Flexible identities:
Can identity change and assimilation promote efficiency in social coordination settings

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Abstract

In this paper I study how identities impact efficiency in social coordination settings. I formalize a game theoretic model and then test the main insights from the model in a laboratory experiment. The model shows there is a tension between choosing efficiently and choosing consistently with ones identity. Efficiency is achieved when all players integrate and choose one same action to coordinate on. Identities, on the other hand, cause agents to have opposing views on which action is best to adopt, driving them towards a segregated society. Arguably, a way to solve this problem is to facilitate agents in minority groups to assimilate by strategically match their identity to that of the majority. I test this conjecture experimentally, looking at different challenges to assimilation as treatment variations. The main findings in the experiment support the predictions of the model: when identities are rigid inefficient segregation is predominant, but flexible identities can solve this and promote efficiency via assimilation.

1 Introduction

In settings of social coordination, agents in a population choose between forms of behavior and benefit when others choose the same. Examples can range from the adoption of a dominant language in a region or of a social norm on how to treat minorities in a society. Social coordination is efficient when all agents adopt one same form of behavior, for it reduces conflicts and makes any potential interaction beneficial. There is, however, a challenge to efficiency when agents have different identities, because identities can create opposing views on which behavior is best to adopt. E.g., agents with identity A perceive language A is the best candidate while those with identity B rather have language B adopted by all. Therefore, in social coordination settings with different identities there is a tension between choosing what is efficient against choosing what is consistent with one's identity. In this paper, I investigate the extent to which identity change can help solve this tension.

By addressing this question, my work is based on a general consideration on whether identities can be instrumental to the achievement of goals, for which the strategic change of identity is a way accomplish such objective (see e.g., Chandra 2012; Saleh and Tirole 2019). Arguably, the success of identity change in facilitating efficient solutions to social and economic challenges is far from obvious. There is, however, indicative evidence that when identities are *flexible*, agents in one social group can strategically match their identity to that of the other social group, to improve their well-being and promote efficiency (see e.g., Chandra 2012; Saleh and Tirole 2019). However, there are key factors that may prevent identity change. For instance, conflicts in integration when others do not accept the identity-changer as a member of the group he is intending to join, or costs associated to identity change when others aim to prevent the identity-changer from leaving the group he is initially part of.

When identities are *rigid* or difficult to be changed, the tension is commonly resolved inefficiently given consistency has a stronger pull. Consequently, societies tend to be fragmented in lines of the existing identities: those with identity A separate from those with identity B, so that each group can consistently choose their preferred behavior. In this paper *I study the extent to which flexible identities can promote efficiency in social coordination settings, by breaking societies free from segregation.* In pursuing this aim, the contribution of this paper is two-fold. First, I extend an existing game theoretic model of social coordination (Hernandez et al. 2013; Ellwardt et al. 2016; Goyal et al. 2018) to derive predictions for settings with rigid as well as flexible identities. Second, I test the main insights from the model in a laboratory experiment and assess if flexible identities can resolve the tension between consistency and efficiency. In particular, I evaluate the effectivity of identity change by experimentally manipulating two factors that may prevent the change: costs associated to the change as well as cases where the change is not visible (i.e., others only observe the initial identity and cannot identify who has changed it or maintained it).

I now briefly describe the model, the experimental setup and summarize the main findings of the study.

In the model of social coordination, each individual is initially assigned one of two identities: either A (majority) or B (minority). If identities are *rigid* the initial assignment is fixed. However, if identities are *flexible*, individuals can change their initial identity. In either case, individuals interact with others through a social network, and choose between two actions: a or b. Individuals have identity-based payoffs that are higher when choosing consistently. For example, someone with identity A perceives higher payoffs when he coordinates with others on action a instead of b. There are multiple equilibria, out of which the two most salient are the *consistent* and the *efficient* outcomes.

In the *consistent* equilibrium all individuals maintain their initial identity, exclusively connect with their in-group (others with the same identity) and choose actions as prescribed by their identity. This results in a segregated society where everyone in the majority gathers in a community, so that they can all coordinate by choosing action a, while everyone in the minority is connected in a separate community and choosing action b.

On the contrary, in the *efficient* equilibrium, everyone is connected into one large community independently of their identity, and they all coordinate by choosing one same action. Moreover, when groups are of different sizes, it is efficient to coordinate on the action prescribed to the majority (action a). Consequently, the tension between efficiency and consistency affects the minority directly, because to integrate minority players must choose inconsistently respect to their identity. This suggests that with rigid identities efficient integration is a more elusive equilibrium outcome than inefficient segregation.

The theoretical model shows that when identities are flexible this tension could be alleviated because players in the minority can strategically choose the identity of the dominant majority. This eases the complexity of the coordination problem because all players end up having the same identity, and thus, aligned preferences over which action is best to coordinate on.

In the experiment, groups of 7 participants, 4 in the majority and 3 in the minority, interact in a setting with rigid identities followed by a setting with flexible identities; where participants can keep or change their initial identity. I use this sequence to evaluate if participants in the minority take advantage of the possibility to change their identity. Specifically, I test if the minority uses identity change to integrate with the majority and improve their well-being, after having experienced the tension underlying rigid identities.

At the end of the experiment, each participant makes an allocation decision, which I use to measure in-group bias. Specifically, a participant chooses how to distribute a set of points between two receivers from the 6 others participants in his group: one from the minority and one from the majority. Previous studies have regularly found that participants show in-group bias by allocating more to the receiver with the same identity. The aim of this allocation stage is to test if identity change affects in-group bias.

Thus, I aim to answer three specific questions in the experiment: (i) do rigid identities preclude an efficient solution to the social coordination problem, (ii) How are outcomes affected by flexible identities and are these outcomes more efficient than with rigid identities, and (iii) does identity change alters the perceptions towards others holding the same/different initial identity.

The main findings from the experiment are as follows: (1) the tension between consistency and efficiency cannot be resolved with rigid identities. If the initial identities are rigid, participants segregate by identities, and only half of the maximum efficiency is reached. (2) With flexible identities minority players strategically change their identities to match that of the majority. The level of change is significantly prevented by both costly changes and by no visibility of the change. However, across all treatments flexible identities promote efficiency above the level attained with rigid identities. Finally (3) both minority and majority participants are significantly biased in favoring their initial in-group. There are no differences in how biased the majority is independent of the treatment. Thus, suggesting that even though minority players assimilate and play according to the preferences of the majority, this does not guarantee an improvement in how they are perceived by their out-group. On the other hand, minority players reduce their bias the more successful identity change was in promoting efficiency. Thus, suggesting that the division between in-group and out-group of those who switch is blurred by assimilation.

The paper contributes to the literature on social coordination in networks, studying settings where players choose partners and actions. Within this literature a line of inquiry looks at conflicting preferences over outcomes (i.e., cases with different identities). The main finding is that having different identities leads to inefficient segregation and exclusion (see e.g. Schelling 1960; Lewis 1969; Jackson and Storms 2018). Many solutions have been proposed to alleviate this tension, such as making connectivity free and accessible, or even providing monetary subsidies to the formation of ties between individuals with different identities, but the fragmentation of society is persistent to these solutions (see e.g. Goyal et al. 2018). On the other hand, there are papers looking at aligned preferences over outcomes (i.e., none or a single identity), which have found that partner choice leads to the attainment of efficient equilibria (see e.g., Riedl et al. 2016). My work looks at the intersection of these two lines of work through identity change, and shows conditions under which assimilation is likely to work and eradicate conflict.

My work also contributes to the literature on identity change in coordination settings. Theoretical work on this topic has argued that identities can change endogenously as a choice individuals make (see e.g., Akerlof and Kranton 2000; Dasgupta and Goyal 2019). Experimentally, Andreoni et al. (2018) has looked as the change of identities caused by external shocks, where agents have no agency over the choice. My work provides an experimental test of identity change as a strategic choice and suggests that agents can use it to improve individual and social outcomes.

The paper is organized as follows. In section 2 the model is presented, followed by the characterization of equilibrium conditions in Section 3. The experimental design is described in Section 4. Section 5 reports the results of the experiment. Section 6 concludes with a discussion.

2 The model

I study the effect rigid and flexible identities have on efficiency in a social coordination game.[1] This is formalized as a 3-stage game, as follows:

There is a set of players $N = \{1, 2, \ldots, n\}$, which represents the nodes of the network. Each player $i \in N$ is endowed with an *initial* identity $\theta_i = \{\mathsf{A}, \mathsf{B}\}$. For clarity in the exposition and without loss of generality, I assume players with initial identity A are the majority.[2] Identities represent social categories that prescribe how to behave. When players do not behave consistently with the prescription of their own identity, they experience a loss in their utility (the notion of consistency is explained in more detail below).[3] The identity profile of all players is represented by a vector $\theta = \{\theta_1, \ldots, \theta_i, \ldots, \theta_n\}$, and it is common knowledge among all players.

Stage 1. Identity choice: In the first stage of the game, each player i decides between maintaining or changing his initial identity. That is, he chooses $\bar{\theta}_i \in \{\mathsf{A}, \mathsf{B}\}$, and $\bar{\theta}_i$ may or may not be equal to θ_i. This results in a new identity profile $\bar{\theta} = \{\bar{\theta}_1, \ldots, \bar{\theta}_i, \ldots, \bar{\theta}_n\}$. It is

[1] This model extends previous works on social coordination games: see Hernandez et al. (2013) for a case with exogenous networks, Ellwardt et al. (2016) for a case of endogenous networks varying the proportion of the majority and the minority groups, Hernandez et al. (2017) for a general case of equilibrium characterization in arbitrary networks, and Goyal et al. (2018) for a case of endogenous networks with different link formation costs. In all previous cases group identities are exogenous and rigid while in this model group identities are flexible and can be endogenously chosen.

[2] It will be clear in the equilibrium characterization that the main results of the model are not affected by the relative size of the groups.

[3] The underlying assumption is that there are norms of behavior associated with group identities. If an individual behaves consistently with his prescribed behavior he perceives a prime derived from his identity, otherwise he experiences a loss in utility. This was first formalized in economics in Akerlof and Kranton (2000).

common knowledge who has changed his initial identity and who has maintained it. For each i let $\bar{\theta}_{-i}$ be the vector obtained from $\bar{\theta}$ by deleting $\bar{\theta}_i$.

Stage 2. Network choice: In the second stage, each player i chooses whether to make a link proposal $g_{ij} \in \{0,1\}$ to every other player $j \in N \backslash \{i\}$. Let $G_i = \{0,1\}^{n-1}$ define i's set of link proposals. The collection of all proposals results in a directed network $g = (g_1, \ldots, g_n)$, where $N_i\{g\} = \{j \in N : g_{ij} = 1\}$ is the set of players to whom i has proposed a link, with cardinality $|N_i\{g\}|$. An undirected link between i and j, $\bar{g}_{ij} = 1$, is formed if $g_{ij} = 1$ and $g_{ji} = 1$. The resulting undirected network $\bar{g}$ represents all bilateral connections between players, where $N_i\{\bar{g}\} = \{j \in N : \bar{g}_{ij} = 1\}$ is the set of i's undirected neighbors in $\bar{g}$, with cardinality $|N_i\{\bar{g}\}|$. In the final stage, i interacts exclusively with his undirected neighbors (or neighbors for short). Let the finite set of all undirected networks be defined as $\bar{G}$.

Stage 3. Action choice: In the last stage of the game, each player i chooses an action $x_i = \{\mathsf{a},\mathsf{b}\}$, once the network has been formed. The action i chooses, x_i, is *consistent* with his identity if $\bar{\theta}_i = \mathsf{A}$ and $x_i = \mathsf{a}$, or if $\bar{\theta}_i = \mathsf{B}$ and $x_i = \mathsf{b}$, and i's action is *inconsistent* with his identity otherwise. With slight abuse of notation, I write $x_i = \bar{\theta}_i$ if x_i is consistent with $\bar{\theta}_i$, and $x_i \neq \bar{\theta}_i$ otherwise. Denote the vector of chosen actions as $x = \{x_1, \ldots, x_i, \ldots, x_n\}$. For each i, let x_{-i} be the vector obtained from x by deleting x_i.

Given an outcome profile $(\bar{\theta}, g, x)$, the utility of player i is defined as:

$$u_i(\bar{\theta}_i, g, \bar{g}, x) = \lambda \cdot (1 + \sum_{j \in N_i(\bar{g})} \mathbb{1}_{\{x_j = x_i\}}) - (k \cdot |N_i(g)| + \delta \cdot \mathbb{1}_{\{\bar{\theta}_i \neq \theta_i\}}) \tag{1}$$

where $\mathbb{1}_{\{x_j = x_i\}}$ is the indicator function that yields 1 if player j chooses the same action as player i, $\lambda = \alpha$ if $x_i = \bar{\theta}_i$ and $\lambda = \beta$ if $x_i \neq \bar{\theta}_i$, where $\alpha > \beta$. That is, player i benefits from those neighbors who choose the same action as he does, and the benefit is higher if i's action is consistent with his identity. The cost of proposing a link for player i is $k > 0$, which is independent of whether a link was reciprocated or not, with $k < \beta < \alpha$.[4] Thus, the payoff function accounts for both the cost of intentions to connect and the gains from

[4]To focus on the interesting cases, I will assume a cost of proposing a link $0 < k < \beta$. Otherwise, if $k > \beta$ no player will benefit from playing their less preferred action. Moreover, if $k > \alpha$ no player would benefit from proposing/forming any link at all.

coordinating with successful reciprocal links. Finally, $\mathbb{1}_{\{\bar{\theta}_i \neq \theta_i\}}$ is the indicator function that yields 1 if player i changes his identity. Every player i pays a non-negative cost δ if he changes his initial identity in Stage 1, that is if $\bar{\theta}_i \neq \theta_i$, and pays no cost if he maintains his initial identity, that is if $\bar{\theta}_i = \theta_i$.

This is a multi-stage game with simultaneous decisions in each stage. A player's strategy is a contingent plan, specifying a choice at each stage conditional on each possible previous decision profile. In the following section, I characterize the equilibrium outcomes of this game.

3 Equilibrium analysis

To characterize the equilibria for the social coordination game, I apply backward induction. The equilibrium characterization is used to understand differences between settings with rigid and flexible identities. In a setting with rigid identities, the initial identity of all players is fixed (i.e., the model without Stage 1), while in a setting with flexible identities players have a choice between changing or maintaining their initial identity.

The main intuition form the equilibrium characterization indicates that rigid identities create a tension between consistency and efficiency. Consistency drives players towards a segregated society where the minority forms a separate community from the majority, so that each group chooses its prescribed action. Unlike consistency, the efficient outcome is shaped by an integrated society where the minority assimilates and chooses the same action as the majority. The tension arises because efficiency requires minority players to choose inconsistently with respect to their identity. The consistency-efficiency tension is alleviated when identities are flexible because the minority players can strategically match their identity with that of the majority. Thus, the choice of changing identities facilitates the attainment of efficiency by turning a complex social coordination game into a simpler setting where the preferences of all players are aligned. This is explained in detail in the section below.

3.1 Equilibrium outcomes with rigid identities

I begin with the characterization of equilibrium outcomes for the model with rigid identities. That is, the social coordination game without Stage 1.

In the final stage, *action choice*, every player i chooses an action a or b, which may be consistent with his identity or not. The action choice is characterized by a threshold χ_i, such that players choose consistently with their identity if at least χ_i of their neighbors also choose the same action.

Intuitively, a player plays a coordination game with each of his neighbors, and the corresponding threshold is a function of the number of neighbors a player has, his degree $|N_i(\bar{g})|$. If at least χ_i neighbors choose i's prescribed behavior, then player i's best response is to adopt it too. That is, exactly at this threshold a player is indifferent, but otherwise he has a unique best response. This result, from Hernandez et al. (2013) and Ellwardt et al. (2016), is expressed in Proposition 1.

Proposition 1. *Given a player's local network and identity, if χ_i of i's neighbors choose his prescribed action, it is always a best response for i to choose consistently with his identity.*

Proof. Player i's payoff is $\alpha(\chi_i+1)$ if he chooses consistently, $x_i = \bar{\theta}_i$, and $\beta(|N_i(\bar{g})|-\chi_i+1)$ otherwise. As a result, i is strictly better off choosing $\bar{\theta}_i$ if $\alpha(\chi_i+1) > \beta(|N_i(\bar{g})| - \chi_i + 1)$, which can be rewritten as:

$$\chi_i > \frac{\beta}{\alpha+\beta}|N_i(\bar{g})| - \frac{\alpha-\beta}{\alpha+\beta} \tag{2}$$

Similarly, i is strictly worse off if $\chi_i < \frac{\beta}{\alpha+\beta}|N_i(\bar{g})| - \frac{\alpha-\beta}{\alpha+\beta}$, else i is indifferent between both actions. □

Proposition 1 shows that the adoption threshold χ_i increases with the number of neighbors a player has. Therefore, the more connected a player is the harder it becomes for him to choose consistently. At the same time, the more neighbors a player has the larger his potential gains. This is illustrative of the tension individuals face between payoffs and consistency.

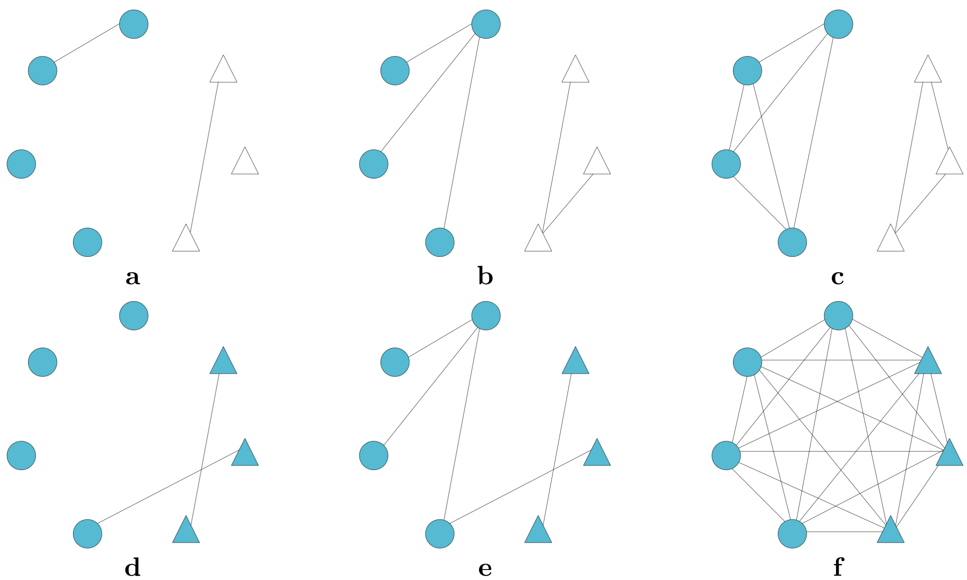


Figure 1. Examples of equilibrium outcomes.

Note: A player in the majority (initial identity A) is illustrated as a circle and a player in the minority (initial identity B) is illustrated as a triangle. Colored nodes show players whose chosen action is a. Otherwise, white nodes show players who choose action b. A line connecting two nodes represents an undirected link. Networks 1a, 1b and 1c are equilibria where some players coordinate on a and others on b. Each equilibrium is more efficient than the previous due to increased connectivity. Networks 1d, 1e and 1f are equilibria where all players coordinate on action a. Similarly, an outcome becomes more efficient by increasing connectivity between players choosing the same action.

At the aggregate level, Proposition 1 implies different outcomes can emerge in equilibrium. There are cases where a fraction of players chooses one action and the remainder chooses the other (as illustrated in Figures 1a, 1b and 1c) or cases where all players choose one same action (as illustrated in Figures 1d, 1e and 1f). For example, action a is chosen by all players in networks 1d, 1e and 1f because those with identity A have enough support from their neighbors to choose consistently with their identity, while players with identity B lack the support, which makes them better off by choosing inconsistently with their identity.

To conclude the equilibrium characterization for games with rigid identities, I now proceed to solve for Stage 2: *network choice.*

Proposition 2. *Suppose $(x, \bar{g})$ is an equilibrium outcome. Then all links formed in g are exclusively connecting pairs of players choosing the same action. Otherwise, no link proposal is made.*

Proof. The proof of Proposition 2 has two parts: (i) a pair i and j propose a link to each other, $g_{ij} = g_{ji} = 1$, only if they are both choosing the same action $x_i = x_j$. Since i and j are coordinating, they get α or β if connected and 0 otherwise, (ii) while if i and j are not choosing the same action $x_i \neq x_j$, i's best response is to not propose a link to j, and viceversa. Since i and j are not coordinating, i gets 0 if he does not propose a link and $-k$ otherwise. Therefore, no pair of players choosing different actions make a link proposal to each other. □

Proposition 2 indicates that in equilibrium, players exclude others when their chosen actions do not match. The natural consequence of exclusion is the formation of behavioral communities (see e.g., Jackson and Storms 2018), where everyone connected within a community is choosing the same action and there are no connections between communities of players choosing differently. There are, however, multiple network structures that satisfy the conditions from Proposition 2, for a given action profile. These network structures vary in how densely connected they are, up to the point of having fully connected clusters where every player is linked to all others choosing the same action (see examples in Figure 1).

This last case represents the optimal network structure for a given action profile, because society cannot improve by becoming more connected.

Corollary 1. *The equilibrium outcome $(x, \bar{g})$ Pareto dominates all other outcomes given the action profile x, when all players choosing the same action are connected in $\bar{g}$.*

Proof. For an equilibrium outcome $(x, \bar{g})$, let the short hand notation of $\bar{g} + \bar{g}_{ij}$ represent the undirected network $\bar{g}'$ obtained by adding the link $\bar{g}'_{ij}$ to an existing network $\bar{g}$, such that $x_i = x_j$. Given the additional link increases i's and j's utility in $\bar{g}'$ compared to $\bar{g}$, it is easy to see that outcome $(x, \bar{g}')$ Pareto dominates $(x, \bar{g})$. It follows naturally that the equilibrium outcome $(x, \bar{g}')$ Pareto dominates all other outcomes with action profile x, when there are no pairs of players choosing the same action, who remain unconnected in $\bar{g}'$. □

The intuition from Corollary 1 points to two specific types of network structures in equilibrium, from which society cannot improve with denser networks (and given it is in equilibrium, networks cannot improve by eliminating connections either).[5]

The first type of structure is a disconnected network partitioned into two completely intra-connected communities, where every player in one community chooses one action and every player in the other community chooses the other action. I will refer to this outcome as *segregated with partial coordination* (see Figure 1c). The second type of structure is a complete network, where all players choose the same action. I will refer to this outcome as *integrated with full coordination*, which occur when all players coordinate on either action b or a (see Figure 1f).

To conclude, I look at efficient outcomes across all action profiles. An efficient outcome is defined as one maximizing the sum of all individual payoffs, i.e., maximizing aggregate welfare. Following from the externalities inherent in the model, the most efficient outcome is that in which all players choose the same action and form a complete network.

[5] This means that the Pareto dominant outcomes can be considered to also be pairwise stable, see for example Ellwardt et al. (2016); Goyal et al. (2018).

Proposition 3. *The socially efficient outcome is an integrated network with full coordination on the action prescribed to the majority.*

The proof for Proposition 3 is extense and thus relegated to Appendix A.

The result on efficiency implies that, to achieve full coordination in the integrated outcome, some players must choose inconsistently respect to their identities. Given efficient coordination is on action a, the action prescribed to the majority, players in the minority are the ones who must choose inconsistently (see Figure 1f).

In contrast to efficiency, achieving consistency requires players to exclusively connect by their identities. Consistency results in an inefficient segregated outcome with partial coordination, where minority players only connect with other minority players and choose action b, while majority players connect exclusively within the majority and choose a (see Figure 1c).

The underlying coordination problem is simpler when individuals segregate in line with their identity, because players only face others with aligned preferences. On the other hand, the coordination problem underlying the efficient equilibrium is more complex given that when two players with different identities connect (e.g., one from the majority and the other from the minority), they both want to coordinate on one same action but have conflicting preferences over which action is best to choose. That is why the tension between efficiency and consistency persists with integration.

3.2 Equilibrium outcomes with flexible identities

In this section I look at equilibrium outcomes for the full model with flexible identities, where players first choose between identities. Again, I apply backward induction. The analysis of equilibrium outcomes follows from the results with rigid identities derived in the previous section, with a focus on Stage 1.

In the first stage, each player i chooses his identity $\bar{\theta}_i \in \{\mathsf{A},\mathsf{B}\}$. The choice can be understood as whether to change one's initial identity, $\bar{\theta}_i \neq \theta_i$, or to maintain it, $\bar{\theta}_i = \theta_i$. I define the following equilibrium.

Definition 1. *An outcome* $(\bar{\theta}, g, x)$ *is an equilibrium outcome if:*

1. *given* $\bar{\theta}$*,* (g, x) *is an equilibrium,*

2. *for each* i *and each* $\bar{\theta}_i'$*,* $u_i(\bar{\theta}, \bar{g}, x) \geq \max_{(g',x')}\{u_i(\bar{\theta}_i', \bar{\theta}_{-i}, g', x')\}$*, where* (g', x') *is an equilibrium under* $(\bar{\theta}_i', \bar{\theta}_{-i})$*.*

In this definition, if a player deviates at Stage 1, I assume that he will obtain the highest possible utility in an equilibrium outcome of the subsequent game, and ask that in equilibrium no player would benefit by deviating in Stage 1. Note that if (g, x) is an equilibrium under $\bar{\theta}$ and $\bar{\theta}_i \neq x_i$, then (g, x) remains an equilibrium under $(\bar{\theta}_i', \bar{\theta}_{-i})$, where $\bar{\theta}_i' = x_i$.

In equilibrium, if player i changes his identity, then he behaves consistently in Stage 3, that is, $x_i = \bar{\theta}_i$. Otherwise, if $x_i \neq \bar{\theta}_i$, i would be better off by maintaining his identity in Stage 1, so that he would get α from each of his neighbors in the same stable outcome (g, x). However, if player i maintains his identity in Stage 1 and behaves inconsistently in Stage 3, that is, $x_i \neq \bar{\theta}_i = \theta_i$, then it must be because the cost of changing his identity is higher than the benefit he can obtain from it. That is, the cost δ can be an obstacle to identity change, preventing the solution of the consistency-efficiency tension.

Proposition 4. *Suppose* $(\bar{\theta}, g, x)$ *is an equilibrium outcome. Then, all players consistently match their chosen identity and action, unless the cost of changing identities is larger than the benefit.*

Proof. There are two cases, (i) if there is no cost for changing identities, $\delta = 0$, then all players choosing inconsistently change their initial identity, given that $\beta(|N_i(\bar{g})| - |\chi_i(\bar{g})| + 1) < \alpha(|N_i(\bar{g})| - |\chi_i(\bar{g})| + 1)$. Conversely, no player choosing consistently changes his initial identity; (ii) if changing identities is costly, $\delta > 0$, then all players choosing inconsistently change their initial identity when $\beta(|N_i(\bar{g})| - |\chi_i(\bar{g})| + 1) < \alpha(|N_i(\bar{g})| - |\chi_i(\bar{g})| + 1) - \delta \rightarrow \delta < (\alpha - \beta)(|N_i(\bar{g})| - |\chi_i(\bar{g})| + 1)$.Otherwise, if $\delta > (\alpha - \beta)(|N_i(\bar{g})| - |\chi_i(\bar{g})| + 1)$, no player choosing inconsistently changes his initial identity. □

The intuition of Proposition 4 is as follows: flexible identities can break the tension between consistency and efficiency, given that in equilibrium all players match their identity and action to choose consistently. Therefore, in an integrated outcome with full coordination, such as the efficient outcome for rigid identities (see Figure 1f), every minority player has incentives to change his identity and match it to the identity of the majority. By changing his identity every minority player would improve, given that the benefits from coordinating are derived from the chosen identity, irrespective of the initial identity.

Naturally, changing identities is only profitable if the gains from the new identity are higher than the cost of changing. Note that a player changing his identity increases his gains by $\alpha - \beta$ for each coordination. Therefore, when there are positive costs to changing, the more connected a player is the more likely he is to change his identity. This implies that denser networks are more conducive of both identity change and efficiency.

Finally, in relation to efficient outcomes, flexible identities add some variations compared to rigid identities. The following is a Corollary to Proposition 3.

Corollary 2. *With flexible identities, the socially efficient outcome is an integrated outcome with full coordination on: (i) either* a *or* b *if there are no changing costs, or (ii)* a *if changing costs are positive.*

The proof for Corollary 2 is a continuation of the proof for Proposition 3 and thus is included in Appendix A.

The intuition on efficiency with flexible identities is as follows: if changing one's identity is free, either action can be chosen for full coordination because players from either the minority or the majority can match their action and chosen identity at no additional cost.

But, if the changing cost is positive, there is a unique efficient outcome with coordination on a, where all players in the minority change their identity. This because fewer players would incur in the changing cost. Moreover, when changing costs are higher than the benefits from adopting the new identity, efficient coordination is still on the majority's preferred action. But, the minority players do not change their group identity. Note that this outcome is also the resulting efficient outcome when identities are rigid, and thus is a case where the tension between consistency and efficiency is actively present.[6]

[6] When there is no majority, independently of changing costs, full coordination on either action is equally efficient.

In conclusion, there is a tension between consistency and efficiency when identities are rigid. Consistency leads to inefficient segregation where players coordinate partially, while efficient outcomes are integrated and all players fully coordinate on one same action. Flexible identities solve this tension by allowing players who integrate to match their action and their chosen identity, making the efficient outcome one where all players have aligned incentives. To evaluate the extent to which players use flexible identities to promote efficiency, I use a laboratory experiment, as described in the following section.

4 Experimental design

I design an experiment that allows me to study rigid and flexible identities in a social coordination setting. My goal is to evaluate the role of flexible identities on solving the consistency-efficiency tension that arises when identities are rigid. Therefore, all participants first interact in a setting with rigid identities and subsequently in one with flexible identities. I experimentally vary the obstacles to identity change participants face. Specifically, I look at problems of social regulation, where there is a cost of changing identities that increases the fewer participants in a group change their identity. I also look at problems of assigned membership, where the initial identity is visible but the chosen identity is not. Therefore, others may assign a participant a different identity than what he has chosen, preventing integration. This is explained in more detail below.

4.1 Experimental treatments

In all treatments, participants interact in two parts.[7] Part 1 is a setting with *rigid* identities and Part 2 is a setting with *flexible* identities. All experimental variations are introduced in Part 2, given the focus is on studying the effectivity of identity change in promoting efficiency under different constraints. The experimental treatments are illustrated in Table 1. On the one hand, I vary whether there is a cost to identity change (which depends on

[7]During the experiment, the design was presented as a four-part study to facilitate understanding of the sequence among participants, see Instructions in Appendix C.

the choices of others). On the other hand, I vary whether participants can see each others' chosen identity or not.

		Costly identity change	
		No	*Yes*
Restricted visibility of chosen identity	*No*	BASELINE	COST
	Yes	HIDDEN	REVEAL

Table 1. Experimental treatments.

First, I explain the Part 1, with *rigid* identities, which is common to all treatments. Then, I illustrate how variations are implemented in each of the experimental conditions in Part 2.

Part 1: rigid identities. In all treatments, groups of 7 participants are matched together during the entire sequence. At the beginning of the experiment, 4 participants are randomly assigned to the majority (initial identity A) and 3 to the minority (initial identity B). Then, before period 1, majority and minority separately carry out a simple group-cohesion task. Through a group chat, they each choose a name to label their identity, out of a list of five names.[8] This task is used to strengthen identification with the induced identity, given that communication and solving tasks as a group have been shown to reinforce positive perceptions towards the in-group (see e.g., Chen and Chen 2011).

After both majority and minority have chosen their identity names, the 7 participants play together, for 10 periods, a social coordination game with *rigid* identities (as described in Section 3.1).

In each period, participants are randomly labeled from 1 to 7 and displayed on the screen using symbols that indicate their initial identity: circles for the majority (A) and triangles for the minority (B), as illustrated in Figure 2. The identities and corresponding symbols are fixed for all 10 periods, while the numeric label is re-assigned in each period. This prevents participants from identifying others and building reputation, so that each

[8] Participants in the majority chose a name between: *Cats, Tigers, Lions, Leopards, Jaguars*, and participants in the minority chose between: *Dogs, Jackals, Coyotes, Foxes, Wolves.* Because the name chosen by each group was used during the experiment to label their identity, I did not use the labels A or B. These are used as a generic label in the paper to facilitate the description of the study.

period resembles the one-shot nature of the theory model.

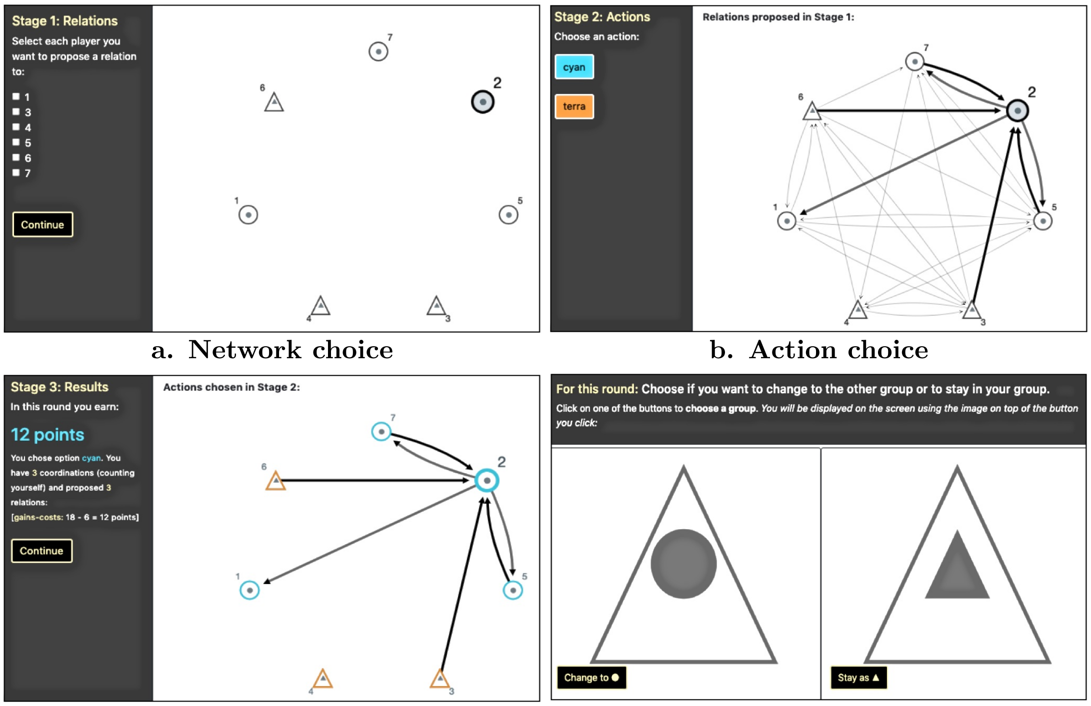
Participants make decisions in two stages. First, in the *network-choice* stage, participants propose links (see Figure 2a) and pay a cost for every proposal made. Links are formed when two participants mutually propose to each other. Subsequently, in the *action-choice* stage, participants choose an action a or b,[9] to coordinate with each of their neighbors (see Figure 2b).

Payoffs are realized using Equation 1 with the following parameters: $\alpha = 6, \beta = 4$ and $k = 2$. Therefore, a majority participant, with initial identity A, earns 6 points for each coordination on action a and 4 points for each coordination on action b, and pays 2 points for each link proposal made. Conversely, a minority participant, with initial identity B, earns 6 points for each coordination on action b and 4 points for each coordination on action a, and pays, as well, 2 points for each of his outgoing proposals. Thus, as in Equation 1, payoffs depends on whether the action a participant chooses is consistent with his identity, on the number of his neighbors choosing the same action and on the number of links he proposes. At the end of every period, participants receive information on their payoffs for the current period (see Figure 2c). One of the 10 periods is randomly selected for payment, and all participants know this from the start (see Procedures in Section 4.3).

Part 2: flexible identities. The 7 participants, then, play 10 periods of a social coordination game with *flexible* identities. The main difference with Part 1 is the inclusion of a stage, before the network choice, where each participant chooses his identity. The three stages are then: *Identity choice*, *Network choice* and *Action choice*. I describe Stage 1 in detail, as follows:

At the beginning of every period, each participant chooses between maintaining or changing his *initial* identity. If a participant with initial identity A maintains his identity, he will continue earning points as an A, 6 points for each coordination on action a and 4 points for each coordination on action b. However, if he changes his identity to B, he will earn points as a B, 6 points for each coordination on action b and 4 points for each

[9] In the experiment actions were labeled as "*cyan*" for a and "*terra*" for b, which facilitated the use of these colors as visual illustration of choices on the screen.



a. Network choice **b. Action choice**

c. Results **d. Identity choice**

Figure 2. Screens in the experiment.

Note: (a) Participants see their own and others' numeric labels and identities (internal and external symbols), and choose which links to propose by ticking on the boxes on the left. (b) Then, they observe the proposals made, illustrated with gray arrows, and the proposals received, illustrated with black arrows, by everyone. Own link proposals are displayed with thicker lines. In this screen participants choose an action by clicking on the corresponding button on the left, one for action a "*cyan*" and one for action b "*terra*". (c) Participants see the action chosen by everyone else, illustrated as the border-color of each node, and a summary of their payoffs in the current period. In Stage 1 of Part 2, (d) participants choose whether to maintain or change their initial identity by clicking on the corresponding button. The image above each button illustrates how they will be displayed on the screen given their identity choice. The internal symbol represents the chosen identity and the external keeps track of the initial identity, which is fixed.

coordination on action a. The same holds for a participant initially assigned to identity B, depending on the identity he chooses.

As in the previous part, a participant is displayed on the screen through symbols. The external symbol of each participant will be kept fixed in all periods and used to represent his initial identity. The internal symbol, on the other hand, may vary between periods according to the identity a participant chooses. This is illustrated in Figure 2d as an example for a participant in the minority. Notice that in both cases the *external* symbol is a triangle, given his initial identity is B. On the left hand side, the *internal* symbol is a circle, representing the case in which the participant changed his identity and chose that of the majority. On the right hand side, the *internal* symbol matches the *external* symbol, representing a participant who did not change his identity. Subsequently, participants play the two remaining stages, network choice and action choice, as in *rigid*.

The main differences between experimental treatments are described as follows: (T1) Baseline: This is the game as presented before, with no obstacles to identity change. That is, initial and chosen identities are visible to others and changing identities is free and independent from others' choices.

(T2) Cost, is a game where the change of identity is visible, as in the Baseline. However, identity change is costly, and the cost increases in the number of players with the same initial identity who choose to maintain it. Specifically, the changing cost is $\delta = 6 + (2 \cdot \textit{number of in-group members not changing})$. Therefore, any player who changes his identity pays a fixed cost of 6 points for the change, plus a variable cost that increases by 2 points for each player with the same initial identity who chose to maintain it. In this way, I exogenously introduce social regulation (e.g., peer sanctions) to those who change their identity as a function of those who maintain it.

(T3) Hidden, is a game in which identity change is free but the choice is not visible to others. This means that participants can see each others' initial identity but no one can identify each others' chosen identity.[10]

Finally, (T4) Reveal, is a game where chosen identities are not visible and the change

[10]In the experiment, this is done by eliminating the internal symbol from all nodes on the screen.

is free, as in HIDDEN. However, once identities have been chosen, participants can reveal their choice to others, at a cost. The revelation cost has the same form of social regulation as that in T2. That is, $\delta_{\text{Reveal}} = 6 + (2 \cdot \textit{number of in-group members not changing})$, where a player pays a fixed cost of 6 points for revealing his chosen identity and, in case he changed identities, pays a variable cost that increases by 2 points for each player with the same initial identity who maintains it.

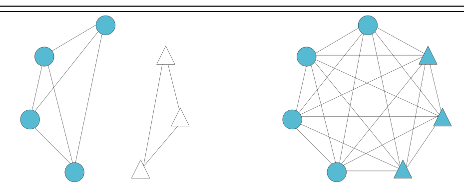
At the end of the period 20, each participant makes an individual allocation choice that only has payoff consequence for others. The choice is to divide a 10-point pie between two randomly assigned receivers, who are selected out of the other 6 participants in his group, according to their initial identity: one from A and another from B. This choice is used to evaluate in-group bias.

4.2 Predictions: Measures of equilibrium outcomes

Now, I summarize some measures of the social coordination game in equilibrium, for both *rigid* and *flexible* identities.

Table 2. Measures of equilibrium outcomes.

Note: ...



	I. SEGREGATED		II. INTEGRATED	
	Rigid	*Flexible*	*Rigid*	*Flexible*
Efficiency level	0.67	0.54 or 0.58	1.00	1.00
Consistency	1.00	1.00	0.57	1.00
Assimilation	0.57	0.57	1.00	1.00
Density	0.43	0.43	1.00	1.00

I focus on two of the equilibrium outcomes that can emerge with both rigid and flexible identities, and use their main properties as benchmark predictions for the experiment. The first outcome results when players strive for consistency. This equilibrium is a *segregated* *outcomes with partial coordination* (see column I of Table 2), where players connect exclusively by their identities (minority with minority and majority with majority) and all players choose actions consistently with their identities. This is an equilibrium outcome if identities are rigid. It is also an equilibrium with flexible identities, when both minority and majority players maintain their initial identities.

The second outcome emerges when players strive for efficiency. This is an *integrated outcome with full coordination* (see column II of Table 2), where there is a link between every pair of players and everyone chooses the action prescribed to the majority. This outcome is the efficient equilibrium with rigid identities. It is also the efficient equilibrium with flexible identities when all minority players change their identity, while all majority players maintain it.

For both, segregated and integrated outcomes, I focus on four main measures that, together, provide a clear illustration of each equilibrium outcome: efficiency level, consistency, assimilation, and density.

Efficiency level is calculated as the total sum of point obtained in an outcome, as a fraction of the total sum of points in the efficient (*integrated*) equilibrium, which represents the maximum number of points attainable. For example, when identities are *rigid*, the total sum of points is 114 in the segregated equilibrium and 168 in the integrated equilibrium. Therefore, the *efficiency level* in the segregated equilibrium is 0.67 (67% of the maximum efficiency: 114/168) and 1 in the integrated equilibrium.

The total sum of points for the integrated outcome with *flexible* identities is 210 for all treatments, except for Cost for which every minority player pays 6 points for changing his identity. Thus, in Cost the maximum total sum of points is 198. Consequently, the *efficiency level* of the segregated outcomes is 0.54 in the former and 0.58 in the latter, while it is 1 in the integrated outcome for all treatments.

Consistency is the proportion of participants in a group choosing the action corresponding to their (chosen) identity. Consistency ranges between 0 and 1. In the segregated outcome players always choose consistently, while in the integrated outcome this is only the case with flexible identities. When identities are rigid, the three minority players choose inconsistently with their identity, so that consistency is 0.57.

Assimilation (on the majority's prescribed action a*)* is the proportion of participants choosing action a, from 0 if all choose b to 1 if all choose a. Clearly, assimilation is 1 in the integrated outcome because all minority and majority players choose as prescribed to the majority (7 out of 7 players), while it is 0.57 in the segregated outcome because the minority chooses consistently (4 out of 7 players).

Finally, *density* is the proportion of links as a fraction of the 21 possible links in a 7-node network, ranging from 0 if no link is formed to 1 if all 21 links are formed.

4.3 Experimental procedures

The experiment was conducted at the laboratory of the University of Rosario (REBEL). A total of 336 subjects participated in the study (12 groups of 7 participants in each of the 4 treatments). Participants interacted through computer terminals and the experiment was programmed using oTree (Chen et al. 2016). Each session lasted around 120 minutes, including the time used to read the instructions and to anonymously pay.

From the beginning, participants were informed that the study consisted of four parts. However, instructions were administered, on screen, at the beginning of each part. After reading the instructions, participants were presented with a set of comprehension questions and could not advance until all answers were correct. At all times, participants could click a button on the screen and a summary of the instructions for that part would be displayed (see Appendix C).

Earnings were calculated at the end of every session and participants did not receive any information of actual earnings before that. For Part 1, *rigid* identities, one of the 10 periods played was randomly selected for payment. For Part 2, *flexible* identities, payoffs come from two sources. One of the 10 periods played was randomly selected for payment, as in Part 1. Also, the allocation choice from one of the 7 participants in each group was randomly selected for payment. An information screen was displayed to each participant at the end of the experiment, showing: (i) the period selected for payment and the points earned both in Part 1 and Part 2, and (ii) whether he was a receiver in the decision selected for payment in allocation choice and the points he earned.

Each participant was also informed of his total points and its conversion into monetary earnings, using the exchange rate of 2 points = 800 Colombian Pesos (COP). On average participants earned $46,000$ COP (Approx. 15.5 USD), including a show-up fee. The standard conditions of anonymity and non-deception were implemented in the experiment, and no one participated in more than one session.

5 Results

In this section, I report findings on the effect that flexible identities have on promoting efficiency, after participants play the social coordination game with rigid identities, by comparing settings with different types of obstacles to identity change.

The data in my experiment consists of the decisions made over 20 periods by groups of 7 participants. There are 12 groups in each of the 4 treatments, resulting in 960 observations at the group level and 6720 observations at the individual level. Half of the data comes from Part 1 with *rigid* identities (first 10 periods) and half from Part 2 with *flexible* identities (last 10 periods).

Throughout the paper, I test the role of flexible identities, by running random effects GLS regressions, clustering standard errors on groups. I use dummy variables for treatments as the independent variables. I report two-sided p-values in the text and provide all regressions in Appendix B.[11]

Table 3 presents a summary of the main measures used to characterize outcomes. First of all, it reports the average level of efficiency attained in each condition. In addition, it reports averages of the fraction of participants choosing consistently with their identities, the fraction of participants assimilating by choosing the action prescribed to the majority, and the number of links formed as a fraction of the total number of links possible. The column POOLED reports averages for Part 1, pooled across all groups. The table also reports separate measures for settings with *rigid* and with *flexible* identities, by treatments.

[11] I also analyzed the data using Wilcoxon-Mann-Whitney tests and group averages as the unit of observation. The regressions' results are consistent with those of the non-parametric tests.

Note that a discrimination of the data by treatment is not meaningful in Part 1, given there are no treatment variations yet. However, it is illustrative of the history of play before groups were assigned to treatments in Part 2.

For the central findings, I will focus exclusively on the comparison between the three main treatments of this study: Baseline, Cost and Hidden. Treatment Reveal is a condition designed to test further differences between Cost and Hidden, and I address this comparison specifically in Section 5.4.[12]

Table 3. Measures of outcomes for Part 1 and Part 2 (by treatment)

Note: Averages across groups and periods. Standard deviations, in parentheses, are calculated using all observations at the group level.

	Part 1: *Rigid identities*				**Part 2: *Flexible identities***		
	Pooled	Baseline	Cost	Hidden	Baseline	Cost	Hidden
Efficiency level	0.56	0.56	0.59	0.54	0.82	0.68	0.63
	(0.14)	(0.13)	(0.12)	(0.15)	(0.18)	(0.23)	(0.25)
Consistency	0.94	0.95	0.95	0.95	0.99	0.96	0.98
	(0.11)	(0.11)	(0.11)	(0.08)	(0.04)	(0.09)	(0.06)
Assimilation	0.61	0.61	0.61	0.59	0.99	0.85	0.85
	(0.11)	(0.10)	(0.12)	(0.09)	(0.05)	(0.17)	(0.19)
Density	0.40	0.39	0.41	0.39	0.82	0.67	0.62
	(0.08)	(0.06)	(0.10)	(0.07)	(0.19)	(0.26)	(0.26)

5.1 Do *rigid* identities limit efficiency in exchange for consistency?

I begin by examining whether *rigid* identities prevent the attainment of efficiency. To do so, I look at how rigid identities shape network outcomes, with respect to the four measures described above. Figure 3 illustrates averages for Part 1, against the predicted equilibria that were described in Section 4.2. The equilibrium outcomes provide a clear illustration of the tension between consistency and efficiency. Note that for the *segregated* equilibrium more than 30% of the attainable efficiency is sacrificed (black-frame bar) in order to achieve 100% of consistent choices (dark-blue bar). For the integrated equilibrium, about 40% of the consistent choices are given up, by the minority, to guarantee 100% of

[12] Note however that treatment Reveal is included as a covariate in all regressions reported in Appendix B.

the maximum level of efficiency. For each case, the figure also illustrates the fraction of players assimilating (blue circle), and the average density in the network (yellow X).

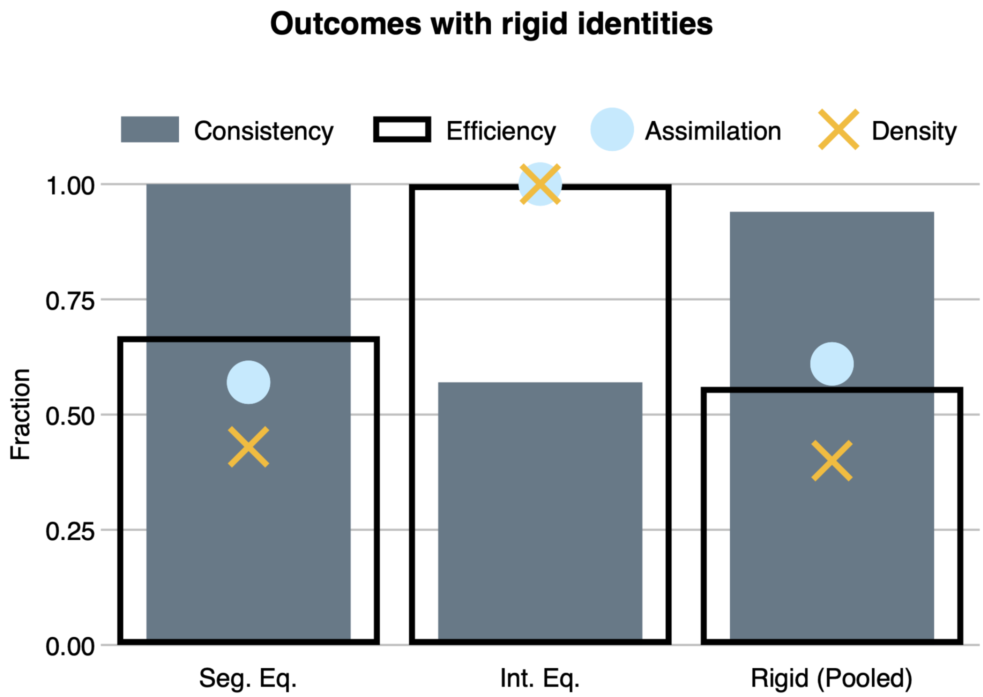


Figure 3. Effects of *rigid* identities on network outcomes

Note: The figure illustrate the predicted *segregated* and *integrated* equilibrium outcomes, as well as the average choices for Part 1, pooling the observations across all groups and periods. The bars report the efficiency level as a fraction of the maximum efficiency that can be reached with rigid identities, the fraction of participants choosing an action consistent with their identity, the fraction of participants assimilating to the majority by choosing action a, and the fraction of links formed.

In comparison to the equilibrium outcomes, and in line with the conjectures from the theory, I find that in social coordination settings with rigid identities, participants strive for consistency at the expense of efficiency. Outcomes closely resemble the segregated equilibrium. On average, 94% of the participants in every network (6.58 out of 7) chose consistently with their initial identities. Consequently, the level of efficiency in the resulting network is 55.8% (93.9/168) of the total attainable. About 61% of the participants (4.27 out of 7) assimilated by choosing the action prescribed for the majority. Moreover, groups in Part 1 formed on average 40% of all possible links (yellow X), and only 2.6% of them (0.55 links) connect participants with different identities. Thus, networks with *rigid* identities are loosely connected, and more specifically: segregated by identities. This is summarized in the following result.

Result 1. *When identities are rigid, consistency has a stronger pull than efficiency in shaping outcomes: Inefficient networks are formed, where participants segregate by majority and minority, and predominantly choose consistently with their identities. This affects the efficiency level so that more than* 40% *of the maximum efficiency is given up.*

5.2 How do obstacles to identity change shape outcomes?

Next I evaluate the role of *flexible* identities in shaping outcomes under the different conditions: the Baseline, Cost and Hidden, followed by a comparison on efficiency between Part 1 (*rigid*) and Part 2 (*flexible*) in Section 5.3. The predicted efficient outcome with *flexible* identities is the integrated equilibrium, illustrated in Figure 4, where the choices of identity change raises consistency from 57% to 100%, compared to the efficient equilibrium with *rigid* identities (see Figure 3).

Table 4. Identity change for minority and majority, by treatment

Note: Averages across treatments. Standard deviations, in parentheses, are calculated using all observations at the individual level.

	Baseline	Cost	Hidden
Change by minority	0.953	0.594	0.653
	(0.212)	(0.492)	(0.477)
Change by majority	0.008	0.006	0.006
	(0.091)	(0.079)	(0.079)

However, to evaluate treatment variations with *flexible* identities, groups must not have significantly different histories of play in Part 1, with regards to the treatment groups are going to be assigned to in Part 2. Otherwise, it would not be possible to cleanly compare the effect of treatments in Part 2.

The tests, reported in Tables B1 and B2, show there are no significant differences between groups by treatments in Part 1. For example, the efficiency level cannot be distinguished between the Baseline and Cost (56% ≈ 59%, p = 0.443), the Baseline and Hidden (56% ≈ 54%, p = 0.726), or even between Cost and Hidden (59% ≈ 54%, p = 0.288). Similarly, there are no differences in consistency, assimilation or network density. Consequently, any difference between treatments in Part 2, can be confidently interpreted as caused by the experimental conditions. Now, I look at each treatment:

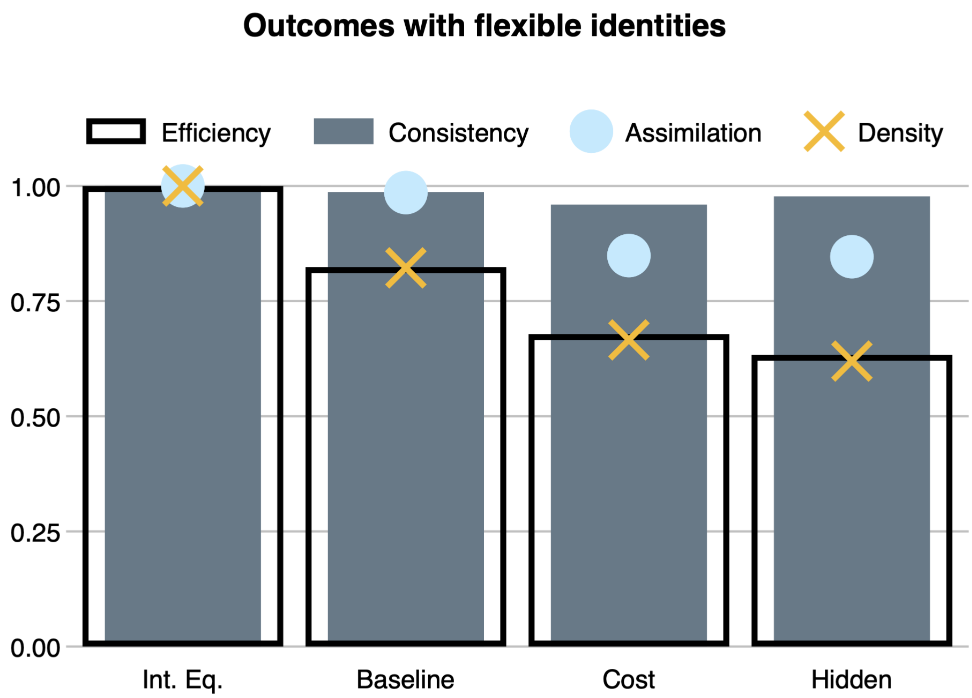


Figure 4. Effects of *flexible* identities on network outcomes

Note: The figure illustrates the predicted *integrated* equilibrium outcome, as well as the average choices for Part 2, by treatment. The bars report the efficiency level as a fraction of the maximum efficiency that can be reached with flexible identities, the fraction of participants choosing an action consistent with their identity, the fraction of participants assimilating to the majority by choosing action `a`, and the fraction of links formed.

Baseline: First, I look at the choices made in the Baseline treatment. In this condition there are no obstacles: identity change is free and the choice is visible to others. It is easy to observe in Figure 4, that outcomes in Baseline close resemble the integrated equilibrium. Participants in the minority changed their identity 95.3% of the times and those in the majority maintained their identity 99.2% of the times (see Table 4), and everyone chose assimilated and chose the same action 99% of the times. However, despite these choices, the level of efficiency is only 82% of the maximum attainable, because the networks are missing 18% of the links needed.

Cost: Now I look at network outcomes in Cost and compare it to the Baseline (all regressions are reported in Tables B3 and B4). In T2, changes of identity have a positive cost that increases with the number of in-group members who maintain their initial identity (see third outcome in Figure 4). Therefore, although integration is efficient in Cost, the coordination problem that has to be overcome to achieve efficiency is more complex coordination than in the Baseline. However, the chosen identity is visible to others, so that after the decision is made, the complexity is the same is in Baseline. In Cost efficiency drops significantly compared to the Baseline (68% < 82%, p = 0.020). This is because the cost reduces identity change significantly (59% < 95%, p = 001, see Tables B6 and B7), which in turn reduces assimilation (85% < 99%, p = 0.002) and density (67% < 82%, p = 0.003). However, there are no differences in the relation between the chosen identity and the chosen action, so consistency is indistinguishable to the Baseline (96% ≈ 99%, p = 0.173).

Hidden: The last comparison is with treatment Hidden, for which the change of identity is free but invisible to others. In this treatment, potential losses are high given that linking is costly. Therefore, if the change of identity by a participant in the minority cannot be identified, he may propose links to all majority members and receive no proposals back. Moreover, even if such a participant manages to link with all other participants in the initial minority, it will not be clear for any of them what are the incentives of others. Surprisingly, however, outcomes are not significantly more inefficient than in Cost, and in fact the distance between Hidden and the Baseline is not different from that of outcomes in Cost compared to the Baseline (see Tables B3 and B4). Efficiency is 62%, which is lower than the Baseline (p = 0.005) but indistinguishable from Cost (p = 0.549). Moreover, compared to Cost, the choices of identity change do not vary either for the majority (0.6% in both cases, p = 0.833) or for the minority (65% ≈ 59%, p = 0.601), as reported in Tables B6 and B7. As with Cost, consistency is high and not different from the Baseline (p = 0.135), despite differences in the level of identity change.

This is summarized in the following result:

Result 2. *Obstacles moderate but do not impede identity change. This impacts efficiency negatively compared to the* Baseline*.*

In what follows, I take a deeper look into the strategies groups use to overcome the different obstacles to identity change. Arguably, in Cost it is possible, although costly, for a minority participant to individually change his identity and be identified by the majority. Thus, there is no need to coordinate with *all* others. On the other hand, in Hidden, it is not possible for a participant to be individually identified as the one changing his identity. However, if *all* three participants in the minority change their identity and assimilate, this can be a clear signal for further periods.

I test this conjecture and find evidence supporting different strategies to identity change at the group level, between treatments (see Tables B6 and B7). In Hidden there are more groups where the the chosen identity of all three minority participants is perfectly correlated (all change or all maintain their initial identity) compared to Cost (74% > 52%, p = 0.067), see Figure 5. Naturally, the correlation of chosen identities is highest in the Baseline compared to Cost (p = 0.002) and Hidden (0.033), where frictions are not a constraint.

This is all summarized in the following result:

Result 3. *To overcome the challenge of visibility, minority participants significantly correlated their choices of identity, while those facing a cost changed their identity unilaterally, without tacit coordination with their in-group.*

5.3 Can *flexible* identities solve the consistency-efficiency tension in favor of efficiency?

So far, the findings have indicated that when initial identities are fixed, this leads to segregation between the minority and the majority, because participants choose consistency over efficiency. Also, that with flexible identities minority participants can strategically

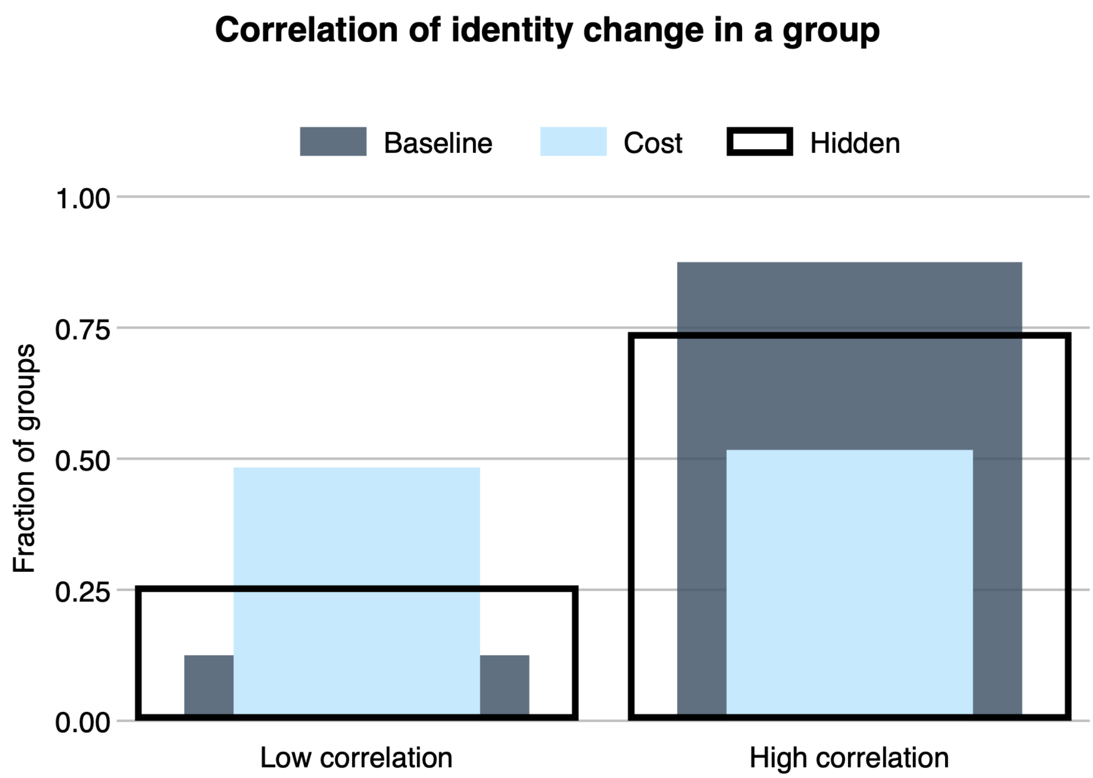


Figure 5. Level of correlation of identity choices of all minority participants in a group, by treatment

Note: The graph shows the fraction of groups where all three participants in the minority choose the same identity (High correlation) and the fraction where not all choose the same (Low correlation), for the Baseline (dark-gray bar), Cost (light-blue bar) and Hidden (black-frame bar).

match their identity with that of the dominant majority, so that the incentives of all players in favor of action a are aligned. This is achieved to a large extent, even in chases with challenging obstacles to identity change, such as Cost and Hidden. Next, I evaluate the extent to which flexible identities help resolve the tension in an efficient way. For this, I make a within-subject comparison of the efficiency levels in Part 1 and Part 2, by treatment (descriptive statistics are reported in Table 3).

In line with the intuition from the theory, I find that flexible identities provide an efficient solution to the consistency-efficiency tension (see Figure 6). The level of efficiency

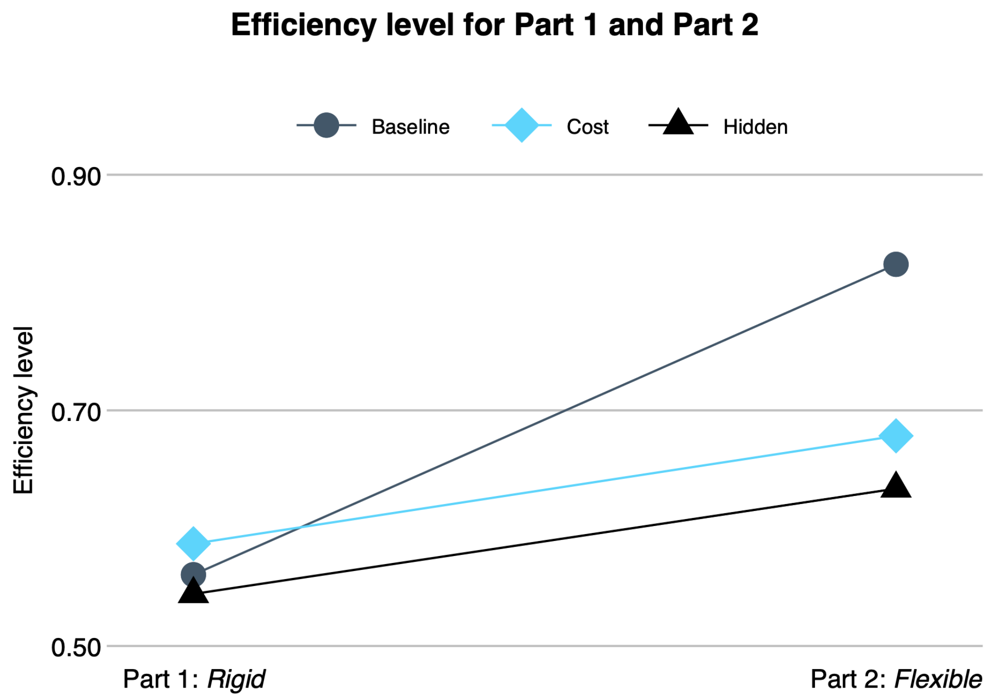


Figure 6. Effects of *flexible* identities on efficiency

Note: The figure shows the average level of efficiency in Part 1, with *rigid* identities, and in Part 2, with flexible identities. Efficiency is reported separately by treatment, even thought there were no treatment variations between groups in Part 1, for this clearly displays the effect of *flexible* identities in promoting efficiency.

is significantly larger in Part 2 than in Part 1 for the Baseline (82% > 56%, $p < 0.001$), for Cost (68% > 59%, $p = 0.035$), and for Hidden (63% > 54%, $p = 0.017$), as reported in Table B5.

Result 4. *When identities are flexible, the consistency-efficiency tension can be better resolved than when identities are rigid. Outcomes are significantly more efficient in Part 2 compared to outcomes in Part 1, across all treatments.*

5.4 Which obstacle are participants more inclined to avoid?

In this section I briefly look at treatment Reveal, where participants are presented with two potential scenarios to choose from. All participants begin in a setting with free identity change but no visibility of the choice, as in HIDDEN. Once the identity choice has been made, each participant decides if he wants to reveal this choice and make his identity visible to others or not. Revelation has a cost that increases, for those who change their identity, on the number of in-group members who maintain their initial identity. So that it changes the setting from one resembling HIDDEN to one resembling COST. The question is then, which of these two obstacles are participants more inclined to avoid? If they switch and pay the cost of revelation, it can be said they rather avoid the challenge of integrating with the majority. Otherwise, they are said to rather avoid the challenge of leaving the minority.

On average, the majority participants change identities 1.8% of the times while the minority changes 70% (differences are not significant with COSTor HIDDEN, as reported in Table B6). In comparison, the choice of revelation is much lower: 22% for the minority and 9.4% for the majority. This, however, does not make any significant differences on outcomes, compared to COST or HIDDEN, in any of the four measures used: efficiency, consistency, assimilation and density, as reported in Table B3

Result 5. *When it comes to obstacles to identity change, participants rather avoid the cost of leaving the in-group than the challenges of incomplete information to join the out-group.*

5.5 Does identity change affects in-group bias?

To conclude, I test if the interactions between minority and majority participants affects how biased participants are towards their initial in-group. Specifically, I look at the allocation choices made by participants between the two receivers: one from the minority and one from the majority (see Table 5). I define in-group bias as the difference between the allocation to the receiver with the same initial identity minus the allocation to the receiver with the opposite initial identity. Figure 7 illustrates in-group bias by treatment for the minority and the majority.

The comparison shows there is a bias for both minority and majority. For the majority, in-group bias does not differ between treatments (see Table B8). So that, even when the minority integrates and plays the coordination game in the way the majority prefers they

Table 5. In-group bias (allocation to in-group minus out-group) for minority and majority, by treatment

Note: Averages across treatments. Standard deviations, in parentheses, are calculated using all observations at the individual level.

	Baseline	Cost	Hidden
Minority	2.22	4.84	3.71
	(3.70)	(4.58)	(3.79)
Majority	3.64	3.09	3.95
	(4.19)	(4.04)	(4.31)

are unaffected by it. On the other hand, in-group bias for the minority is positive but it decreases significantly in the Baseline, where identity change was so high, individually and as a group (i.e., correlation of identity choices was highest), compared to Cost (p = 0.008) or Hidden (p = 0.099).

The presence of a positive in-group bias suggests that participants create a sense of identification with others assigned to the same group, for both minority and majority identities. In turn, this implies that the choice of identity change for the minority is strategic. Moreover, for the treatment where *flexible* identities lead to most success, the Baseline, identity change also generates a sense of identification with the out-group. However, this is only in the direction of the minority towards the majority.

Result 6. *There is positive in-group bias for participants irrespective of their initial identity. when participants do not change (i.e., majority) their perceptions towards the out-group is unaffected by the behavior of others. When participants change (i.e., the minority), differences in group perception are reduced, for cases where successful assimilation is high.*

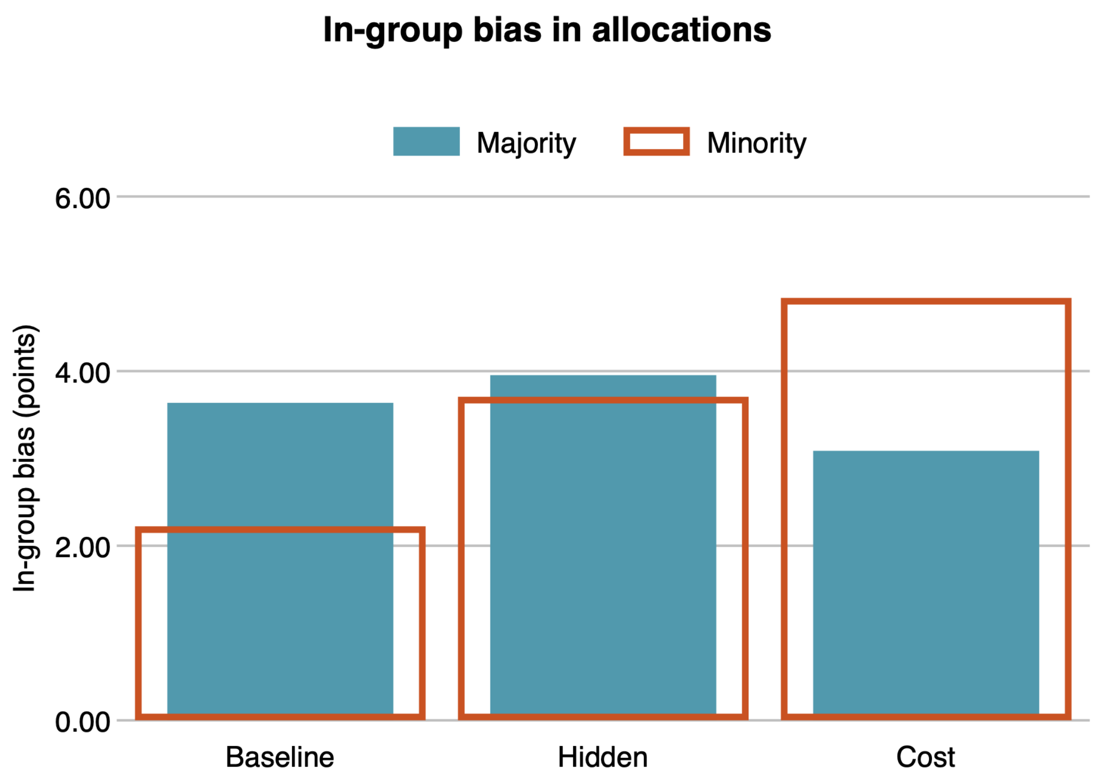


Figure 7. In-group bias for the majority and the minority by treatment

Note: The graph shows the difference in points allocated to in-group minus out-group for the minority (red-frame bar) and the majority (blue bar), for each treatment.

6 Conclusions

In this paper I have studied how identities and assimilation impact efficiency in social coordination settings. The theoretical model suggests that in equilibrium it is simpler for players to segregate by identities than to integrate, because no one would have to adopt a behavior that is not consistent with his identity. The trade-off is on efficiency. To solve this tension between consistency and efficiency, players in the minority can assimilate by matching their identity to that of the majority.

I tests this conjecture in a laboratory experiment and find that (i) minority players resort to assimilation as a way to solve this tension, (ii) assimilation is moderated by obstacles to identity change, such as costly change or restricted visibility, but (iii) it is not prevented, which makes efficiency higher than without assimilation. Finally, I test its role on inter-group perceptions and found (iv) that assimilation only impacts those who change their identity.

The findings from my work suggests that policies motivating assimilation could lead to improved efficiency. However, it raises concerns on the limits of assimilation in blurring inter-group divisions.

Future research could explore how to motivate individuals in the dominant groups to perceive others as in-group members when those others assimilate.

References

Akerlof, G. and Kranton, R. (2000). Identity and economics. Quarterly Journal of Economics, 115:1–39.

Andreoni, J., Nikiforakis, N., and Siegenthaler, S. (2018). Social change and the conformity trap. Working paper, x:1–1.

Chandra, K. (2012). Constructivist theories of ethnic politics. Oxford University Press.

Chen, D., Schonger, M., and Wickens, C. (2016). otree-an open-source platform for laboratory, online, and field experiments. Journal of Behavioral and Experimental Finance, 9:88–97.

Chen, R. and Chen, Y. (2011). The potential of social identity for equilibrium selection. American Economic Review, 101:2562–2589.

Dasgupta, P. and Goyal, S. (2019). Narrow identities. Journal of Institutional and Theoretical Economics, 175:395–419.

Ellwardt, L., Hernández, P., Martínez-Canovas, G., and Muñoz-Herrera, M. (2016). Conflict and segregation in networks: An experiment on the interplay between individual preferences and social influence. Dynamic and Games, 3:191–216.

Goyal, S., Hernandez, P., Moisan, F., Martinez, G., Muñoz-Herrera, M., and Sanchez, A. (2018). Integration and diversity. NYUAD Working Paper, 0025:1–60.

Hernandez, P., Muñoz-Herrera, M., Martinez-Canovas, G., and Sanchez, A. (2017). Equilibrium characterization of networks under conflicting preferences. Economics Letters, 155:154–156.

Hernandez, P., Muñoz-Herrera, M., and Sanchez, A. (2013). Heterogeneous network games: Conflicting preferences. Games and Economic Behavior, 79:56–66.

Jackson, M. O. and Storms, E. C. (2018). Behavioral communities and the atomic structure of networks. Working paper, x:1–1.

Lewis, D. (1969). Convention: a philosophical study. Harvard University Press.

Riedl, A., Rohde, I., and Strobel, M. (2016). Efficient coordination in weakest-link games. The Review of Economic Studies, 83:737?767.

Saleh, M. and Tirole, J. (2019). Taxing identity: Theory and evidence from early islam. CEPR Discussion Papers, 13705:1–84.

Schelling, T. (1960). The strategy of conflict. Harvard University Press.

A Proofs

Proof of Proposition 3:

Proof. Let x and y be the number of players playing a in N_{A} and N_{B}, respectively. The sum of individual payoffs is

$$W(x, y) = (n - x - y)(\alpha(|N_{\mathsf{A}}| - x) + \beta(|N_{\mathsf{B}}| - y)) + (x + y)(\beta x + \alpha y). \tag{A-1}$$

For fixed y, social welfare is decreasing in x if $x < x^*$ and increasing in x for $x > x^*$, where

$$x^* = \frac{\beta(|N_{\mathsf{B}}| - 2y) + \alpha(|N_{\mathsf{A}}| - 2y) + \alpha(n)}{2(\alpha + \beta)}. \tag{A-2}$$

Similarly, for any x, social welfare is decreasing in y if $y < y^*$, and increasing in y for $y > y^*$, where

$$y^* = \frac{\alpha(|N_{\mathsf{A}}| - 2x) + \beta(|N_{\mathsf{B}}| - 2x) + \beta(n)}{2(\alpha + \beta)} \tag{A-3}$$

Since $0 \leq x \leq |N_{\mathsf{A}}|$ and $0 \leq y \leq |N_{\mathsf{B}}|$, it follows that $W(x, y)$ is maximized for some $x \in \{0, |N_{\mathsf{A}}|\}$ and some $y \in \{0, |N_{\mathsf{B}}|\}$. Note that $W(0, |N_{\mathsf{B}}|) = \alpha(|N_{\mathsf{A}}|^2 + |N_{\mathsf{B}}|^2)$, and $W(|N_{\mathsf{A}}|, 0) = \beta(|N_{\mathsf{A}}|^2 + |N_{\mathsf{B}}|^2)$, which directly implies that $W(0, |N_{\mathsf{B}}|) > W(|N_{\mathsf{A}}|, 0)$ (because $\alpha > \beta$). Furthermore, since $W(0, 0) = n(\alpha|N_{\mathsf{A}}| + \beta|N_{\mathsf{B}}|)$, then $W(0, 0) > W(0, |N_{\mathsf{B}}|)$ if and only if

$$\frac{|N_{\mathsf{A}}|}{|N_{\mathsf{B}}|} > \frac{\alpha - \beta}{\alpha + \beta} \tag{A-4}$$

This inequality holds whenever $|N_{\mathsf{A}}| > |N_{\mathsf{B}}|$.

Similarly, since $W(|N_{\mathsf{A}}|, |N_{\mathsf{B}}|) = n(\beta|N_{\mathsf{A}}| + \alpha|N_{\mathsf{B}}|)$, then $W(|N_{\mathsf{A}}|, |N_{\mathsf{B}}|) > W(0, |N_{\mathsf{B}}|)$ if and only if

$$\frac{|N_{\mathsf{B}}|}{|N_{\mathsf{A}}|} > \frac{\alpha - \beta}{\alpha + \beta} \tag{A-5}$$

This inequality holds whenever $|N_{\mathsf{B}}| > |N_{\mathsf{A}}|$. Furthermore, note that equations A-2 and A-3 hold for $|N_{\mathsf{A}}| = |N_{\mathsf{B}}|$ as long as $\beta > 0$. To summarize, there is always either $W(0,0) > W(0,|N_{\mathsf{B}}|)$ or $W(|N_{\mathsf{A}}|,|N_{\mathsf{B}}|) > W(0,|N_{\mathsf{B}}|)$ as long as $|N_{\mathsf{A}}| \neq |N_{\mathsf{B}}|$ or $\beta > 0$.

Now, consider the case where $x = |N_{\mathsf{A}}|$ and $y = |N_{\mathsf{B}}|$: this implies that $x + y = n$. Since $\alpha > \beta$, it can be shown that $W(0,0) > W(|N_{\mathsf{A}}|,|N_{\mathsf{B}}|)$ so long as $|N_{\mathsf{A}}| > |N_{\mathsf{B}}|$. Moreover, $W(0,0) < W(|N_{\mathsf{A}}|,|N_{\mathsf{B}}|)$ holds as long as $|N_{\mathsf{A}}| < |N_{\mathsf{B}}|$. Finally, $W(0,0) = W(|N_{\mathsf{A}}|,|N_{\mathsf{B}}|)$ if $|N_{\mathsf{A}}| = |N_{\mathsf{B}}|$.

This shows that in a setting with rigid identities, social welfare is maximized when the network is integrated and there is full coordination because all players choose the majority's prescribed action. □

Proof of Corollary 2:

Proof. Following from the previous proof for Proposition 3, consider now the setting with flexible identities. There are three different symmetric scenarios: (i) a case in which all players maintain their initial identity, $\bar{\theta}_i = \theta_i$, (ii) a case where all players choose the same identity, either because all players in the minority change their initial identity or because all players in the majority change it, e.g., $\bar{\theta}_i \neq \theta_i$ if $\theta_i = \{\mathsf{A}\}$ and $\bar{\theta}_i = \theta_i$ if $\theta_i = \{\mathsf{B}\}$, and (iii) all players, both in the majority and the minority, change their initial identity, $\bar{\theta}_i \neq \theta_i, \forall i \in N$.

The results so far have shown the efficient outcome in case (i). Compare this to the setting in which all players with a given identity change it. Thus, $\bar{\theta}_i = \bar{\theta}_j = \mathsf{A}, \forall i, j \in N$. Thus, if the changing cost is $\delta = 0$ then: $W(0,0) = n(\alpha N_{\mathsf{A}} + \beta N_{\mathsf{B}}) < W(n_{\theta_i=\theta_j=\mathsf{A}}) = \alpha n^2$ which is always true given that $\alpha > \beta$. This shows that if identities are flexible, it is efficient for all players to choose the same identity as well as consistently choose the action prescribed to that identity. This outcome is better than a combination of identities, and thus it is more efficient than the case where both minority and majority change identities. This also implies that as long as the changing cost is zero, society is indifferent between one or the other identity. Either a or b are equivalently efficient for full coordination.

Finally, consider the case in which the cost to change identities is positive: $W(0,0) =$

$n(\alpha N_{\mathsf{A}} + \beta N_{\mathsf{B}}) < W(n_{\theta_i = \theta_j = up}) = \alpha n^2 - \delta|N_{\mathsf{A}}|$ which is true as long as:

$$\delta < n(\alpha - \beta) \tag{A-6}$$

Note that this is the same condition stated in the proof for Proposition 4 for the case in which all players are linked and have the same identity, so that $\delta < (|N_i(\bar{g})| - \chi_i + 1)(\alpha - \beta) = n(\alpha - \beta)$. Which simply states that as long as the cost of changing is not too high, the efficient outcome is that in which all players choose the same identity and the action that is consistent with the chosen identity. If changing is costly the chosen action is that of the majority, given that fewer players pay the changing cost. This completes the proof. □

B Regression tables

The data in my experiment consists of the decisions made by 336 individuals who interact over 20 periods in groups of 7 players. The tables below report the results associated to random effects GLS regressions with standard errors clustered on groups. Following the regressions, there are tables reporting post-estimation tests of coefficients between treatments.

Table B1 contains regressions testing differences in the randomization of groups by treatment, on the effect that rigid identities have on the main properties of network outcomes. In all regressions the independent variables are dummies for each treatment, for which the BASELINE is the omitted category. Moreover, I use group random effects in all regressions. In column I, the dependent variable is the efficiency level out of the total that can be achieved. In column II, the dependent variable is consistency, representing the proportion of participants in a group choosing as prescribed by their identity. In column III, the dependent variable is assimilation, which is the proportion of participants in a group choosing the majority's prescribed action a. Finally, in column IV, the dependent variable is density, which reports the proportion of links formed in the network.

Table B1. Effect of *rigid* identities on network outcomes

Note: GLS regressions with group random effects and standard errors clustered on groups (in parenthesis). The dependent variable is the level of efficiency in column I, consistency of choice and identity in column II, assimilation into the majority's action in column III, and network density in column IV. ***, **, and * indicate statistical significance at the 0.01, 0.05, and 0.10 levels.

	I	II	III	IV
COST	0.026	−0.001	0.004	0.023
	(0.034)	(0.038)	(0.038)	(0.022)
HIDDEN	−0.017	0.004	−0.015	0.003
	(0.047)	(0.029)	(0.028)	(0.019)
REVEAL	−0.017	0.024	−0.007	0.023
	(0.042)	(0.042)	(0.038)	(0.017)
Constant	0.561***	0.948***	0.609***	0.387***
	(0.029)	(0.024)	(0.023)	(0.012)
χ^2	2.35	0.54	0.49	2.55
# Obs.	480	480	480	480

In addition, Table B2 contains post-estimation tests comparing the coefficients of the treatments used as covariates in each of the four regressions.

Table B2. Test of coefficients between treatments for *rigid* identities

Note: Post-estimation Wald test on the equality of coefficients between treatments, from the GLS regressions reported in Table B1. The χ^2 coefficients are reported for each linear comparison for which ***, **, and * indicate statistical significance at the 0.01, 0.05, and 0.10 levels. The dependent variable of the regression is the level of efficiency in column I, consistency of choice and identity in column II, assimilation into the majority's action in column III, and the network density in column IV.

	I	**II**	**III**	**IV**
Cost-Hidden= 0	1.13	0.02	0.32	0.71
Cost-Reveal= 0	0.00	0.54	0.06	1.11
Hidden-Reveal= 0	1.57	0.26	0.06	0.00

Table B3 contains regressions testing differences in the effect that obstacles to identity change have on network outcomes. In all regressions the independent variables are dummies for each treatment, for which the Baseline is the omitted category. Moreover, I use group random effects in all regressions. In column I, the dependent variable is the efficiency level out of the total that can be achieved in each treatment. In column II, the dependent variable is consistency. In column III, the dependent variable is assimilation. Finally, in column IV, the dependent variable is density.

In addition, Table B4 contains post-estimation tests comparing the coefficients of the treatments used as covariates in each of the four regressions.

Finally, Table B5 reports values from regressions comparing outcomes between *rigid* and *flexible* settings. In each regression, I use a dummy that takes value 1 for Part 2 with *flexible* identities (the omitted category is Part 1 with *rigid* identities). The table only reports the coefficients and p-values for the dummy variable by treatment, for all four measures: efficiency level (column I), consistency (column II), assimilation (column III) and density (column IV).

Table B6 contains regressions testing differences in the effect that obstacles have on the choice of identity change. In all regressions the independent variables are dummies for each treatment, for which the Baseline is the omitted category. Moreover, I use group random effects in all regressions. In column I, the dependent variable is the probability to

Table B3. Effect of *flexible* identities on network outcomes

Note: GLS regressions with group random effects and standard errors clustered on groups (in parenthesis). The dependent variable is network density in column I, assimilation into the majority's action in column II, consistency of choice and identity in column III, and the level of efficiency in column IV. ***, **, and * indicate statistical significance at the 0.01, 0.05, and 0.10 levels.

	I	II	III	IV
Cost	-0.146^{**}	-0.027	-0.137^{***}	-0.156^{**}
	(0.063)	(0.020)	(0.044)	(0.069)
Hidden	-0.190^{***}	-0.009	-0.139^{***}	-0.202^{***}
	(0.068)	(0.006)	(0.049)	(0.074)
Reveal	-0.207^{***}	-0.017^{*}	-0.101^{**}	-0.184^{***}
	(0.059)	(0.009)	(0.040)	(0.061)
Constant	0.824^{***}	0.987^{***}	0.986^{***}	0.822^{***}
	(0.039)	(0.004)	(0.008)	(0.039)
χ^2	15.31^{***}	5.53	22.21^{***}	13.13^{***}
# Obs.	480	480	480	480

Table B4. Test of coefficients between treatments for *flexible* identities

Note: Post-estimation Wald test on the equality of coefficients between treatments, from the GLS regressions reported in Table B3. The χ^2 coefficients are reported for each linear comparison for which ***, **, and * indicate statistical significance at the 0.01, 0.05, and 0.10 levels. The dependent variable of the regression is the level of efficiency in column I, consistency of choice and identity in column II, assimilation into the majority's action in column III, and the network density in column IV.

	I	II	III	IV
Cost-Hidden$=0$	0.36	0.76	0.00	0.29
Cost-Reveal$=0$	0.05	0.45	0.36	0.06
Hidden-Reveal$=0$	0.86	0.24	0.37	0.14

change identity for a participant in the majority. In column II, the dependent variable is the probability to change identity for a participant in the minority. Finally, in column III, the dependent variable is the probability that all three participants in the minority choose the same identity.

In addition, Table B7 contains post-estimation tests comparing the coefficients of the treatments used as covariates in each of the four regressions in Table B6.

Table B8 contains regressions testing differences in the effect that treatments have on in-group bias, for the majority and the minority. In all regressions the independent variables are dummies for each treatment, for which the Baseline is the omitted category.

Table B5. Comparison between Part 1 and Part 2 by treatment

Note: Coefficients from GLS regressions comparing *flexible* against *rigid* identities, by treatment. The coefficients for the dummy variable *flexible* are reported for each treatment, for which ***, **, and * indicate statistical significance at the 0.01, 0.05, and 0.10 levels. The dependent variable of the regressions is the level of efficiency in column I, consistency of choice and identity in column II, assimilation into the majority's action in column III, and the network density in column IV.

	I	II	III	IV
Baseline	0.264***	0.039	0.376***	0.435***
Cost	0.089**	0.026**	0.252***	0.229***
Hidden	0.092**	0.013	0.236***	0.256***
Reveal	0.074	0.046	0.282***	0.288***

Table B6. Effect of obstacles on the probability of identity change

Note: GLS regressions with group random effects and standard errors clustered on groups (in parenthesis). The dependent variable is the choice of a participant to change his identity or not for the majority in column I, or the minority in column II, and the probability that all three minority participants choose the same identity in column III. ***, **, and * indicate statistical significance at the 0.01, 0.05, and 0.10 levels.

	I	II	III
Cost	−0.166	−2.419***	−1.335***
	(0.439)	(0.520)	(0.429)
Hidden	−0.0.71	−2.062***	−0.574**
	(0.393)	(0.619)	(0.269)
Reveal	0.394	−1.849***	−1.067**
	(0.368)	(0.526)	(0.428)
Constant	−3.048***	2.838***	1.331***
	(0.382)	(0.286)	(0.195)
χ^2	2.73	29.021***	12.87***
# Obs.	1920	1440	480

Moreover, I use group random effects in all regressions. The dependent variable is in-group bias, measured as the amount of points allocated to the receiver from in-group above the receiver from the out-group. Column I reports the results for participants in the majority, and column II for participants in the minority.

In addition, Table B9 contains post-estimation tests comparing the coefficients of the treatments used as covariates in each of the four regressions in Table B8.

Table B7. Test of coefficients between treatments for identity change

Note: Post-estimation Wald test on the equality of coefficients between treatments, from the GLS regression reported in Table B6. The χ^2 coefficients are reported for each linear comparison for which ***, **, and * indicate statistical significance at the 0.01, 0.05, and 0.10 levels. The dependent variable of the regression is the probability that a participant changes his initial identity for the majority in column I, or the minority in column II, and the probability that all three minority participants choose the same identity in column III.

	I	**II**	**III**
Cost-Hidden= 0	0.04	0.27	3.34*
Cost-Reveal= 0	1.25	0.09	1.41
Hidden-Reveal= 0	2.11	0.87	0.27

Table B8. In-group bias for each identity, by majority and minority

Note: OLS regressions with group random effects and standard errors clustered on groups (in parenthesis). The dependent variable is in-group bias, the amount of points allocated to the in-group receiver above the out-group receiver, for the majority in column I, or the minority in column II. ***, **, and * indicate statistical significance at the 0.01, 0.05, and 0.10 levels.

	I	**II**
Cost	−0.549	2.616***
	(0.979)	(0.952)
Hidden	0.317	1.484*
	(1.111)	(0.880)
Reveal	−0.998	1.051***
	(0.826)	(0.888)
Constant	3.636***	2.222***
	(0.684)	(0.504)
F	0.85	2.79*
# Obs.	180	134

Table B9. Test of coefficients between treatments for in-group bias

Note: Post-estimation Wald test on the equality of coefficients between treatments, from the OLS regression reported in Table B8. The χ^2 coefficients are reported for each linear comparison for which ***, **, and * indicate statistical significance at the 0.01, 0.05, and 0.10 levels. The dependent variable of the regression is in-group bias, the amount of points allocated to the in-group receiver above the out-group receiver, for the majority in column I, or the minority in column II.

	I	**II**
Cost-Hidden= 0	0.60	1.09
Cost-Reveal= 0	1.76	0.18
Hidden-Reveal= 0	0.28	2.07

C Subjects' instructions

Below I include a sample of the instructions participants read in *Assignment*, *rigid*, *flexible* and *Allocation* for the Baseline treatment. Each set of instructions has comprehension questions that participants were required to answer correctly before continuing.

Instructions Part 1 - Page 1

Welcome to this study

You will receive a minimum pay of **10,000 pesos** for your participation in this study. Please read these instructions carefully to find out how you can earn **additional money**.

All interactions take place through the computers. Please do not talk or communicate with the other participants in any other way.

Please raise your hand if you have any question, and an experimentalist will come and answer your question privately.

This study is **anonymous**. Therefore, your identity will not be revealed to the other participants nor their to you.

This study has **4 parts**. You will now only read the instructions for Part 1. Once Part 1 is over, you will read the instructions for Part 2, and so on. In all four parts you will interact with the same participants.

You will participant with other 6 participants in the different parts of the study. 4 participants will be assigned to group ● and 3 participants will be assigned to group ▲. This is explained in the next screens.

In this experiment you can earn points depending on your choices and the choices made by the other participants. The amount of points you can earn is explained in the instructions for each part. At the end of the study, we will convert the total number of points you have earned into pesos using the following exchange rate: **1 points = 800 pesos**. You will receive your earnings in cash.

Continue

Part 1: Your group

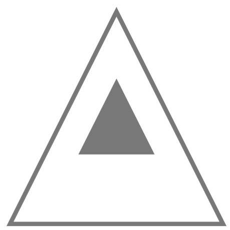
Here we explain the visual information of your group (the way it will be displayed on the screen). This information will be useful for the subsequent parts of the experiment. In this part you will also make a decision together with the other participants assigned to your group: you will choose a name for your group. This is explained as follows:

1. Group image

You have been assigned to **group ▲** (internal symbol) and your **appearance** is △ (external symbol).

There are 3 players in your group▲, you included. There are 4 players in group ●.

Each player in your group will be displayed on the screen using the following image:



In the chat box on the right hand side you can communicate with the other participants in group ▲ and choose a name for your group, *by clicking on the button with the name you prefer as a group*. **To choose a name, all 4 players in your group must click on the same button**.

2. Group name

In the chat box below, you will be labeled as **Player 2**. It is not allowed to use any offensive language. And to maintain anonymity, it is not allowed to send any information that can be used by the other participants to identify who you are.

Write on the chat box to communicate with the other players in your group.

Send

Click on the button with the name chosen by your group.

Dogs | Jackals | Coyotes

Foxes | Wolves

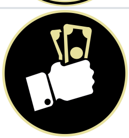
Instructions Part 2 - Page 1

This is Part 2

In the following screens you will see the instructions of Part 2. At the end of the instructions you will be a summary of the most important information. This **summary** will be available in each screen during Part 2.

Part 2 has **10 rounds**. As in Part 1, once Part 2 has ended, you will read the instructions for Part 3. In Part 2 you can interact witht he same 6 other players from Part 1, those in group ● (Cats) and those in group ▲ (Dogs).

Each of the 10 rounds in Part 2 have three stages: **Conections** (stage 1), **Actions** (stage 2), y **Results** (stage 3). The choices you make in each stage are explained in the following screens.



You will receive payment for **one of the 10 rounds** of Part 2. At the end of the study, the computer will randomly choose which round will be used for payment.

Continue

Decisions in Part 2

Groups, Appearances & Labels

In Part 2 you will participate with 6 other players (the same as in Part 1). Each player is randomly assigned to a group ● "Lions" or ▲ "Coyotes" (inner symbol) , and will also have an appearance ◯ or △ (símbolo externo). Each player will also have a numeric label from 1 to 7. You will see the group, appearance and label of each player on the screen (see Figure 1).

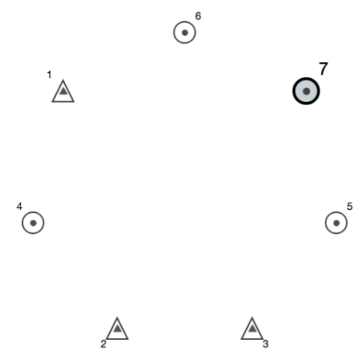
On the header of each screen you will see a summary of this information as in the example below:

You are player 7 (Round 1 of 10)
Your group is ● and your appearance ◯

In each round there will be 4 players in group ● "Lions" and 3 in group ▲ "Coyotes". A player's group and appearance **will not change** between rounds during Part 2, hile his numeric label and position in the screen will be **randomly changed in each round**.

For instance, the player in the header above is in group ● "Lions" and has the numeric label 7 in round 1. In round 2, the same player will be in the same group than before but his label may be any number from 1 to 7, and his position may be anywhere on the screen. The same is the case for all other players.

Fig. 1: Groups

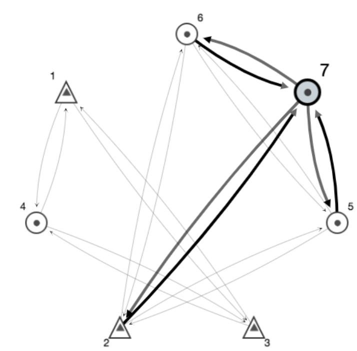


Stage 1: Connections

In the **Connections stage** you can propose a connection to those players you want to participate with in Stage 2. You can propose a connection to any player no matter their group or appearance. If you propose a connection to a player who **also** proposes to you, there is an **active connection** between the two of you. In Stage 2 you will **only participate** with the players with whom you have an active connection.

You will see your connections on the screen (see Figure 2). There is a light arrow leaving from you for each connection you proposed, and a dark arrow heading towards you for each connection proposed to you. **If both** arrows are present you have an **active connection** with that other player. If only one of you proposes a connection but the other does not, there is no active connection between the two of you. **Your connections are illustrated with thicker lines and those of others are thinner.*

Fig. 2: Connections

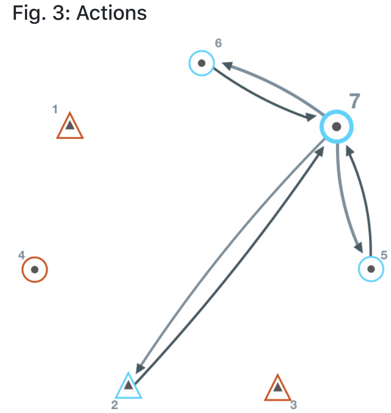


Stage 2: Actions

In the **Actions stage** you will pick one of two actions: Cyan or Terra. You only pick one action for the stage, not one for each connection. You will get points for each of your active connections choosing **the same action as you**. You will **not** get any points for an active connection choosing **a different action** than you, nor from a player choosing the same action as you, if he **is not** an active connection.

The action chosen by each player is illustrated by the color of his appearance (see Figure 3).

Fig. 3: Actions



Before you continue, please answer the following comprehension questions:

1. You have been assigned to a group: ● or ▲ (inner symbol). How often does your group change?

- ◯ It is fixed and does not change
- ◯ The computer changes it in each round
- ◯ I can change it in each round

2. You will be given an appearance: ◯ or △ (external symbol). How often does your appearance change?

- ◯ It is fixed and does not change
- ◯ The computer changes it in each round
- ◯ I can change it in each round by changing my group

3. You will be assigned a label from 1 to 7. How often does your label change?

- ◯ It is fixed and does not change
- ◯ The computer changes it in each round
- ◯ I can change it in each round

4. In Stage 2 (Actions) you only participate with your active connections. When is a connection active?

- ◯ When I propose a relation to another player regardless of he/she proposing a relation to me
- ◯ When another player proposes a relation to me regardless of me proposing a relation to him/her
- ◯ When I propose a relation to a player who also proposes a relation to me

5. In Figure 2 above, how many active connections does player 7 have?

- ◯ 5
- ◯ 4
- ◯ 3

Continue

Points in Part 2

Stage 3: Results

In stage 3 for each round, you will see how many points you get in that round. The points are calculated by the gains of coordinating with your active connections minus the costs of your proposed connections. A coordination is an instance where you and another player with whom you have an active connection both chose the same action: Cyan or Terra. The computer will do the calculations for you in each round, but below you can see how the points are calculated in 3 simple steps:

Step 1: Gains from coordination

Gains in each round depend on (i) your group, (ii) the action you pick, and (iii) the number of your active connections choosing the same (including yourself). You do not earn anything with a player if you do not have an active connection together and choose the same action.

If your group is ● "Lions" and you:

- choose Cyan, you get **6 points** for each active connection also choosing Cyan (including yourself) and **0 points** for any active connection also choosing Terra
- choose Terra, you get **4 points** for each active connection also choosing Terra (including yourself) and **0 points** for any active connection also choosing Cyan

If your group is ▲ "Coyotes" and you:

- choose Terra, you get **6 points** for each active connection also choosing Terra (including yourself) and **0 points** for any active connection also choosing Cyan
- choose Cyan, you get **4 points** for each active connection also choosing Cyan (including yourself) and **0 points** for any active connection also choosing Terra

Step 2: Costs from proposals

Your costs in each round depend **only on the number of connections you propose**. You pay a cost of **2 points** for each proposal you make, independently of whether the other player also proposes a connection to you or not.

Step 3: Total points

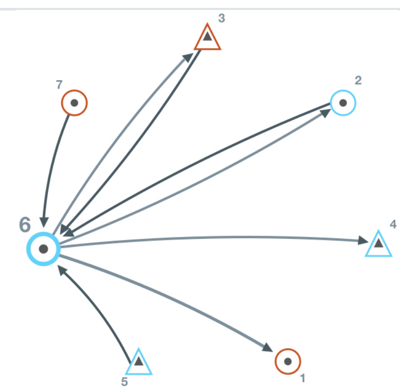
Your points are calculated as the **gains from coordinating with your active connections** minus the **cost of each connection you propose**. The examples illustrate this:

Example 1: Player 6 in group ● "Lions" chose Cyan

1. Earnings: Player 6 formed **two** active connections (with players 2 and 3) and have **two** coordinations, (with player 2 and with himself). The two coordinations are multiplied by **6** (because his group is ● "Lions" and he chose Cyan).
Player 6 did not coordinate with player 3, therefore he does not earn points with that active connection. Player 6 coordinated with players 4 and 5, but did not form an active connection with either of them, so he cannot earn points with them. Player 6's earnings are: **12 points.**

2. Costs: Player 6 proposed **four** connections (to players 1, 2, 3 and 4), the cost of each proposal is 2 points, so he pays **8 points**.

3. Total Points: Player 6 gets 12 in gains minus 8 in costs: 12 - 8 = **4 points** in this round.



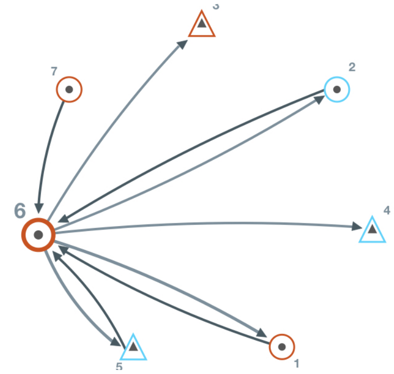
Example 2: Player 6 in group ● **"Lions"** chose Terra

1. Earnings: Player 6 formed **three** active connections (with players 1, 2 and 3) and have **two** coordinations, (with player 1 and with himself). The two coordinations are multiplied by **4** (because his group is ● "Lions" and he chose Terra).

Player 6 did not coordinate with players 2 and 5, therefore he does not earn points with those active connection. Player 6 coordinated with players 3 and 7, but did not form an active connection with either of them, so he cannot earn points with them. Player 6's earnings are: **8 points.**

2. Costos: Player 6 proposed **five** connections (to players 1, 2, 3, 4 and 5), the cost of each proposal is 2 points, so he pays **10 points**.

3. Puntos Totales: Player 6 gets 8 in gains minus 10 in costs: 8 - 10 = **-2 points** in this round.



Before you continue, please answer the following comprehension questions:

1. Imagine your group is ● "Lions", you chose action Cyan and you have one active connection with a player who chose action Cyan . What are the total points you get *from this connection* (not including what you get from coordinatng with yourself)?

- I gain 6 and pay the cost of 2 = 4 points in total
- I gain 4 and pay the cost of 2 = 2 points in total
- I gain 0 and pay the cost of 2 = -2 points in total

2. Imagine your group is ● "Lions", you chose action Cyan and you have one active connection with a player who chose action Terra . What are the total points you get *from this connection* (not including what you get from coordinatng with yourself)?

- I gain 6 and pay the cost of 2 = 4 points in total
- I gain 4 and pay the cost of 2 = 2 points in total
- I gain 0 and pay the cost of 2 = -2 points in total

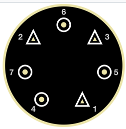
Continue

Instructions Part 2 - Page 6

Summary

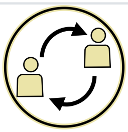
The summary of the instructions (below) will be available in each round. To display it just click on the button **Show Summary** at the bottom of the screen.

Instructions Part 2



Groups, Appearances & Labels

In Part 2 you will interact with 6 other players. At the beginning of the experiment each of you was assigned to one of two groups: ● "Lions" or ▲ "Coyotes" (internal symbol), and was assigned an appearance: ◯ or △ (external symbol) and a numeric label (between 1 and 7 7). Your group and appearance are fixed for all 10 rounds in Part 2 while your numeric label and your position on the screen will change in each round.
There are 3 stages in each round..



Stage 1: Connections

In stage 1, you can propose connections to the other players. A connection with another player is **active** if both you and the other player propose a connection to each other. Each connection you propose will cost you 2 points, independently of whether the other player also proposes a connection to you or not.

Stage 2: Actions

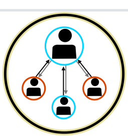
In stage 2, you will choose an action: Cyan or Terra. You will earn points depending on your group, the action you choose, and the number of your active connections choosing **the same action** as you:

If your group is ● "Lions" and you:

- choose Cyan, you get **6 points** for each active connection also choosing Cyan (including yourself) and **0 points** for any active connection also choosing Terra
- choose Terra, you get **4 points** for each active connection also choosing Terra (including yourself) and **0 points** for any active connection also choosing Cyan

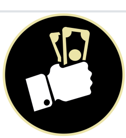
If your group is ▲ "Coyotes" and you:

- choose Terra, you get **6 points** for each active connection also choosing Terra (including yourself) and **0 points** for any active connection also choosing Cyan
- choose Cyan, you get **4 points** for each active connection also choosing Cyan (including yourself) and **0 points** for any active connection also choosing Terra



Stage 3: Results

In stage 3, you will see how many points you get in that round. The points are calculated by the gains of coordinating with your active connections minus the costs of your proposed connections. The border of each player's appearance (◯ or △) shows the action that player chose.



Earnings in Part 2

You will participate for 10 rounds in Part 2. At the end of the experiment the computer **will randomly select one of the 10 round**. The number of points you got in the selected round will be added to the total number of points used to determine your payment.

Begin Part 2

Welcome to Part 3

You have concluded Part 2 and will now begin Part 3:

First, you will read the instructions for **Part 3**.

Then, you will participate in Part 3 for **10 rounds**.

You will be paid for **one of the 10 rounds** in Part 3. As in Part 2, at the end of the study, the computer will randomly choose which round will be used for payment.

Continue

Instructions Part 3 - Page 2

Decisions in Part 3

In Part 3 you will participate for 10 rounds with the same 6 other players from Part 2. While, each round in Part 2 had 3 stages, each round in Part 3 will have 4 stages: **Group choice** (Stage 1), **Connections** (Stage 2), **Actions** (Stage 3) and **Results** (Stage 4).

The Connections, Actions and Results stages are the same as in Part 2. The **Group Choice** stage is **new** and is explained below.

Stage 1: Group Choice

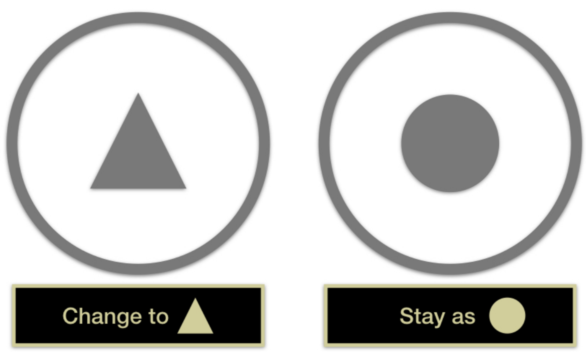
At the beginning of each round, **before Stage 1**, all players will be assigned to the same group they belonged to in Part 2. If you were ● "Lions" in Part 2, you will begin each round in Part 3 as a ●. If you were ▲ "Coyotes" in Part 2, you will begin each round in Part 3 as a ▲.

Then, in the **Group Choice** stage, each player will decide if he wants to stay in his group or if he wants to change it.

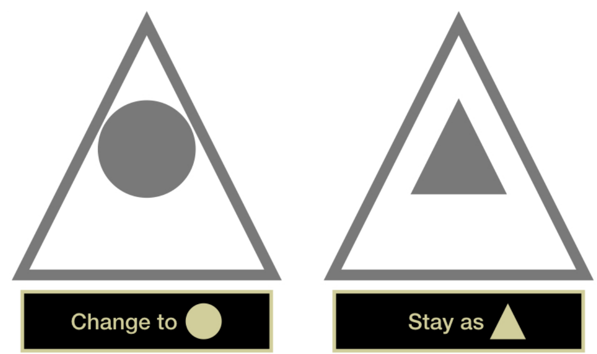
The group symbol will indicate the group each player has chosen. A player's appearance will not change when he changes his group.

The example below shows the choices a player can make depending on his group at the beginning of each round. The image above each button indicates how other players will see him in the remaining three stages of that round (Connections, Actions and Results), depending on whether he changes or stays in his group.

Group choice for a player belonging to group ● "Lions"



Group choice for a player belonging to group ▲ "Coyotes"



Points in Part 3:

If a player in group ● "Lions" stays in the same group, he will continue earning points as a ● "Lions". That is, 6 points for each coordination on Cyan and 4 points for each coordination on Terra .

However, if a player in group ● "Lions" changes to group ▲ "Coyotes", he will earn points as a ▲ "Coyotes". That is, 6 points for each coordination on Terra and 4 points for each coordination on Cyan .

Similarly, if a player in group ▲ "Coyotes" changes to group ● "Lions", he will earn points as a ● "Lions". That is, 6 points for each coordination on Cyan and 4 pointss for each coordination on Terra .

But if he chooses to stay in group ▲ Coyotes", he will continue earning points as a ▲ Coyotes". That is, 6 points for each coordination on Terra and 4 points for each coordination on Cyan .

Stage 2: Connections

This Stage is the same as in Part 2. Each player can propose to others and pays a cost of 2 points for each connection proposed.

Stage 3: Actions

This Stage is the same as in Part 2. Each player chooses one of two actions: Cyan or Terra and earns points by the number of his/her active connections choosing the same action.

Stage 4: Results

This Stage is the same as in Part 2. Each player is informed of the number of total points he gets in the round. Points are calculated by the gains from coordination (which depend on the group chosen in the current round, the action chosen, and the number of coordinations with active connections) minus the costs of proposing connections to others. .

Before you continue, please answer the following comprehension questions:

1. You have been assigned to a group: ● or ▲ (inner symbol). How often does your group change?

- ◯ It is fixed and does not change
- ◯ The computer changes it in each round
- ◯ I can change it in each round

2. You will be given an appearance: ◯ or △ (external symbol). How often does your appearance change?

- ◯ It is fixed and does not change
- ◯ The computer changes it in each round
- ◯ I can change it in each round by changing my group

3. You will be assigned a label from 1 to 7. How often does your label change?

- ◯ It is fixed and does not change
- ◯ The computer changes it in each round
- ◯ I can change it in each round

4. Imagine you began in group ● "Lions", and you changed to group ▲ "Coyotes". Then you chose action Cyan **and you have one active connection with a player who chose action** Cyan **. What are the total points you get *from this connection* (not including what you get from coordinatng with yourself)?**

- ◯ I gain 6 and pay the cost of 2 = 4 points in total
- ◯ I gain 4 and pay the cost of 2 = 2 points in total
- ◯ I gain 0 and pay the cost of 2 = -2 points in total

5. Imagine you began in group ● "Lions", and you stayed in your group. Then you chose action Cyan **and you have one active connection with a player who chose action** Cyan **. What are the total points you get *from this connection* (not including what you get from coordinatng with yourself)?**

- ◯ I gain 6 and pay the cost of 2 = 4 points in total
- ◯ I gain 4 and pay the cost of 2 = 2 points in total
- ◯ I gain 0 and pay the cost of 2 = -2 points in total

6. After the Group choice (Stage 1), what will other players see about you in the remaining three stages?

- ◯ They can see the group I choose and my new appearance
- ◯ They can see the group I choose and my appearance from Part 2
- ◯ They cannot see the group I choose only my appearance from Part 2

Continue

Summary

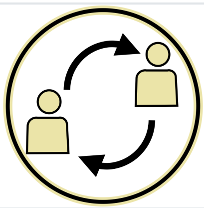
The summary of the instructions (below) will be available in each round. To display it just click on the button Show Summary at the bottom of the screen.

Instructions Part 3

In Part 3 you will interact with the same 6 players from Part 2. There are 4 stages in each round.

Stage 1: Group Choice

At the beginning of each round, **before Stage 1**, you and all other players will be assigned to the same group they belonged to in Part 2. In Stage 1 you will choose a group. You can stay in the group same group you have been assigned to or you can change groups. **The group symbol will indicate the group each player has chosen. A player's appearance will not change when he changes his group**.



Stage 2: Connections

In this stage, you can propose connections to the other players at a cost of 2 points.

Stage 3: Actions

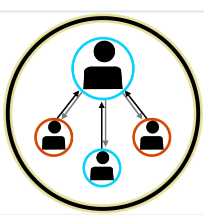
In this stage, you choose an action: Cyan or Terra . You will earn points depending on the group you choose, the action you choose, and the number of your active connections choosing **the same action** as you:

If your chosen group is ● "Lions" and you:

- choose Cyan , you get **6 points** for each active connection choosing Cyan (including yourself) and **0 points** for any active connection choosing Terra
- choose Terra , you get **4 points** for each active connection choosing Terra (including yourself) and **0 points** for any active connection choosing Cyan

If your chosen group is ▲ "Coyotes" and you:

- choose Terra , you get **6 points** for each active connection choosing Terra (including yourself) and **0 points** for any active connection choosing Cyan
- choose Cyan , you get **4 points** for each active connection choosing Cyan (including yourself) and **0 points** for any active connection choosing Terra



Stage 4: Results

In this stage, you will see how many points you get in that round. Points are calculated by the gains from coordination with your active connections minus the costs of the connections you have proposed.

Earnings in Part 3

You will participate for 10 rounds in Part 3. At the end of the experiment the computer **will randomly select one of the 10 rounds**. The number of points you got in the selected round will be added to the total number of points used to determine your payment.

Instructions Part 3 - Page 5

Begin Part 3