Group Identities in Conflicts

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Abstract

We study an inter-group contest where each of the two conflicting groups can develop either a group identity or an individualistic identity. A group identity eliminates free-riding behavior within the group but intensifies the inter-group contest. We show the following: if groups are similar in size and technologies, both adopt group identities. This results in welfare losses for all individuals. If one group is considerably stronger in the contest, only this group will develop a group identity and benefit at the expense of the other. Outgroup hostility favors asymmetric identities. Applications and theoretical background are discussed.

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1 Introduction

Many political, economic, and social conflicts are carried out among groups rather than by individuals. The payoff structure in such inter-group conflicts entails clear disincentives for individual group members to exert effort: individuals bear the full costs of their efforts (e.g., in opportunities forgone, physical exertion, and risk of death or injury) while the (marginal) benefits from success in the conflict largely spill over to other group members (Esteban and Ray, 2001). In the presence of such within-group free-rider problems, groups can be expected to have a competitive advantage in conflicts with other groups if they are able to internalize their intra-group externalities, e.g., by means of formal rules, institutions, norms, or group identities (Bornstein, 2003, Takàcs, 2001). Often groups do not have access to formal rules or institutions. In such situations, a common group identity may be one (but potentially "coarse") way to create norms of cooperative behavior among group members (see, e.g., Sherif 1966, Akerlof and Kranton 2000, Ginges and Atran 2009).

In this paper we study the *emergence* of group identities in conflicts between groups. Roughly, a group identity helps to align individual members' behavior with the overall interest of the group, thus solving internal free-riding problems,[1] but potentially at the cost of an increased out-group hostility. Our major point is that the emergence or non-emergence of such group identities is contingent on the conflict situation, i.e., on the involved groups' relative strengths, as approximated by their size, contest technology, available resources, etc. The benefit from a group identity is that it aligns (possibly in an imperfect way) individual behavior with the group's overall interests; as a consequence, individuals who identify with their group strive harder in the conflict.

We discuss the emergence of group identities in the following framework: in a rent-seeking contest, two groups compete for a given prize that is shared among group members of the winning group. The contest exhibits standard within-group externalities.[2] We combine this approach with a model of endogenous social identities, based on the minimum-group paradigm from social identity theory (SIT; Tajfel

[1]McLeish and Oxoby (2011) provide support for the idea that the salience of a shared identities has positive effects on the willingness to cooperate.

[2]For a survey of the literature on contests between groups see Garfinkel and Skaperdas (2007), Section 7, or Konrad (2009), Chapters 5.5 and 7.

and Turner 1979, 1986) and borrows from Shayo (2007, 2009) and Choi and Bowles (2007):[3] individual members of both groups can either develop a group identity or an individualistic identity (see Section 2). Individualistic group members only care for their personal material payoff (and act accordingly). By contrast, individuals with a group identity act in the interest of the whole group; they may, in addition, also bear hostility towards the other group (spiteful behavior).

It turns out that the structure and welfare of the associated equilibria depends on two factors, relative group size and relative advantage in the technology of conflict. In particular, if groups are similar (i.e., of comparable sizes and with equally effective conflict technologies), both will adopt a group identity and behave in accordance with the theory of parochial altruism. This prediction is consistent with experimental evidence in Abbink et al. (2010, 2012) who test for parochialism in a symmetric group conflict. However, both groups will be worse off compared to a situation with individualistic identities. Intra-group incentive effects of identification can, thus, have a dark side – which (only) shows up in an equilibrium context that highlights the symmetry of interests in the creation of identities.[4]

If groups are sufficiently dissimilar, only the relatively larger and/or technologically more effective group (the "top dog") develops a group identity, whereas the other ("underdog") maintains an individualistic identity. The group with a group identity will always profit at the expense of the individualistic one. These findings find support in a study by Pettit and Lount (2010) who found that members of teams work harder in intergroup settings when competing with relatively low-status competitors. The authors were able to identify threats of social-identities and self categorization as an important explanatory variable for this effect.

Relative group size and efficiency matter for identity choice – but for different reasons: in larger groups, the free-rider problem is more severe, implying that larger groups benefit more from a group identity. Differences in contest technology determine, however, whether contest efforts are strategic complements or substitutes (in equilibrium): for the relatively more effective group, investments in the contest are

[3]To our knowledge, Robinson (2001) is the only other paper that discusses the role of social identities in contests. It analyzes in an informal way conflicting group identities if (as in this paper) the process of identification is costless and perfect.

[4]This finding is not confined to incentives generated by the identification with groups but extends to all standard incentive mechanisms.

strategic complements, whereas they are strategic substitutes for the relatively less effective group. Hence, starting from an equilibrium with individualistic identities in both groups, the stronger group *ceteris paribus* induces the other group to reduce their investments in the contest, whereas the opposite is true for the underdog. If within-group solidarity is accompanied by hostility towards other groups, individuals become more aggressive in conflicts. Under such circumstances, one-sided group identities become even more prominent, since the incentive to invest in the contest grows disproportionately stronger for the stronger group.

Our theoretical findings emphasize the contingencies and strategic aspects of identities in group conflicts. In addition to the above mentioned evidence from the laboratory (Pettit and Lount 2010), our theory is supported by and sheds new light on qualitative evidence from real-world conflicts. Examples where identities emerge endogenously are numerous, ranging from fighting spirit on military battlefields or in team sports to historical patterns of nationalism to social phenomena on (seemingly) deviant and dysfunctional behavior. For illustration, we present four cases.

1. The battlefield: Military theorists have always emphasized the decisive role of morale and fighting spirits in wartimes, a conjecture that has in a comprehensive econometric study recently been supported by Rotte and Schmidt (2003). Yet, bravery, perseverance, readiness to make sacrifice and army cohesion are not innate properties of individuals or armies but rather emerge endogenously from the conflict situation. For World War I, Ferguson (1998, pp. 301ff) and Watson (2008, Ch. 6) argue that, in face of increasing disadvantages in terms of troop size, weapons and equipment, the view that victory was out of question spread rapidly through the German military and society in summer 1918 and caused a dispersal of fighting spirit and a collapse of morale that finally turned non-victory and the hope for a draw into defeat. Weitz (2000) argues that a similar pattern of disintegration occurred within the Confederate troops towards the end of the American Civil War. In both cases, the abandonment of group identities were the consequence, rather than the cause, of military inferiority. The strategic aspects of weakening oneself are also well-understood: Varoufakis (1997) outlines a long philosophical and military history where one side in a conflict deliberately chooses a weaker position as an appeal to the dominant opponent to be spared violence. Experimental evidence in Varoufakis (1997) indeed suggests that strong opponents behave less aggressively and magnanimous towards opponents who chose to be weak.

2. Nations and nationalism: Equating, at the national level, a group identity with patriotism or nationalism, our approach parallels the stylized theory of nationalism which social anthropologist Ernest Gellner distills from the history of the Habsburg empire in the 19th century (Gellner 2006[1983]). The theory is framed in terms of a intergroup conflict between the fictitious peoples of "Ruritania" and "Megalomania". Originally, Ruritania was a loosely connected, rural society without any national identity or sense of cultural commonalities amongst its population. It formed part of the Empire of Megalomania. In the wake of industrialization, better education and increases in its population size and power (relative to Megalomania) Ruritanians eventually exchanged their individual identity for a group identity: *"Ruritanians had previously thought and felt in terms of family unit and village . . . But now, . . . the new concept of the Ruritanian nation was born."* (Gellner 2006[1983], p. 69). This stylized historical process can be understood as a move from a situation with a one-sided group identity to two-sided group identities, triggered by (exogenous) changes in relative population sizes and contest technologies. As in our model, the regime switch leads to an intensification of the political, economic and social conflicts between Megalomania and Ruritania, eventually causing Megalomanian hegemony to collapse. Gellner's approach has been fruitfully applied to numerous cases of nationalism around the world (Tambini 1998). Arguing that national identification might be almost effortlessly achieved through simple cultural cues or cheap symbolism, Tyrrell (2007) combined it with SIT.

3. "Dysfunctional" identities: According to Merton (1968), a proper understanding of group behavior can only be obtained when the dysfunctional aspects of institutions are recognized. In his view, one group's functioning could induce another group to be dysfunctional, and vice versa. Our model casts this as a strategic interdependence between the different groups' determination of identities. Our result that an apparently effective strategy, namely the adoption of a costless group identity, may turn out to be suboptimal from a strategic perspective, exemplifies that apparently dysfunctional behavioral patterns may be driven by some kind of "higher" rationality. An individualistic identity seems to be dysfunctional (only) as long as one abstracts from the strategic context of the group. It may, however, be a functional adaptation to a dominant environment; dysfunctionality may be a way to reduce the competitive pressure from other groups. Strategic considerations of this sort have so far not been discussed in the literature on identities and norms.

4. Sports: A number of contributions in social psychology has shown that in sports competitions identification with a group is affected by the groups success (End et al. 2002, Wann et al. 1996, Sloan 1989, Cialdini et al., 1976): after a victory of a team, identity ties among its fans strengthen. Conversely, fans of losing teams tend to disassociate from their team. Anecdotal evidence shows that such effects also arise among the team members themselves: In 1998, when it triumphantly won the FIFA World Cup, the French national soccer team was widely praised for its team spirit and optimistic pride.The French soccer players were clearly hailed for their individual performance and grand technical abilities, but much more for their unified group identity, which symbolized patriotism and shared values in an ethnically diverse nation. By contrast, in 2010, after a lacklustre qualification campaign,the French team was eliminated early from the FIFA World Cup without winning even a single match but amid scenes of selfishness, indifference, indiscipline, and openly racist controversies among players. Though not among the favorites of the tournament, the French squad with its big egos but small team spirit performed vastly under expectations.[5]

The rest of the paper is organized as follows. Section 2 briefly surveys the literature on social identities. Our two-stage model of conflict and identity choice is introduced and analyzed in Section 3. We will discuss issues of commitment and equilibrium selection in Section 4. Section 5 concludes. Proofs are in the Appendix.

2 Social identities and parochial altruism

Our approach rests on the premise that individuals can adopt social or group identities, a concept that is well established in social psychology. According to social identity theory (SIT), developed by among others, by Tajfel et al. (1971), Tajfel and Turner (1979, 1986), or Turner et al. (1987), individual behavior cannot be understood adequately in isolation. Rather one has to account for individual's integration

[5] See http://en.wikipedia.org/wiki/France_national_football_team and http://www.nytimes.com/2010/06/24/world/europe/24france.html.

in social groups. Individuals in identical formal institutions may act differently, depending on the social context. One of the most important results of SIT is that the creation of a "minimum-group situation" – where individuals are randomly and arbitrarily assigned to groups – suffices to generate identification with (the members of) this group and often also antagonism towards members of other groups. The effect even holds if participants know that they are randomly matched.

Choi and Bowles (2007) and De Dreu et al. (2010) strongly underscore the implications of SIT. They argue that two patterns of behavioral dispositions are likely to have evolved from the specific circumstances given in late Pleistocene and early Holocene: parochial altruism towards group members and potential hostility towards outsiders (PA-H) on the one hand and tolerant non-altruism and restricted aggression (TN-RA) on the other. The evolutionary stability of the PA-H and TN-RA allele suggests that there exist either two types of individuals within a population or two types of behavioral dispositions within an individual.

Relying on dispositions shaped by the forces of evolution, group identities are quite "coarse" instruments to direct the incentives in conflicts; mechanism designers might come up with more sophisticated and tailor-made incentive schemes. Our model reflects this "coarseness" by (only) allowing for two types of identities: a group identity (in the sense of PA-H) and an individualistic identity (in the sense of TN-RA). In addition, we focus on general-equilibrium behavior which allows a detailed study of the incentive effects of identities. This distinguishes our approach from, for example, the partial-equilibrium principal-agent model in Akerlof and Kranton (2000, 2005) where identification serves to align the interests of the principal and the agent. The coexistence of cooperation between group members and hostility towards outsiders induces two motives why individuals would spend effort in intergroup conflicts: they can raise their (or their own group's) material well-being and they can lower the well-being of the other group.

In our approach, each individual belongs to precisely one group and can only identify (or not) with this group. Sen (2006) argues that such a "solitarist" view in fact sustains conflict and violence; he prefers to invoke the variety of possible identities from which individuals could select as a temperating device for societal conflicts. As predicted by Sen (2006), identities in our approach create higher conflict intensities. Moreover, we argue that, in case of a conflict between clearly identifiable groups, it is individually rational to join others in adopting a (singular) group identity. For many real-world conflicts, this seems to be descriptively more accurate than Sen's more cosmopolitan vision.

3 A model of identity in conflicts

3.1 Model primitives

The contest: We build on a model of free-rider behavior in intergroup contests developed by Nitzan (1991). Two groups, A and D, compete for a given rent of value R. This rent is rival in consumption, and the fraction of the rent appropriated by a group is divided equally among its members.[6] Individuals perceive themselves as being identical in all respects except for their group membership. Group $j = A, D$ consists of $N_j > 1$ identical members. A member voluntarily invests an amount a_i ($i = 1, \ldots, N_A$ in group A) or d_i ($i = 1, \ldots, N_D$ in group D) in a contest to appropriate the rent. We denote by $a = (a_1, \ldots, a_{N_A}) = (a_i, a_{-i})$ and $d = (d_1, \ldots, d_{N_D}) = (d_i, d_{-i})$ the vectors of investments.

The fractions of the rent that are appropriated by groups A and D are given by generalized Tullock contest-success function,

$$p_A(a, d) = \frac{\theta \cdot \sum_{i=1}^{N_A} a_i}{\theta \cdot \sum_{i=1}^{N_A} a_i + \sum_{i=1}^{N_D} d_i} \quad \text{and} \quad p_D(a, d) = \frac{\sum_{i=1}^{N_D} d_i}{\theta \cdot \sum_{i=1}^{N_A} a_i + \sum_{i=1}^{N_D} d_i}.$$

The parameter $\theta > 0$ measures the relative effectiveness of group A relative to group D. It reflects an important aspect of asymmetry between groups and will shape identity choices.

Individual preferences: The *material payoff* for members of group A and D is given by, respectively,

$$\pi_A^i(a, d) = \frac{1}{N_A} \cdot p_A(a, d) \cdot R - a_i \quad \text{and} \quad \pi_D^i(a, d) = \frac{1}{N_D} \cdot p_D(a, d) \cdot R - d_i. \qquad (1)$$

This specification entails a free-rider problem: every individual bears the full costs of its investment, but only gets a fraction of the additional rent. Hence, if individuals maximize material payoffs incentives to invest in the contest are diluted.

[6] Hence, investments in a group-contest to capture the rent are structurally equivalent to a commons problem. Alternatively the rent could be a group-specific public good. Qualitatively, our results extend to any other sharing rule that does not adjudge the complete marginal return on the investment to individuals.

The basic idea in the literature on identity is that an individual who adopts a certain identity imposes on itself identity-specific behavioral norms (Akerlof and Kranton 2005). In the terminology of Kahneman et al. (1997), changes in identities may go along with different *decision utility functions*, giving rise to different behaviors. For example, Shayo (2007, 2009) explains the consequences of social identities and their endogenous formation by assuming that individuals maximize utility functions that increase in personal material payoffs π^i, in the total benefits (or status) of the category with which they identify and in the homogeneity of the group with which individuals associate. We assume that the behaviorally relevant utility, u^i, is additively separable between the individual's material payoff, π_i, and (perceived) benefits S^i_j that arise when the individuals adopts identity j:

$$u^i(\pi^i, S^i_j) = \pi^i + S^i_j. \tag{2}$$

Following Choi and Bowles' (2007) dichotomy of archetypal behavioral dispositions, we assume that each individual only has two possible social identities. It can develop parochial altruism with respect to group members and hostility to non-group members, which we call a *group identity*), or it can develop tolerant non-altruism and restricted aggression, which we call an *individualistic identity*.

We assume that an individual with individualistic identity only cares for its material payoff, π^i. I.e., $S^i_j = 0$ in (2). In line with parochial altruism, we assume that an individual with a group identity cares for his group's interests, defined in the utilitarian sense as the sum of the group members' material payoffs,

$$\Pi^i_j = \sum_{k \neq i} \pi^k_j$$

($j = A, D$). This specification is a tractable case of the approach in Shayo (2007); what is essential is that Π^i_j is a strictly monotonic, welfarist function that aligns individual incentives and group welfare.

Parochial altruism is often associated with outright hostility towards the other group (Choi and Bowles 2007 Brewer 1999, Tajfel and Turner 1986). We capture this by a preference for dissociation from the other group (Sherif, 1966): the individual delights in seeing benefits of the other group decrease. Hostility towards others is akin to a relative-status motive as in Shayo (2007), giving rise to spiteful behavior. Specifically, for an individual with a group identity we assume that

$$S^i_j = \Pi^i_j - z \cdot \sum_{k=1}^{N_m} \pi^k_m, \quad j, m = A, D; \quad j \neq m,$$

where $z \in [0,1]$ measures the intensity (identical across groups) of hostility borne against the other group.

Identities: Individual identities are binary variables $\alpha_i, \delta_i \in \{0,1\}$ (for members $i = 1, \ldots, N_A$ in group A and $i = 1, \ldots, N_D$ of group D) where α_i $[\delta_i]$ takes on value 1 if member i of group A $[D]$ identifies with its group, and zero if it chooses an individualistic identity. In the terminology of Searle (2010), social identities are status functions that are necessarily ontologically subjective and that build on their collective recognition. We therefore assume that a group identity for the group as a whole only emerges if all members of that group identify with it.[7] Group identities are, thus, binary functions such that

$$\alpha = \begin{cases} 1 & \text{if } \alpha_i = 1\, \forall i = 1, \ldots, N_A \\ 0 & \text{else,} \end{cases} \quad \text{and} \quad \delta = \begin{cases} 1 & \text{if } \delta_i = 1\, \forall i = 1, \ldots, N_D \\ 0 & \text{else.} \end{cases} \tag{3}$$

Plugging all this into (2), we write decision utilities as

$$u_A^i = \pi_A^i + \alpha \left(\sum_{k \neq i} \pi_A^k - z \sum_{k=1}^{N_D} \pi_D^k \right) \quad \text{and} \quad u_D^i = \pi_D^i + \delta \left(\sum_{k \neq j} \pi_D^k - z \sum_{k=1}^{N_A} \pi_A^k \right). \tag{4}$$

Both u_A^i and u_D^i depend on investments (a, d) in the contest, on the chosen identities (α, δ), as well as on the primitives N_A, N_D, θ, and z. Suppressing these exogenous parameters, we write:

$$u_A^i = u_A^i(a, d, \alpha, \delta) \quad \text{and} \quad u_D^i = u_D^i(a, d, \alpha, \delta).$$

The game: We analyze a two-stage game where group members invest in the contest for given identities at the second stage and choose identities at the first stage. Somewhat loosely,[8] an equilibrium is a tuple $\{a^*, d^*, \alpha^*, \delta^*\}$ such that

- for all $i = 1, \ldots, N_A$ and $k = 1, \ldots, N_D$, a_i^* maximizes u_A^i and d_k^* maximizes u_D^k, given the values of $\{\alpha^*, \delta^*\}$, and

[7] This assumption buys us a simple game in Section 3.2 since we need not consider all possible vectors of individual identities that might emerge within a group. We may lose asymmetric equilibria, which are, however, of secondary interest. In a richer model the "unanimity" assumption (3) could be replaced by a trigger function, conveying that a group identity prevails once a certain threshold of support is reached.

[8] We will be more specific about the equilibrium concept later.

- the individual choices of identities α_i, δ_k in the first stage give rise to group identities α^* and δ^* that maximize, respectively, u_A^i and u_D^k for members of A and D, anticipating the effects on stage-two behavior.

We assume that identity choices become common knowledge after the first stage and that individuals commit to the identities previously adopted (see Section 4 for a discussion).

In the second-stage subgame, identity profiles are already given. Specifically, exactly one of the following four cases prevails: both groups have an individualistic identity, only one group has an individualistic identity (two permutative cases), and both groups have a group identity. Individuals now decide on their investments in the contest. The structure of the Nash equilibria of such games is well-studied and we refrain from presenting them formally here.[9] The details are reported in the Appendix.

3.2 Identities in equilibrium

In the first stage of the game, each individual of group A [D] maximizes her utility by the choice of α^i [δ_i], anticipating the second-stage contest and considering the identity choices α^{-i} [δ^{-i}] of the other agents and the emerging identities δ and α. We assume that all individuals in a group coordinate on an identity simultaneously. This appears justified by the minimal-group paradigm; for more complex scenarios, a richer model should identity formation as a process, spread over time, moving sequentially and possibly triggered by past events.

The "unanimous" aggregation rule (3) implies that the game has multiple Nash equilibria, all resulting from self-fulfilling expectations about individualistic strategies by at least one other member of the group. To get rid of the multiplicity of equilibria – which can generally not be avoided in coordination games –, there are (at least) two ways: first, by simply imposing the conjecture that group members behave as representative agents of their group and, second, by choosing a more refined equilibrium concept (for the identity subgame). Trembling-hand perfection of

[9]The case with individualistic identities has multiple equilibria with the property that total investments are identical in all of them (Baik 2008). We restrict attention to equilibria where the members of the same group choose identical investment levels.

the equilibria is an appropriate choice; it is based on the idea that the event that all except for one individuals of a group unanimously choose either an individualistic or a group identity happens with strictly positive probability in any perturbed game. As a consequence, every individual is decisive for the determination of a group identity with a strictly positive probability.[10]

Both the quick fix *via* a representative agent and the refinement to trembling-hand perfect subgame equilibria lead to the same result (although at different degrees of sophistication and rigor). We report the outcome in Proposition 1 below – which is an immediate corollary of the more technical Proposition 3 on trembling-hand perfect equilibria. This result is presented in the Appendix, which also provides an exact definition of the critical value $\hat{z}$. With slight abuse in terminology, we shall refer to pairs (α, δ) as Nash equilibrium identities of the identity-choice game; strictly we should report vectors of individual identity choices which then aggregate to (α, δ) according to (3).

Proposition 1: Suppose that outgroup hostility in case of a group identity is not too strong ($0 \leq z \leq \hat{z} \ll 1$). Then there exist threshold values $\underline{\theta} = \underline{\theta}(z, N_A, N_D)$ and $\bar{\theta} = \bar{\theta}(z, N_A, N_D)$ with $0 < \underline{\theta} < \bar{\theta}$ for all (z, N_A, N_D) such that:

1. if $\theta < \underline{\theta}$ the unique Nash equilibrium of the identity-choice game is $(\alpha, \delta) = (0, 1)$;
2. if $\underline{\theta} < \theta < \bar{\theta}$ the unique Nash equilibrium of the identity-choice game is $(\alpha, \delta) = (1, 1)$;
3. if $\theta > \bar{\theta}$ the unique Nash equilibrium of the identity-choice game is $(\alpha, \delta) = (1, 0)$.

Suppose that outgroup hostility in case of a group identity is strong ($1 > z > \hat{z}$). Then there exist threshold values $\underline{\theta} = \underline{\theta}(z, N_A, N_D)$ and $\bar{\theta} = \bar{\theta}(z, N_A, N_D)$ with $0 < \underline{\theta} < \bar{\theta}$ for all (z, N_A, N_D) such:

1. if $\theta < \underline{\theta}$ the unique Nash equilibrium of the identity-choice game is $(\alpha, \delta) = (0, 1)$;

[10] Internal commitment mechanisms frequently promote a sense of individual responsibility for the group. Being pivotal with positive probability can be interpreted as a formalization of such a sense of responsibility (see Section 4).

2. if $\underline{\theta} < \theta < \bar{\theta}$ there exist two Nash equilibria in the identity-choice game: $(\alpha, \delta) = (1, 0)$ and $(\alpha, \delta) = (0, 1)$;
3. if $\theta > \bar{\theta}$ the unique Nash equilibrium of the identity-choice game is $(\alpha, \delta) = (1, 0)$.

For an explanation let us start with the case of no or weak hostility levels ($0 \leq z < \hat{z}$). If neither group has a large relative advantage in the contest, it is a dominant strategy for all individuals to identify with their respective group. Hence, identity profile $(\alpha, \delta) = (1, 1)$ emerges in equilibrium. If, however, one group has a sufficiently large advantage in the contest, the picture changes. Suppose, e.g., that θ is large, i.e., group A has a large relative advantage. Group A then still has a dominant strategy to choose a group identity. With θ sufficiently large, however, it is also a dominant strategy for members of group D not to identify with their group. For "intermediate" values of θ, group members in D would prefer a group identity if members of group A chose an individualistic identity, whereas they would prefer an individualistic identity otherwise.

The intuition for the existence of asymmetric equilibria can best be understood in terms of Dixit's (1987) discussion of underdogs and favorites in contests. Without behavioral changes by group A, group D would unambiguously benefit from choosing a group identity. However, group A reacts to changes in behavior by group D. For large values of θ, efforts a of group A are strategic complements for efforts d of group D, and d is a strategic substitute for a. This implies that group A will react by increasing its investment in the contest when group D adopts a group identity (and thus, ceteris paribus, becomes more aggressive). As θ is large (group A has a more effective contest technology), this reduces the chances for group D to succeed in the contest in spite of the identity-induced increase in d. Hence, group D is better off by not adopting a group identity. Similar effects arise with respect to group sizes: a group identity is beneficial for large and strong groups but may be detrimental for weak and small groups (see below).

Stronger levels of hostility ($z > \hat{z}$) make a group identity *ceteris paribus* more attractive for strong groups: the marginal benefit of investments in the contest is now even larger (out of the motive of spite), and having a group identity fosters investments. For a weak group, however, the "underdog"-position becomes even less attractive with stronger hostility, and the incentive to stop the stronger group from exerting too much effort in the contest increases. Hence, hostility reinforces the intuition for asymmetric groups.

Our results suggest an important interplay between group identities and contest structure. Re-iterating the applications discussed in the Introduction, they shed new light on processes like the development and breakdown of team- or fighting spirit in sports or warfare or (as a more singular, historical event) the asynchronous development of nationalism. Proposition 1 implicitly also encompasses interesting comparative statics with respect to group sizes (N_A, N_D) and relative contest efficiency (θ). Exogenous shifts in these parameters lead to different identity equilibria. In particular, a decrease in N_A or in θ may induce group A to replace a formerly held group identity by an individualistic identity (*mutatis mutandis*, for group D this might happen when N_D decreases or θ increases) and, consequently, to a discontinuous reduction in contest efforts. This helps to explain the "battlefield phenomena" described in Section 1. Similarly, starting from a situation with a one-sided group identity, the formerly individualistic group (which was relatively small or weak) may adopt switch to a group identity and, as a consequence, to a sharper between-group conflict once it experiences an increase in size or in relative productivity; this is reminiscent of Gellner's Ruritania narrative for nationalism.

At first glance, our result that large, "majority" groups are more likely than small, "minority" groups to develop identity ties appears at odds with social distinctiveness theory (SDT; Brewer 1991). A second look reveals, however, that it in fact contributes to a deeper understanding of the factors favoring group identities in practice. A comparative advantage of smaller groups in forming shared identities is akin to Olson's "group size paradox" (Olson 1965) which posits that larger groups have greater difficulties in establishing and organizing themselves than smaller, homogeneous ones. Empirical investigations of the group-size paradox and related issues, however, paint a diverse picture (see Agrarwal and Goyal 2001). Among others, Marwell and Oliver (1993), McAdam (1882), Oliver (1993), McCarthy and Wolfson (1996), and Dejean et al. (2009) show a positive correlation between group size and within-group cooperation. Brewer (1992, p. 480), in discussing her own experimental evidence that social identities were stronger in majority groups, conjectures that majority groups might generally be perceived as high-status groups (which makes it *ceteris paribus* attractive to identify with). Our analysis shows that it is exactly the comparatively larger free-rider problem faced by majority groups that makes a group identity potentially valuable, *all other things being equal*. In practice, however, all other things are usually not equal, and a logically independent but empirically often correlated explanatory variable is intra-group heterogeneity. Generally, the intersection of individual characteristics and common traits is smaller in larger groups, which makes it harder in larger (and therefore more diverse) groups to define a social identity that relies on mutually accepted and shared markers. By assuming that all individuals are identical within groups, our formal model keeps a group's potential for building a social identity independent of its size. This observation has two important implications. First, "pure" group-size effects should be conceptually distinguished from effects due to increased heterogeneity. Second, the predictive power of SDT as well as of our model for specific conflicts depends on the degree of heterogeneity within groups.

3.3 Welfare

We treat group identities not an intrinsic and potentially welfare-relevant sources of utility for individuals. It "only" induces individuals to behave in the collective interest, irrespectively of what individual benefits are (Ginges and Atran 2009). In the terminology of Kahneman et al. (1997), material payoffs are the "experienced utilities" which (for individuals with a group identity) differ from decision utilities (4). If intrinsic utility gains from identification with a group were assumed, the underlying change in preferences would pose severe problems for any assessment that relies on the idea of normative individualism (Fang and Loury 2005). In addition, a theory easily becomes meaningless in the sense that sufficiently large "empathy rents" from identifying with the rest of the group may easily outweigh any change in material payoffs.[11] Taking *per-capita* rents as the basis for welfare comparisons avoids these problems, and the material payoffs of the individuals are good proxies for welfare in this context.[12] To see the welfare implications of identity choice, we compare the equilibrium levels of material utility with the levels when both groups

[11]Bierbrauer and Netzer (2012) discuss this issue in the context of mechanism design where they show that a mechanism designer that manages expectations in a smart way can easily induce welfare gains by influencing the individuals' preferences.

[12]The supplement "in this context" is of importance because (i) the choice of a specific identity can be a major factor for personal well-being and (ii) quantitative measures of material well-being may not be strictly positively correlated with utility.

choose individualistic identities.

Proposition 2:

1. In any asymmetric equilibrium, the group with a group identity is better off and the individualistic group is worse off compared to a situation of two-sided individualism.
2. In an equilibrium with two-sided group identities, both groups are worse off if they have similar sizes, group A is better off and group D is worse off if N_A is sufficiently larger than N_D and θ is relatively large, group D is better off and group A is worse off if N_D is sufficiently larger than N_A and θ is relatively small, compared to a situation of two-sided individualism.

Proposition 2 shows that the unilateral formation of a group identity increases the material welfare of the group with group identity, but necessarily at the expense of the other, individualistic group. If z is small enough to allow for two-sided group identities, both groups lose from the formation of group identities if they are of similar size. However, even with two-sided group identities it is possible that one group profits at the expense of the other, namely if this group is sufficiently larger than the other or has a sufficiently large technological advantage.

When applied to military conflicts, Proposition 2 highlights the fact that the development of a group identity or ideals like "service before self" may in fact mitigate the incentive problem present for each soldier involved in a battle. However, because the incentives to create those identities are on both sides, the consequence is an intensification of the conflict and, consequently, a larger dissipation of the rent. This is reminiscent of Dawes (1980)'s analysis of battles as a social dilemma where, without group identity, "taking chances" (i.e., defection) is rational for the individual but harmful to the group while, from a broader perspective that includes all soldiers on both sides, defection is both individually rational and collectively efficient. If individual incentives for defection are eliminated (by, say, promoting group identities), "*the result will be a rout and slaughter worse for all the soldiers than is taking chances*" (Dawes, 1980, p. 170).

4 Further Discussion

Implicitly, our model entails that a problem of commitment and one of equilibrium selection are solved. Though apparently technical, these issues deserve further conceptual discussion.

Commitment: Commitment is key to understanding why group members stick to their identities: why should individuals behave in stage 2 according to the group identities chosen in stage 1? After all, identities should be regarded as quite fluid according to the minimum-group paradigm, and their "stickiness" cannot be taken for granted in the absence of formal commitment mechanisms.[13]

Credible commitment mechanisms can be external: as self-inflicted inflexibilities ("burning bridges") at the individual level – e.g., by binding contracts or holding illiquid assets – or at the group level – e.g., by creating institutions (Bénabou and Tirole 2005) or enforcement mechanisms that promote coordination or sanction the lack thereof (e.g., establishing the rule of law plus a police system to enforce it). Moreover, commitment can also arise internally, from influencing individuals' mind sets. In general, embedding members into networks and symbolic linkages between their activities and personal lives promote commitment (Passy and Giugni 2000). Kanter (1968) distinguishes two types of internal mechanisms, cohesion mechanisms and control mechanisms. Relevant examples of the former include geographic isolation, economic self-sufficiency, distinctive cultural codes, community songs, rites and celebrations. These mechanisms work by barring individuals from distractions through outside stimuli or by implanting pro-group attitudes in individuals' minds. Control mechanisms bind individuals' self-esteem to the group's norms, create a group narrative, an "injustice frame", or an ideology to accomplish "institutionalized awe", thus satisfying individuals' need for meaning and orientation. Sociological approaches suggest that the credibility of such narratives etc. depends on whether they arise in secrecy or in public; publicness acts as a strong commitment device (Ryan and Gamson 2006). To be both adoptable and stable, group identities must be grounded in distinguishing factors of sufficient salience. The discussion shows

[13]Note a problem of causality here: many empirical studies show that social identities facilitate commitment, implying that they themselves can be interpreted as a commitment mechanism (Burke and Reitzes 1991). At the same time, commitment is necessary to sustain collective identities (Hunt and Benford 2004).

that our results rely on the existence of these factors; a more general theory should encompass the emergence of such salient factors.

Equilibrium selection in coordination games: The identity-choice subgame in our model technically is a coordination game: a group identity will only be achieved in (3) if all individuals adjust their actions uniformly. Likewise, in SIT a uniform understanding is required for social categories if they are meant to "provide a system of orientation for self-reference ... [and to] create and define the individual's place in society" (Tajfel and Turner 1986, p. 16). Arriving at such a common understanding also raises a coordination problem, similar to the emergence of generally recognized norms, conventions (Young 1993) or societal control mechanisms (Kanter 1968).

Games with multiple equilibria leave the predicted outcome *a priori* unclear unless criteria for equilibrium selection are added. We use trembling-hand perfection to single out the symmetric equilibrium where all individuals choose to adopt a group identity (see Section 3.3). Alternatively, we could resort to focality (Schelling 1960) and posit that individuals are likely to coordinate on an equilibrium if it is more prominent or conspicuous than others. Given our assumption of identical individuals within groups, equilibria where all individuals choose the same strategy are certainly focal. Various studies have indeed confirmed this hypothesis for games with a salient and non-conflicting decision label and symmetric payoffs – which in our model is guaranteed by assumption. However, Crawford et al. (2008) and others show that focal points fail to align behavior if players are heterogeneous.

Altogether, the the literature on equilibrium selection suggests that group salience and homogeneity are key for successful equilibrium selection. Our assumption of within-group homogeneity is therefore consistent with our assumption of trembling-hand perfection as an equilibrium-selection device. Our results will most likely to be applicable to situations where a large degree of homogeneity with respect to the most salient characteristics of group members exists. This finding builds a bridge to our earlier discussion that commitment via societal cohesion or control mechanisms is easier the less diverse a group is.

5 Conclusions

Social identities shape behavior and performance in conflicts. However, they are neither exogenous nor chosen by individuals in hermitage or adopted by groups in isolation. Rather, they are equilibrium outcomes and can only be understood relative to the social game in which they are embedded. This general point and the specific results derived in this paper have positive as well as normative implications for strategies that aim at promoting identification of group members with the objectives of their group. From a normative point of view, and contrary to the optimistic picture portrayed by most of the literature on identities, identities have a dark side: if identification with one's group is used in incentive problems that entail an inter-group contest, both groups may turn out to be worse off if adopting group identities; the attending game has the character of a prisoners' dilemma. And even in an asymmetric equilibrium, the group adopting a group identity does so at the expense of the other. From a positive point of view, our results identify two key variables that influence group identities in conflicts: differences in relative strength between the groups and relative group sizes. By and large, a group identity seems to be more important in large groups with a relatively effective conflict technology.

The general effects emerging from our model may help to explain social phenomena in a variety of societal conflicts and contests. It is needless to say, however, that conflicts are not solely identity-driven and that identities may evolve also in situations, or from aspects, other than contests. Yet, the analysis of identities as an equilibrium outcome and of the determinants that shape them appears a promising research avenue.

Appendix

Equilibria of the second-stage subgame (Section 3.2)

Suppressing constant parameters in notation, denote by $V_A(\alpha,\delta)$ and $V_D(\alpha,\delta)$ the subgame equilibrium levels of material individual payoffs π_A^i and π_D^i for members of groups A and D, respectively (individual indexes can be dropped by symmetry within groups). Formally, V_A and V_D are the Nash equilibrium values of u_A^i and u_D^i when individual group members solve the problems $\max_{a_i} u_A^i(a_i, a_{-i}, d, \alpha, \delta)$ and $\max_i u_D^i(a, d_i, d_{-i}, \alpha, \delta)$, respectively. Since $(\alpha,\delta) \in \{0,1\}^2$, four cases have to be distinguished:

Case 1: Both groups have an individualistic identity. A representative member of group A, D solves the following problem:

$$\max_{a_i} u_A^i(a_i, a_{-i}, d, 0, 0), \quad \max_{i} u_D^i(a, d_i, d_{-i}, 0, 0).$$

The Nash equilibrium in this subgame is given by

$$a_i(0,0) = \frac{N_D R\theta}{N_A(N_A + N_D\theta)^2}, \quad d_i(0,0) = \frac{N_A R\theta}{N_D(N_A + N_D\theta)^2}. \tag{A.1}$$

Hence, investments in the conflict are decreasing in the size of one's own group: the larger the group, the smaller is the effect of an individual's contribution on the outcome of the game, and the larger are incentives to free-ride.

In this case, individual payoffs u_j^i coincide with own per-capita material payoffs, π_i^k:

$$V_A(0,0) = \frac{N_D R\theta(N_A + N_D\theta - 1)}{N_A(N_A + N_D\theta)^2}, \quad V_D(0,0) = \frac{N_A R(N_A + (N_D - 1)\theta)}{N_D(N_A + N_D\theta)^2}. \tag{A.2}$$

Case 2: Only group D has a group identity. With $(\alpha, \delta) = (0, 1)$, representative members of group A and D solve the following problems:

$$\max_{a_i} u_A(a_i, a_{-i}, d, 0, 1), \quad \text{and} \quad \max_{d_i} u_D(a, d_i, d_{-i}, 0, 1).$$

The Nash equilibrium of this subgame is given by

$$a_i(0,1) = \frac{R\theta(z+1)}{N_A((1+z)N_A + \theta)^2}, \quad d_i(0,1) = \frac{RN_A\theta(z+1)^2}{N_D((1+z)N_A + \theta)^2}. \tag{A.3}$$

The associated per-capita material welfare levels are

$$\begin{aligned} V_A(0,1) &= \frac{R\theta(N_A + \theta + (N_A - 1)z - 1)}{N_A((1+z)N_A + \theta)^2}, \qquad\qquad (A.4) \\ V_D(0,1) &= \frac{R(N_a^2 N_d(1+z)^2 - N_d\theta^2 z - N_a\theta(1+z)(1 + N_d(z-1) + z))}{N_D((1+z)N_A + \theta)^2}. \end{aligned}$$

Case 3: Only group A has a group identity. The case $(\alpha, \delta) = (1, 0)$ is a permutation of case 2. Per-capita material welfare levels amount to:

$$\begin{aligned} V_A(1,0) &= \frac{R(N_a N_d^2\theta^2(1+z)^2 - N_a z - N_d\theta(1+z)(N_a(z-1) + 1 + z))}{N_A(N_D\theta(z+1) + 1)^2}, \\ V_D(1,0) &= \frac{R((N_D - 1)\theta(z+1) + 1)}{N_D(N_D\theta(z+1) + 1)^2}. \qquad\qquad (A.5) \end{aligned}$$

Case 4: Both groups have a group identity. With $(\alpha, \delta) = (1, 1)$ the individual optimization problems in groups A and D are:

$$\max_{a_i} u_A(a_i, a_{-i}, d, 1, 1), \quad \text{and} \quad \max_{d_i} u_D(a, d_i, d_{-i}, 1, 1).$$

In the Nash equilibrium of this subgame,

$$a_i(1,1) = \frac{R\theta(z+1)}{N_A(\theta+1)^2}, \quad d_i(1,1) = \frac{R\theta(z+1)}{N_D(\theta+1)^2}, \tag{A.6}$$

individuals capture rents of

$$V_A(1,1) = \frac{R((\theta - z)N_a(1+\theta) - (1+z)\theta)}{N_A(\theta+1)^2},$$
$$V_D(1,1) = \frac{R((1-\theta z)N_d(1+\theta) - (1+z)\theta)}{N_D(\theta+1)^2}. \quad (A.7)$$

A full comparison of the various Nash equilibria is only marginally relevant to our analysis. Yet, some aspects deserve mention. Differences in group sizes ($N_A \neq N_D$) and productivities ($\theta \neq 1$) shape the intensity of conflicts in a complex way. Comparing (A.6) and (A.1) for groups of equal size ($N_A = N_D$) shows that group identities lead to a higher conflict intensity. Comparing, for identical group sizes, contest efforts a_i and d_i in the asymmetric cases 2 and 3, individual efforts are higher in groups with a group identity, compared to individualistic groups. Sharper hostility (a higher level of z) leads to more intense conflicts.

Proof of Proposition 1

Proposition 1 is a corollary of Proposition 3 below. Its proof requires some preliminaries.

Let $\Gamma = \{N_A, N_D, \{\alpha_i\}_{i=1,\dots,N_A}, \{\delta_j\}_{j=1,\dots,N_D}, \alpha(.), \delta(.), V_A(.), V_D(.)\}$ be the strategic form of the first-stage game. For $i = 1,\dots,N_A$, denote by α_i^M a mixed strategy for α_i (i.e., a probability that $\alpha_i = 1$ is played) and, likewise, by δ_j^M a mixed strategy on δ_j (with $j = 1,\dots,N_D$). The corresponding game in mixed strategies is defined by $\Gamma^M = \{N_A, N_D, \{\alpha_i^M\}_{i=1,\dots,N_A}, \{\delta_j^M\}_{j=1,\dots,N_D}, \alpha(.), \delta(.), E[V_A(.)], E[V_D(.)]\}$, where we have assumed that individuals maximize their expected material payoff and $E[.]$ denotes the expectations operator. A perturbed game Γ^P is a game Γ^M that allows only for totally mixed strategies $\alpha_i^M \in (0,1)$, $\delta_j^M \in (0,1)$.

Definition: A strategy profile $\{\alpha_i^*\}_{i=1,\dots,N_A}, \{\delta_j^*\}_{j=1,\dots,N_D}$ in Γ is a trembling-hand perfect Nash equilibrium if there is a sequence of perturbed games Γ^P, converging to Γ, for which the sequence of Nash equilibria $\{\alpha_i^{M*}\}_{i=1,\dots,N_A}, \{\delta_j^{M*}\}_{j=1,\dots,N_D}$ converges to $\{\alpha_i^*\}_{i=1,\dots,N_A}, \{\delta_j^*\}_{j=1,\dots,N_D}$.

Proposition 3: There exist threshold values $\hat{z} \in (0,1)$, $\underline{\theta}(z, N_A, N_D)$ and $\bar{\theta}(z, N_A, N_D)$ with $0 < \underline{\theta}(z, N_A, N_D) < \bar{\theta}(z, N_A, N_D)$ such that the following holds.

If $z \leq \hat{z}$ and

1. if $\theta < \underline{\theta}(z, N_A, N_D)$ the unique trembling-hand perfect Nash equilibrium is $\alpha_i^* = 0$ for $i = 1,\dots,N_A$ and $\delta_j^* = 1$ for $j = 1,\dots,N_D$;
2. if $\underline{\theta}(z, N_A, N_D) < \theta < \bar{\theta}(z, N_A, N_D)$ the unique trembling-hand perfect Nash equilibrium is $\alpha_i^* = 1$ for $i = 1,\dots,N_A$, and $\delta_j^* = 1$ for $j = 1,\dots,N_D$;
3. if $\theta > \bar{\theta}(z, N_A, N_D)$ the unique trembling-hand perfect Nash equilibrium is $\alpha_i^* = 1$ for $i = 1,\dots,N_A$, and $\delta_j^* = 0$ for $j = 1,\dots,N_D$;

4. if $\theta = \underline{\theta}(z, N_A, N_D)$ or $\theta = \bar{\theta}(z, N_A, N_D)$ there exist two trembling-hand perfect Nash equilibria, $\alpha_i^* = 0$, $\delta_j^* = 1$ and $\alpha_i^* = 1$, $\delta_j^* = 1$, and $\alpha_i^* = 1$, $\delta_j^* = 0$ and $\alpha_i^* = 1$, $\delta_j^* = 1$, respectively.

If $z > \hat{z}$ and

1. if $\theta < \underline{\theta}(z, N_A, N_D)$ the unique trembling-hand perfect Nash equilibrium is $\alpha_i^* = 0$ for $i = 1, \dots, N_A$, and $\delta_j^* = 1$ for $j = 1, \dots, N_D$;
2. if $\underline{\theta}(z, N_A, N_D) \leq \theta \leq \bar{\theta}(z, N_A, N_D)$ there exist two trembling-hand perfect Nash equilibria, $\alpha_i^* = 0$, $\delta_j^* = 1$, and $\alpha_i^* = 1$, $\delta_j^* = 0$ (with $i = 1, \dots, N_A$ and $j = 1, \dots, N_D$);
3. if $\theta > \bar{\theta}(z, N_A, N_D)$ the unique trembling-hand perfect Nash equilibrium is $\alpha_i^* = 1$ for $i = 1, \dots, N_A$, and $\delta_j^* = 0$ for $j = 1, \dots, N_D$.

If $z = \hat{z}$ and

1. if $\theta < \underline{\theta}(z, N_A, N_D)$ the unique trembling-hand perfect Nash equilibrium is $\alpha_i^* = 0$ for $i = 1, \dots, N_A$, and $\delta_j^* = 1$ for $j = 1, \dots, N_D$;
2. if $\underline{\theta}(z, N_A, N_D) \leq \theta \leq \bar{\theta}(z, N_A, N_D)$ there exist three trembling-hand perfect Nash equilibria, $\alpha_i^* = 0$, $\delta_j^* = 1$, $\alpha_i^* = 1$, $\delta_j^* = 0$, and $\alpha_i^* = 1$, $\delta_j^* = 1$ (with $i = 1, \dots, N_A$ and $j = 1, \dots, N_D$);
3. if $\theta > \bar{\theta}(z, N_A, N_D)$ the unique trembling-hand perfect Nash equilibrium is $\alpha_i^* = 1$ for $i = 1, \dots, N_A$, and $\delta_j^* = 0$ for $j = 1, \dots, N_D$.

Proof of Proposition 3:

The payoff structure for given identities $\{\alpha, \delta\}$ is given in the following matrix, where group A's identity is displayed in the rows and group D's identity in the columns.

	$\delta = 1$	$\delta = 0$
$\alpha = 1$	$V_A(1,1), V_D(1,1)$	$V_A(1,0), V_D(1,0)$
$\alpha = 0$	$V_A(0,1), V_D(0,1)$	$V_A(0,0), V_D(0,0)$

Group D**:** (i.) Assume that individuals of group A independently play $\alpha_i = 0$ with probability $1 - \epsilon_A, \epsilon_A > 0$. In that case, members of the group have an individualistic identity with probability $1 - \epsilon_A^{N_A}$. Assume in addition that individuals of group D independently play $\delta_j = 0$ with probability $1 - \epsilon_D, \epsilon_D > 0$. For $\epsilon_A \to 0$, the utility differential that results from the creation of a group identity for a member of group D is

$$\begin{aligned}\Delta_D(\alpha = 0) &= V_D(0,1) - V_D(0,0) \\ &= \left(\frac{(z+1)(zN_A + N_A - \theta z)}{(zN_A + N_A + \theta)^2} - \frac{N_A + (N_D - 1)\theta}{(N_A + N_D\theta)^2} \right) \frac{N_A R}{N_D}.\end{aligned}$$

This is non-negative if and only if

$$\theta \leq \theta_D^1 := \frac{N_A(N_D + (N_D - 2)z - 1) + \sqrt{N_A^2 \left(N_D^2(z+1)^2 - 2N_D(z+1) + 4z(z+2) + 5\right)}}{2N_D z + 2} > 0.$$

Individual k of group D is only decisive in influencing the group identity if all other members of group D vote $\delta_j = 1$, with happens with probability $\epsilon_D^{N_D-1} > 0 \forall \epsilon_D > 0$. Hence, an individual of group D is better off adopting a group identity.

(ii.) Assume that individuals of group A independently play $\alpha_i = 1$ with probability $1-\epsilon_A, \epsilon_A > 0$. In that case, members of the group have a group identity with probability $1 - \epsilon_A^{N_A}$. Assume in addition that individuals of group D independently play $\delta_j = 0$ with probability $1 - \epsilon_D, \epsilon_D > 0$. For $\epsilon_A \to 0$, the utility differential that results from the creation of a group identity for a member of group D is

$$\begin{aligned}\Delta_D(\alpha = 1) &= V_D(1,1) - V_D(1,0) \\ &= \left(\frac{1-\theta z}{(\theta+1)^2} - \frac{(N_D-1)\theta(z+1)+1}{(N_D\theta(z+1)+1)^2}\right)\frac{R}{N_D}.\end{aligned}$$

This is non-negative if and only if

$$\theta \leq \theta_D^2 := \frac{2}{2z - N_D(z+1) + \sqrt{N_D^2(z+1)^2 - 2N_D(z+1) + 4z(z+2) + 5} + 1} > 0.$$

Individual k of group D is only decisive in influencing the group identity if all other members of group D choose $\delta_j = 1$, with happens with probability $\epsilon_D^{N_D-1} > 0 \forall \epsilon_D > 0$. Hence, an individual of group D is better off adopting a group identity.

Group A**:** (iii.) Assume that individuals of group D independently play $\delta_j = 0$ with probability $1-\epsilon_D, \epsilon_D > 0$. In that case, members of the group have an individualistic identity with probability $1-\epsilon_D^{N_D}$. Assume in addition that individuals of group A independently play $\alpha_i = 0$ with probability $1-\epsilon_A, \epsilon_A > 0$. For $\epsilon_D \to 0$, the utility differential that results from the creation of a group identity for a member of group A is

$$\begin{aligned}\Delta_A(\delta = 0) &= V_A(1,0) - V_A(0,0) \\ &= \left(\frac{(z+1)(N_D\theta(z+1)-z)}{(N_D\theta(z+1)+1)^2} - \frac{N_A + N_D\theta - 1}{(N_A + N_D\theta)^2}\right)\frac{N_D\theta R}{N_A}\theta,\end{aligned}$$

which is non-negative if and only if

$$\theta \geq \theta_A^1 := \frac{\sqrt{N_D^2\left(N_A^2(z+1)^2 - 2N_A(z+1) + 4z(z+2) + 5\right)} - N_D(N_A + (N_A-2)z - 1)}{2N_D^2(z+1)} > 0.$$

Individual k of group A is only decisive in influencing the group identity if all other members of group A set $\alpha_i = 1$, with happens with probability $\epsilon_A^{N_A-1} > 0 \forall \epsilon_A > 0$. Hence, an individual of group D is better off adopting a group identity.

(iv.) Assume that individuals of group D independently play $\delta_j = 1$ with probability $1 - \epsilon_D, \epsilon_D > 0$. In that case, members of the group have a group identity with probability $1 - \epsilon_D^{N_D}$. Assume in addition that individuals of group A independently play $\alpha_i = 0$ with probability $1 - \epsilon_A, \epsilon_A > 0$. For $\epsilon_D \to 0$, the utility differential that results from a group identity for a member of group A is

$$\begin{aligned}\Delta_A(\delta = 1) &= V_A(1,1) - V_A(0,1) \\ &= \left(\frac{\theta - z}{(\theta+1)^2} - \frac{N_A + \theta + (N_A-1)z - 1}{(zN_A + N_A + \theta)^2}\right)\frac{\theta R}{N_A},\end{aligned}$$

which is non-negative if and only if

$$\theta \le \theta_A^2 := \frac{1}{2}\left(2z - N_A(z+1) + \sqrt{N_A^2(z+1)^2 - 2N_A(z+1) + 4z(z+2) + 5} + 1\right) > 0.$$

Member k of group A is only decisive in influencing the group identity if all other members of group A choose $\alpha_i = 1$, which happens with probability $\epsilon_A^{N_A-1} > 0 \forall \epsilon_A > 0$. Hence, a member of group A is better off adopting a group identity.

(v.) Next, it is straightforward to show that $\theta_A^1 < \theta_A^2$ and $\theta_D^2 < \theta_D^1$. Depending on z, we get the following inequalities:

- If $z < \hat{z}$, it follows that $\theta_A^1 < \theta_A^2 < \theta_D^2 < \theta_D^1$.
- If $z > \hat{z}$, it follows that $\theta_A^1 < \theta_D^2 < \theta_A^2 < \theta_D^1$.
- If $z = \hat{z}$, it follows that $\theta_A^1 < \theta_D^2 = \theta_A^2 < \theta_D^1$.

$\hat{z}$ is implicitly defined by $\Psi(\hat{z}) := \theta_D^2(\hat{z}) - \theta_A^2(\hat{z}) = 0$.

Let $z < \hat{z}$. It follows that $\alpha_i = 0$, $\delta_j = 1$ (for all $i = 1, \ldots, N_A$, $j = 1, \ldots, N_D$) is the trembling-hand perfect equilibrium for $\theta \in [0, \theta_A^2)$. For $\theta \in (\theta_A^2, \theta_D^2)$ it follows that $\alpha_i = 1$, $\delta_j = 1$ for all i, j is the trembling-hand perfect equilibrium. For $\theta \in (\theta_D^2, \infty)$ the equilibrium is at $\alpha_i = 1$, $\delta_j = 0$ for all i, j. Finally, for the boundary cases $\theta = \theta_A^2$ and $\theta = \theta_D^2$ the equilibria from both connecting intervals remain equilibria. Putting $\underline{\theta} = \theta_D^2$ and $\bar{\theta} = \theta_A^2$, the claim follows.

Let $z > \hat{z}$. With the above utility differentials it follows that $\alpha_i = 0$, $\delta_j = 1$ for $i = 1, \ldots, N_A$, $j = 1, \ldots, N_D$ is the trembling-hand perfect equilibrium for $\theta \in [0, \theta_D^2)$. For $\theta \in [\theta_D^2, \theta_A^2]$ the equilibrium is $\alpha_i = 0$, $\delta_j = 1$ as well as $\alpha_i = 1$, $\delta_j = 0$ for all i, j are trembling-hand perfect equilibria. Finally, for $\theta \in (\theta_A^2, \infty)$, $\alpha_i = 1$, $\delta_j = 0$ (for all i, j) is the trembling-hand perfect equilibrium. Putting $\underline{\theta} = \theta_A^2$ and $\bar{\theta} = \theta_D^2$, the claim follows.

If $z = \hat{z}$ one gets $\theta_A^2 = \theta_D^2$. In this case, $\alpha_i = 0$, $\delta_j = 1$ for all i, j is the trembling-hand perfect equilibrium for $\theta \in [0, \theta_D^2)$; $\alpha_i = 0$, $\delta_j = 1$ is the trembling-hand perfect equilibrium for $\theta \in (\theta_D^2, \infty)$. There are three trembling-hand perfect equilibria at $\theta = \theta_D^2$: $\alpha_i = 0$, $\delta_j = 1$; $\alpha_i = 1$, $\delta_j = 0$; and $\alpha_i = 1$, $\delta_j = 1$. Putting $\underline{\theta} = \bar{\theta} = \theta_A^2 = \theta_D^2$, the claim follows. *q.e.d.*

Proof of Proposition 2

Assume there exists an equilibrium with $\alpha = 0, \delta = 1$. Then members of group D must be better off by revealed preference. Members of group A are not worse off if and only if $V_A(0,1) \ge V_A(0,0)$, which is equivalent to

$$\begin{aligned} & \frac{N_A + \theta + (N_A - 1)z - 1}{(zN_A + N_A + \theta)^2} - \frac{N_D(N_A + N_D\theta - 1)}{(N_A + N_D\theta)^2} \ge 0 \\ \Leftrightarrow \quad & -N_A(zN_A + N_A - 1)\left((\theta+1)(z+1)N_A^2 + \left(\theta^2 + \theta - z - 1\right)N_A + \theta^2\right) \ge 0 \\ \Leftrightarrow \quad & (N_A - 1)(z+1) + \theta((1+z)N_A + (1+\theta)) \le 0, \end{aligned} \tag{A.8}$$

which, however, contradicts the assumption that $N_A, N_D \ge 2$.

Next assume there exists an equilibrium with $\alpha = 1, \delta = 0$. Individuals of group A must be better off by revealed preferences. Individuals of group D are not worse off if and only if $V_D(1,0) \geq V_D(0,0)$, which is equivalent to

$$\begin{aligned} & \frac{N_A + \theta + (N_A - 1)z - 1}{(zN_A + N_A + \theta)^2} - \frac{N_D(N_A + N_D\Theta - 1)}{(N_A + N_D\theta)^2} \geq 0 \\ \Leftrightarrow \quad & -\theta(zN_A + N_A - 1)\left(\theta((N_D - 1)\theta(z+1) + 1)N_D^2 + N_A\left(\theta(z+1)N_A^2 + N_D + 1\right)\right) \geq 0, \end{aligned} \tag{A.9}$$

which again contradicts the assumption that $N_A \geq 2$.

If $\alpha = 1, \delta = 1$, group A or D is better off if and only if (i) $V_A(1,1) \geq V_A(0,0)$ and (ii) $V_D(1,1) \geq V_D(0,0)$, which is equivalent to

$$\begin{aligned} A: \quad & \frac{\theta - z}{(\theta+1)^2} - \frac{N_D(N_A + N_D\theta - 1)}{(N_A + N_D\theta)^2} \geq 0, \\ D: \quad & \frac{1 - \theta z}{(\theta+1)^2} - \frac{N_A(N_A + (N_D - 1)\theta)}{(N_A + N_D\theta)^2} \geq 0. \end{aligned} \tag{A.10}$$

If $N_A = N_D = N$, these conditions simplify to

$$\begin{aligned} A: \quad & \frac{1 - N(z+1)}{N(\theta+1)^2} \geq 0, \\ D: \quad & -\frac{\theta(zN + N - 1)}{N(\theta+1)^2} \geq 0, \end{aligned}$$

which immediately contradicts the conjecture. For general population structures, (A.10) has been analyzed using the software package Mathematica 7. The function $Reduce[X >= 0\&\&Na >= 2\&\&Nd >= 2\&\&0 >= z >= 1\&\&t >= 0]$, where X stands for either the left-hand side of the inequality for the A or D-group in (A.10), has generated $false$ as output both times. *q.e.d.*

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