicit measure, the explicit evaluation of the two players was only collected after the status-inducing procedure. We adopted this method because we thought that asking participants to judge the competence and intelligence of the two players before the game might have revealed the real purpose of the experiment.

Funnel debriefing

At the end of the experiment, participants underwent a funnel debriefing procedure (Ferguson & Bargh, 2004; Bargh & Chartrand, 2000) to determine if they had any suspicion about the cover story. The experimenter started with a broad question (i.e. “Do you have any idea about what the purpose of this experiment may be?”) before getting more detailed: “Did you ever wonder whether the other players really existed”? Five participants reported suspicion about the procedure and were therefore excluded.

Statistical analysis

Statistical analyses were conducted using R (version 1.1.383) and STATISTICA (Statsoft).

Affect misattribution procedure

As a first step, we created baseline-corrected indexes for the High Status and Low Status conditions by subtracting the pleasantness ratings attributed to the Chinese characters in Session 1 from their pleasantness ratings in Session 2. Thus, we created two indexes for each task (AMP_SP and AMP_LP) and one for each condition (High Status and Low Status), resulting in four indexes: HS_SP, LS_SP, HS_LP, LS_LP. A 2x2 ANOVA on AMP effect indexes (HS_LP, HS_SP, LS_LP, LS_SP) was ran with Block (Long Presentation-Short Presentation) and Status (High-Low) as within-subjects factors.

Explicit ratings

Using the dep.t.test R function we ran four separated one-way paired-sample t-tests (alternative = GREATER) to measure the explicit ratings of Attractiveness, Intelligence, Competence and Dominance given to the High Status player compared to those given to the Low Status player.

Results

Post-hoc power analysis

We conducted a post hoc power analysis with RStudio (version 1.2.1335) and the pwr package (version 1.2-2). The significance level was set at 0.01, and the effect size of the Status x Block interaction (partial eta squared = 0.42) was converted in the corresponding Cohen's f2. The analysis showed that, with a sample size of 26 subjects, the Status x Task interaction yielded a power of 0.96.

Affect misattribution procedure

While the main effects of Block and Status were not significant (Block: ($F(1,25) = 0.62$, $p = 0.43$; Status ($F(1,25) = 1.36$, $p = 0.25$), we found a significant Block x Status interaction ($F(1,25) = 18.25$, $p < 0.001$, partial eta-squared = 0.42). Bonferroni corrected post hoc tests revealed that in the Long presentation Block (75 ms) the AMP index associated to the High Status player were significantly higher than that associated to the Low Status player ($p < 0.01$), while this was not the case in the

Short presentation Block (17 ms) ($p = 0.23$). Furthermore, the AMP index associated to the High Status player in the Long presentation block was significantly higher than the AMP index associated to the High Status player in the Short presentation block ($p < 0.01$) (see Fig. 4 and Table 1).

Insert Table 1 here

Insert Fig. 4 here

Explicit ratings

We found a significant difference in the Competence ratings ($t(24) = 2.37$, $p = 0.01$, $r = 0.43$) between High Status ($M = 7$, $SD = 1.35$) and Low Status ($M = 6.16$, $SD = 1.34$). There was also a significant difference in the Intelligence ratings ($t(24) = 2.16$, $p = 0.02$, $r = 0.40$) between High Status ($M = 7.16$, $SD = 1.07$) and Low Status ($M = 6.6$, $SD = 1.15$). These results suggest that the participants rated the High Status player as more intelligent and competent than the Low Status player (Table 2). Moreover, the High Status player was rated as more dominant ($M = 5.6$, $SD = 1.85$) than the Low Status one ($M = 4.88$, $SD = 1.67$, $t(24) = 2.12$, $p = 0.02$, $r = 0.39$).

There was no significant difference ($t(25) = -1.60$ $p = 0.93$) in Attractiveness rating scores between High ($M = 4.32$ $SD = 2.12$) and Low Status ($M = 5$, $SD = 2.3$), suggesting that the High Status and Low Status players were evaluated as equally attractive (see Fig 5 and Table 2).

Insert Table 2 here

Insert Fig. 5 here

Discussion

To explore how the dynamic induction of a given social status influences implicit and explicit person appreciation, and whether this impacts the preference for abstract visual stimuli associated to high-

and low-status identity, we adapted a status-inducing procedure from Boksem (2012) in which participants were led to believe that they were playing a cooperative game with two other (unseen) players. A score-based hierarchy was displayed during the game that reflected the relative contribution of each player toward the common goal of increasing a collective score and thus a shared reward. Before and after the game, a modified version of the AMP task was used to investigate whether the evaluation of the two players had been influenced by their relative position in the hierarchy. Using two different prime durations we also explored whether the short vs long presentation time of the different social-status primes might impact the misattribution effect. To our knowledge, this is the first study to use an implicit method for investigating the effects of social status on person evaluation.

Instead, previous research has relied on explicit measures such as scales and questionnaires, limiting the possibility to shed light on implicit mechanisms characterizing social biases. Implicit tasks such as the AMP offer a controlled and rigorous way to measure attitudes and preferences without the participant being aware of what the experimenter is trying to measure, therefore reducing the chance of triggering compliance, adherence to social norms or individuals' dependency on social desirability.

Short presentation AMP

Baseline-corrected pleasantness ratings attributed to abstract stimuli in the High Status condition were not different from those in the Low Status condition, suggesting that the implicit evaluation of the two players in the short presentation task was not affected by their relative status, or that their evaluation was not strong enough to bias the evaluation of the abstract target stimuli. It should be noted that the two faces used as prime images in our study, rather than having an explicit, feature-based valence (e.g. images displaying negative or positive emotions, as in previous studies), were emotionally neutral, and coded as High Status or Low Status players with a competence-based induction procedure. One possible interpretation of this lack of difference in pleasantness ratings is that a presentation timing of 17 is not sufficient for the extraction of knowledge-based status

antecedents (Mattan et al., 2017) from faces, and that a longer processing time is required. This would be in line with the EEG results reported by Breton and colleagues (2014), which suggest that hierarchy does not affect the structural encoding of neutral-expression faces.

It is worth noting that we observed a reduction in the pleasantness ratings of the target pictures from the first AMP session to the second that was independent of the status condition (see Fig 4). This result might suggest that repeating the AMP twice causes a lowering in pleasantness judgements of the target pictures due to habituation effects (see Tinio & Leder, 2009 for a discussion on boredom and mere exposure effect). Our finding that implicit preference for high-status individuals fails to occur when the status prime is presented for 17 ms raises some important issues for the study of implicit social evaluation. We suggest that, while the use of short presentation timings might be adequate when the object of study is a social dimension that is clearly visible (i.e. race, gender, attractiveness, body weight, dominant posture or facial expression), longer presentation timings might better suit the need to investigate the effects of knowledge-based characteristics on social evaluation.

Long presentation AMP

In the AMP_LP, we found that the neutral target's pleasantness ratings were significantly higher in the High Status than in the Low Status condition after the status-inducing procedure (i.e. Session 2 compared to Session 1). The presence of an affect misattribution effect (Payne et al., 2015) suggests that, with the long presentation timing, the pictures of the High Status and Low Status players acted as positive and negative primes, respectively. This result suggests that in the context of a cooperative game, where status is acquired by displaying superior competence and commitment to the common goal, high status individuals are preferred over low status ones. A preference for high-ranking individuals is common among non-human primates: for example, male rhesus macaques are willing to sacrifice a reward for viewing the picture of a high-status conspecific (Deaner et al., 2005). Moreover, when choosing partners for a collaborative task, chimpanzees tend to choose as partners those conspecifics that demonstrated better skills in the same task (Melis et al., 2006), suggesting that non-human primates may possess a rudimental form of competence-

based status differentiation. This status bias has also been reported in 21 to 31 month-old toddlers, who showed a preference toward high-ranking puppets, but only if they did not make use of force to outrank the other puppet (Thomas et al., 2018).

From Session 1 to 2 of the AMP, we observed a drop in pleasantness ratings for target abstract stimuli only when paired with Low Status primes, while the difference between Session 1 and Session 2 for High Status primes was close to zero (see Fig. 4). One possible interpretation of such an effect is that, as the game went on, participants developed a negative attitude toward the Low Status player for contributing less to the collective goal (Willer, 2009), while their evaluation of the High Status player was not affected. However, considering the result in the short presentation task (i.e. an overall reduction in pleasantness ratings from Session 1 to Session 2 for targets paired with both High Status and Low Status primes), another possible interpretation could be that, after the status-inducing procedure, participants developed an implicit preference toward the High Status player that counteracted on the habituation effect of seeing the stimuli for a second time. In other words, we can hypothesize that in the long presentation task, the deteriorating judjement of targets paired with the Low Status primes would only reflect the effect of the repetition (as seen in the short presentation task), while the lack of change in the evaluation of targets paired with the High Status prime would reflect a positive bias toward the High Status player. This last interpretation would be in line with the finding that, at least in non-human primates, high status individuals elicit neural responses related to reward processing (Deaner et al., 2005). While the neural bases of implicit attitudes have been extensively investigated in previous research (see Stanley et al., 2008 for a review), the neural mechanisms that support the process of affective misattribution in the AMP are far from being understood. Status perception involves a wide range of specific neural systems related to person evaluation, attention and salience (Cloutier et al., 2014; Zink et al., 2008; Marsh et al., 2009). One important finding is that high status individuals also elicit greater responses in areas involved in reward processing (Singer et al., 2004; Ly et al., 2011). A possible neural pathway supporting the implementation of the implicit preference toward the high status that we observed in our study would likely involve low-level perceptual areas (i.e. the fusiform face area – Kanwisher et

al., 1997), frontal areas supporting face recognition (Haxby et al., 1996) and, finally, reward-related areas such as striatum and orbitofrontal cortex (Singer et al., 2004). At a very speculative level, we would like to propose that the activation of reward-related brain areas might be the neural correlate of the misattribution effect, in the sense that, due to the very short interval between the prime and the target, reward processing triggered by the prime is “attached” to the neutral target. Coherent with such an interpretation is that a reduction of the misattribution effect has been reported when increasing the temporal distance between prime and target (Payne 2005, experiment 3). The investigation of the neural basis of affective misattribution with different presentation timings might constitute the object of future studies.

Explicit ratings

The implicit results in the long presentation AMP were paralleled at the explicit level by a significant difference in the ratings of the High Status and Low Status players in terms of Competence and Intelligence, confirming the effectiveness of our procedure in inducing a status-based differentiation of the two players (see Fig. 5).

The High Status player was also rated as more dominant. This last finding seems at odds with the “two ways to the top” theory of status, which posits that dominance and competence are two separate (although equally effective) pathways for status acquisition (Heinrich and Gill-White, 2001; Cheng et al. 2013). However, this assumption has been questioned by other researchers, who suggested that dominance itself involves competence and the conferring of prestige, and that pure dominance status does not exist (Chapais, 2015). Our results seem to confirm this second stance.

Limits

This study is limited by the fact that, contrary to the implicit measure, the explicit evaluation of the two players was only collected after the status-inducing procedure. We adopted this method because we reasoned that asking participants to make a judgement about the competence and intelligence of the two players might have revealed the real purpose of the experiment. However,

this method prevented us from measuring the change in the explicit evaluation before and after the manipulation. Since the High Status player was also contributing more to the common gain than the Low Status one, it is possible that the found effect might not be attributed to partners' competence, but to the higher (or lower) economical contribution offered to the group and thus to the participant gain. Indeed, in the present study the dimensions of competence and the contribution to the common goal are linked to one-another in a way that makes it difficult to tease apart their possible independent role in the present results. Our intention was to study individuals' implicit reactivity to others' status in a cooperative scenario, because here the contribution to a common (cooperative) goal was manipulated as an important feature to induce social status. Our choice was specifically grounded on previous studies showing that an individual's contribution to collective gain increases his or her perceived status (Hardy and Van Vugt, 2006; Willer, 2009). A wide variety of studies from social psychology has repeatedly shown that individuals seek social status in groups by displaying not only higher levels of competence but also stronger commitment to the common goal (see Anderson and Kilduff, 2009 for review). Moreover, our paradigm was adapted from a previous study (Boksem et al., 2012), in which it was shown that participant's stance within a competence- *and* contribution-based hierarchy influenced their neural response to a negative feedback, suggesting that this procedure is adequate to induce a status-based differentiation. Future studies are needed in order to try to dissociate, in a cooperative scenario, the impact of a partner's contribution from that of his/her perceived competence on individual's implicit affective response to his perceived status. We believe that our present work shows for the first time that, although contributing to a group gain might determine status attribution per se (Willer, 2009), competence-based (and eventually contribution-based) status attribution in a cooperative scenario modulates individual's implicit preferences.

We acknowledge that the choice of involving only male participants in the present study is somewhat arbitrary. The rationale behind this decision is that since the paradigm implemented in the study is entirely novel and studies indicate that gender may interact with susceptibility to status induction (Santamaria-Garcia et al., 2015; Breton et al., 2018), we wanted to reduce unduly sources of variance (including only images depicting males as stimuli and involving only male participants to

include only same gender players). Future studies should explore whether any gender effect associated to status may modulate implicit preference.

Conclusion

Our results suggest that within a newly formed group of individuals who are trying to achieve a common goal, a status differentiation occurs based on the competence and goal commitment displayed by each member of the group. We show that this status-based differentiation leads to an implicit preference for the higher status identity and that this preference is misattributed to an abstract target when that target must be evaluated. Our results go beyond previous findings on status-based evaluation (Varnum, 2013; Jost and Burgess, 2000; Cheng & Tracy, 2013) by demonstrating that the more positive evaluation of high-status individuals occurs not only at the explicit but also at the implicit level. Previous studies using interactive games found neural and behavioral effects of competence-based social status (Santamaria-Garcia et al., 2013; 2015; Zink et al., 2008, Boksem et al., 2012). We further explored this issue by demonstrating that the target's relative status within a competence-based hierarchy also elicits congruent affective reactions which are projected over the preference evaluation of an abstract stimulus. Our results expand previous research on how social evaluation can be influenced by many visible characteristics of the model (e.g. race, gender, body weight) and demonstrate that social evaluation can also be influenced by non-visible, higher-order variables such as individuals' competence- and contribution to a common goal. In conclusion, the present findings support the view that high status individuals who attain status by demonstrating superior skills and by making higher contributions to the group are preferred over the low status individuals.

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Compliance with ethical standards

The authors declare that they have no conflict of interest.

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653 Figures' and Table's captions

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655 Fig.1 Timeline of the experimental procedure

656

657 Fig. 2 AMP trial timeline. A) Short presentation task. A fixation cross was presented for 1000 ms,
658 followed by a forward mask for 100 ms, the prime image (face of Player A or Player B) for 17 ms
659 and a backward mask for 100 ms. The target image was then presented for 1000 ms, followed by a
660 slide displaying the sentence "how much do you like this image?" and a vertical VAS ranging from
661 "Extremely" (top end) to "Not at all" (bottom end). This slide remained until the participant responded
662 to the question with a mouse click on the VAS. B) Long presentation AMP. The trial structure was
663 identical to the short presentation, with two exceptions: the prime lasted 75 ms and only the
664 backward mask was presented.

665

666 Fig. 3 Time Estimation task trial timeline. A blue circle was presented for a time varying between
667 1500 and 3500 ms, when it turned green. Participants were asked to press the space bar exactly 1
668 second after the color change. After this response, a feedback slide was presented that featured a
669 smile (correct response) or a frown (error), as well as the participant's score for the trial (5 for a
670 correct response, 0 for errors). In the upper part of the slide, participants could also see their
671 individual cumulative score. Every 10 trials a feedback slide featuring both the group score and
672 player ranking was displayed.

673

674 Fig. 4 Feedback slide presented every 10 trials during the Time Estimation task. Subjects were
675 informed about their position within the hierarchy, which was made more explicit by the use of stars
676 below each picture. Displayed on the upper left side of the slide was the sentence "Your shared

score." Next to this text was the corresponding number, which was updated with every feedback presentation.

Fig. 5 Graph of Block x Status interaction. Values represent mean baseline-corrected (Session 2 – Session 1) VAS scores for target evaluation after the presentation of HighStatus (HS) and LowStatus (LS) primes. Marked differences are significant at $p < 0.001$.

Fig. 6 Graph of explicit ratings results. Marked differences are significant at $p < 0.05$.

Table 1 Descriptive statistics (means and standard deviations) for baseline-corrected (Session 2 – Session 1) target evaluation VAS scores. HS = HighStatus prime; LS = LowStatus prime; SP = short presentation task; LP = long presentation task.

Table 2 Descriptive statistics (means and standard deviations) for explicit ratings after the status-inducing procedure. HS: HighStatus; LS: LowStatus; COMP: Competence; INT: Intelligence; DOM: Dominance; ATTR: Attractiveness.