



# **Social Identity Dynamics in a World with Two Adversarial Groups**

*M. Afzal Upal*

**Defence R&D Canada**  
Technical Note  
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## Abstract

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People's social identity beliefs (i.e., their beliefs about their own group and other groups in their environment) can and do change over time. It is essential to understand how these changes happen if we are to develop techniques for influencing social identity beliefs of target audiences in expeditionary environments. The DRDC *TIF Project 10az04: Human Terrain Visualization and Simulation* aims to explore the feasibility of the design of a suite of computer tools that could be used to improve the CF personnel's ability to assess the impact of various possible actions on people's shared beliefs including their social identity beliefs. This report documents the results of the first year of work on the project which has resulted in the development of a simulation framework for understanding the dynamics of social identity beliefs in a world that consists of two groups that have an adversarial relationship with each other. At any given time, an agent can only maintain membership in one of the groups, called its ingroup, while the other group is referred to as its outgroup. We also discuss plans for generalizing the model to worlds consisting of multiple groups and agents having affiliations for multiple groups which are more representative of the real world.

## Résumé

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Les croyances liées à l'identité sociale des gens (p. ex., leurs croyances sur leur propre groupe et les autres dans leur environnement) peuvent changer, et changent avec le temps. Il est important de comprendre comment surviennent ces changements avant de développer des techniques visant à influencer les croyances d'un public cible dans un environnement expéditionnaire. Le projet 10az04 : *Visualisation et simulation de la dimension humaine* du FIT de RDDC a pour but d'étudier la possibilité de concevoir une série d'outils informatiques pouvant améliorer la capacité du personnel des FC à évaluer les répercussions de diverses actions possibles sur les croyances d'un groupe, incluant l'identité sociale des gens. Ce rapport présente les résultats de la première année de travail exécuté sur le projet, ce qui a mené à l'élaboration d'un cadre de simulation pour comprendre la dynamique des croyances liées à l'identité sociale dans un monde formé de deux groupes dont les relations sont conflictuelles. En tout temps, les participants peuvent uniquement faire partie d'un seul groupe, soit l'endogroupe. L'autre partie représente l'exogroupe. Il est également question des plans de généralisation du modèle à des mondes formés de divers groupes et d'agents associés à divers groupes afin qu'il représente davantage le monde réel.

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## Executive summary

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### Social Identity Dynamics in A World with Two Adversarial Groups

M. Afzal Upal; DRDC Toronto TN 2012-111; Defence R&D Canada Toronto.

**Introduction or background:** In expeditionary environments, Canadian Forces commanders are increasingly being asked to take into account the secondary and tertiary effects of their actions on the “hearts and minds” of target populations similar to the way that they take the physical/kinetic effects of their actions into account when planning a course of actions. The problem is that while there are a number of tools that the commanders can use to assess physical effects of their kinetic actions (for instance tools exist that can be used to precisely predict the size of a crater resulting from the impact of a missile to be fired from a ship thousands of miles away from the target), commanders have little or no access to computer tools for assessing the human terrain effects of their kinetic and non-kinetic actions, and select the action that is most likely to be effective. The reason we have computer simulation tools that allow us to precisely simulate and predict the physical impact of a kinetic action (and to talk about what the universe looked like  $10^{-39}$  seconds after the big bang!) is that centuries of physics allows us to isolate irrelevant physical terrain processes and variables from the relevant ones. We currently do not have an equivalent socio-cognitive model of human terrain that isolates variables and processes most relevant to the development of socio-cultural beliefs that cause and perpetuate inter-group conflict. Development of such a model is a must if we are to develop human terrain visualization and simulation tools to aid military commanders in understanding the higher order human terrain effects of their actions. This document reports on the work that we have done towards the development of a model of the dynamics of people’s social identity beliefs. Our model is based in social identity theory. Social Identity Theory (Tajfel & Turner, 1979, 1986; SIT) describes how features of a subjectively perceived social structure can lead people to define themselves in terms of a shared social identity and thereby produce distinct forms of intergroup behaviour. Whenever we think of ourselves as belonging to one gender/ethnicity/class/religion over another, we invoke part of our social identity. SIT provides the cognitive and motivational bases of intergroup differentiation. In other words, its fundamental driving force is the motivation for individuals to view their group in a distinct and positive light. This report documents the results of the first year of work on the project which has resulted in the development of a simulation framework for understanding the dynamics of social identity beliefs in a world that consists of two groups that have an adversarial relationship with each other. At any given time, an agent can only maintain membership in one of the groups, called its ingroup, while the other group is referred to as its outgroup.

**Significance:** This report outlines an interdisciplinary approach involving agent-based social simulation work coupled with traditional controlled psychological experiments in a lab and anthropological field observations that has the potential to be extremely fruitful in development of effective human terrain visualization and simulation systems.

**Future plans:** Over the next two years, we plan to generalize the model to worlds consisting of multiple groups and agents having affiliations for multiple groups which are more representative of the real world.

## Sommaire

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### Social Identity Dynamics in a World with Two Adversarial Groups

M. Afzal Upal; DRDC Toronto TN 2012-111; R & D pour la défense Canada  
Toronto Toronto octobre 2012.

**Introduction ou contexte :** Dans les environnements expéditionnaires, on demande de plus en plus aux commandants des Forces canadiennes de tenir compte des effets secondaires et tertiaires de leurs actions sur le « cœur et l'esprit » des populations ciblées, à peu près de la même manière dont ils considèrent les effets physiques et cinétiques de leurs actions lors de l'établissement du plan d'action. Il existe divers outils servant à évaluer les effets physiques des actions cinétiques (p. ex., des outils permettant de prévoir avec précision la grosseur d'un cratère causé par un missile tiré d'un navire à des milliers de kilomètres de distance de la cible). Cependant, les commandants n'ont accès qu'à peu ou pas d'outils informatiques visant à déterminer les effets des actions cinétiques et non cinétiques sur le terrain humain, puis choisir l'option la plus efficace. Grâce à des siècles de physique permettant d'isoler les variantes et les processus terrestres pertinents de ceux qui ne le sont pas, il est possible, à l'aide d'outils de simulation informatiques, de simuler et de prévoir avec précision les répercussions physiques d'une action cinétique (et de parler de l'aspect de l'univers 10:39 secondes après le Big Bang). Actuellement, il n'existe aucun modèle socio-cognitif semblable du terrain humain pour isoler les variables et les processus les plus pertinents au développement de croyances socio-culturelles entraînant et entretenant la rivalité entre les groupes. L'élaboration d'un tel modèle est essentielle à la conception d'outils de simulation et de visualisation du terrain humain pour aider les commandants à connaître les répercussions d'ordre supérieur de leurs actions. Ce rapport porte sur les travaux réalisés en vue de créer un modèle de dynamique de l'identité sociale. Ce modèle est fondé sur la théorie de l'identité sociale (TIS) (Tajfel et Turner, 1979, 1986) qui décrit comment les caractéristiques d'une structure sociale perçue subjectivement peuvent amener les gens à se définir en fonction d'une identité sociale commune et à créer ainsi des formes distinctes de comportement intergroupe. Lorsqu'un individu s'identifie à un sexe, une ethnie, une classe sociale ou une religion plutôt qu'une autre, cela fait partie de son identité sociale. La TIS offre les bases cognitives et motivationnelles de la différenciation des groupes. En d'autres mots, la véritable force motrice est la motivation des individus à voir leur groupe sous un angle distinct et favorable. Ce rapport présente les résultats de la première année de travail exécuté sur le projet, ce qui a mené à l'élaboration d'un cadre de simulation pour comprendre la dynamique des croyances liées à l'identité sociale dans un monde formé de deux groupes dont les relations sont conflictuelles. En tout temps, les participants peuvent uniquement faire partie d'un seul groupe, soit l'endogroupe. L'autre partie représente l'exogroupe.

**Importance :** Ce rapport fournit une approche interdisciplinaire incluant du travail de simulation sociale, des expériences psychologiques classiques contrôlées en laboratoire et de l'observation dans le domaine de l'anthropologie. Le tout peut s'avérer extrêmement fructueux dans le développement de systèmes efficaces de simulation et de visualisation du terrain humain.

**Futurs plans :** Au cours des deux prochaines années, il est prévu de généraliser le modèle à des mondes formés de divers groupes et d'agents associés à divers groupes afin qu'il représente davantage le monde réel.

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# Table of contents

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Abstract .....	i
Résumé .....	i
Executive summary .....	iii
Sommaire .....	iv
Table of contents .....	vii
List of figures .....	viii
List of tables .....	viii
Acknowledgements .....	ix
1. Human Terrain Visualization and Simulation .....	1
1.1 Socio-Cognitive Structures and Processes Underlying Intergroup Conflict .....	1
1.1.1 Group status and Permeability .....	2
1.1.2 Perceived Relative Deprivation .....	4
2. Working model .....	5
3. Algorithm for Agent-based Simulations .....	7
3.1 Data Structures: .....	7
3.2 Main Algorithm .....	8
4. Conclusion & Future Work .....	13
References .....	14
List of symbols/abbreviations/acronyms/initialisms .....	16

## List of figures

---

Figure 1: A socio-cognitive model of the social identity dynamics. .... 5

## List of tables

---

Table 1: A table summarizing the 3-way interaction between STATUS, PERMEABILITY,  
and SECURITY (i.e., both legitimacy and stability). .... 6

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# 1. Human Terrain Visualization and Simulation

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The DRDC TIF Project 10az04: *Human Terrain Visualization and Simulation* aims to explore the feasibility of the design of a suite of computer tools that could be used to improve CF personnel's (1) cultural awareness training, (2) understanding of human terrain (political, economic and social-cultural beliefs), and (3) ability to assess human terrain effects of various kinetic and non-kinetic operations before executing them. *Human terrain* refers to those socio-cultural aspects of social groups located in the CF's area of operations that are relevant to achieving Canada's aims for the mission. While a number of human-terrain mapping efforts are underway (mainly in the US) to represent tribal and ethnic affiliations on a colour-coded map (Arnold 2010) a broader human terrain visualization capability, that allows users to view how the socio-cultural beliefs of a group are richly interconnected with each other, is lacking. For instance, a CF commander may need to know that the reason why Panjwai villagers perceive an Afghan National Army (ANA) commander to be an outsider and will not allow him into their mosque is that he is a Hazara and that Hazaras are Shiites and some Sunnis consider the rival Shiites to be non-Muslims and non-Muslims are not welcome in the sacred space of a mosque. Furthermore, a commander needs to know the likely consequences of an action before it is taken. What is likely to happen if the CF supports the Hazara ANA officer's attempt to pray at the local mosque? How would that effort affect the co-operation that the CF needs from the locals to carry out its mission? In expeditionary environments, CF commanders are increasingly being asked to take into account the secondary and tertiary effects of their actions on the "hearts and minds" of the target population similar to the way that they take the physical/kinetic effects of their actions into account. The problem is that while there are a number of tools that the commanders can use to assess physical effects of their kinetic actions (for instance tools exist that can be used to precisely predict the size of a crater resulting from the impact of a missile to be fired from a ship thousands of miles away from the target), commanders don't have access to any tools that they can use to assess the human terrain effects of their kinetic and non-kinetic actions, and select the most effective action. The reason we have computer simulation tools that allow us to precisely simulate and predict the physical impact of a kinetic action (and to talk about what the universe looked like  $10^{-39}$  seconds after the big bang!) is that centuries of physics allows us isolate irrelevant physical terrain processes and variables from the relevant ones. We currently do not have an equivalent socio-cognitive model of human terrain that isolates variables and processes most relevant to the development of the socio-cultural beliefs that cause and perpetuate inter-group conflict. Development of such a socio-cognitive model is a first step towards the development of a Human Terrain Visualization and Simulation System (HTVIS) that would be useful to the CF decision makers. Thus, during the first six months of our effort, we have focused our research efforts on sketching out the outline of such a model. This report documents preliminary findings of targeted literature reviews and extensive discussions with stakeholders and socio-cognitive researchers carried out during the first year of the project.

## 1.1 Socio-Cognitive Structures and Processes Underlying Intergroup Conflict

A number of social psychologists have argued that people's social identity perceptions (who "we" are, who "they" are, and how the two are related) play a key role in governing people's behavior, in particular, their behaviour towards members of other groups (Tajfel and Turner 1985). A

number of social studies have shown that perceptions of threats to people's social identity are more likely to motivate people to engage in violence against outgroup members than threats to personal identity or threats to non-identity related beliefs (Sidanius and Pratto 2001). These social psychologists argue that social identity beliefs are key to understanding inter-group conflict in general and insurgent behaviour in particular (Sidanius and Pratto 2001). Even though people's identity beliefs are harder to change than non-identity related beliefs, they are still subject to change. Indeed people's social identity beliefs evolve as people grow older, move from one environment to another, and learn more information.

Social Identity Theory (Tajfel and Turner 1985; Tajfel and Turner 1986; Hogg 2005) (SIT) describes how features of a subjectively perceived social structure can lead people to define themselves in terms of a shared social identity and thereby produce distinct forms of intergroup behavior. We invoke part of our social identity whenever we think of ourselves as belonging to one gender/ethnicity/class/religion over another. SIT provides the cognitive and motivational bases of intergroup differentiation. In other words, its fundamental driving force is the motivation for individuals to view their group in a distinct and positive light.

According to SI, since part of people's self-image is defined by their group membership, they demonstrate a preference for viewing the ingroup in a positive light, in relation to groups to which they do not belong. This tendency toward ingroup bias or favoritism is the motivational core of SIT. It promotes the seeking out of positive distinctiveness for the ingroup.

When continued social comparison yields undesirable results (i.e., when favoritism of one's ingroup in relation to other outgroups is not achieved), group members are motivated to seek change. For instance, connections with other groups – which offer more possibility for positive self-evaluation – may be pursued. *Social mobility* refers to the extent to which the pursuit of alternate social identities is feasible. It assumes that group boundaries are permeable and that individuals can change social groups in order to maintain social status. If social mobility is not possible, then people may engage in alternative strategies such as social creativity or social action to improve their group's status and their self-esteem.

### 1.1.1 Group status and Permeability

As noted earlier, positive group distinctiveness is necessarily based on intergroup comparison. It involves the need to feel superior to other groups in some way. As such, the *status* of the ingroup in its social hierarchy should exert a meaningful impact on social identity. Indeed, SIT proposes that groups of different status should feel differently about their social identity and should also have different feelings about other groups.

Accordingly, SIT examines how people's shared understanding of group status relations leads to different strategies for self-enhancement. When determining how people will be affected by their status, SIT considers the *permeability* of group boundaries, as well as the security of the dimension on which social comparisons are made (i.e., its *stability* and *legitimacy*). People's feelings about these aspects of their status will influence the tactics they assume in their quest for positive distinctiveness. Individuals are likely to display favoritism when an ingroup is central to their self-definition and a given comparison is meaningful or the outcome is contestable (i.e., illegitimate).

Thus, according to SIT, three variables are said to influence ingroup identification and promote identity management strategies. These variables describe three aspects of intergroup relations:

1. **Permeability** refers to the boundaries between two groups in a social comparison situation. When the boundaries are seen as permeable, group members are free to move from one group to another. Conversely, impermeable boundaries do not allow such mobility.
2. **Stability** refers to the perception that the group status hierarchy will change in the future. Thus, a stable intergroup structure is one that will likely remain the way it is.
3. **Legitimacy** refers to the perception that the intergroup relation is justified. A legitimate group status is thought to have been reached by fair means.

These intergroup perceptions, along with the consideration of group status, will influence the extent to which group identity is experienced as positive or negative. SIT suggests that individuals and groups have various means by which to cope with the outcome of these perceptions. For instance, when members of low status groups believe that group boundaries are permeable, they are expected to make attempts at individual mobility (i.e., to leave their group and join a more valued group). Mobility is not attempted, however, if low status members believe group boundaries to be impermeable, that is, if they perceive group membership to be fixed (and leaving is not possible). In such cases, if intergroup relations are secure (i.e., stable and legitimate), then low status group members are expected to engage in **social creativity** in order to redefine elements of the comparative context (as mentioned above). They might do this by embracing new beliefs, such as “we may not be as powerful as them, but we’re friendlier” (this thought might come to mind when Canadians contemplate their relation to the United States). In organizational research, for instance, these self-enhancement dynamics help illustrate how low status professional groups (e.g., garbage collectors, exotic dancers) respond to their social dilemma. That is, they tend to cope by defining their occupation along positive dimensions, such as having flexible hours, more work-life balance, the ability to meet new people, and the chance to work outside. Social creativity allows people to retain identification with their group, while redefining what that identity means (Elsbach & Kramer, 1996).

Conversely, when group boundaries are impermeable and intergroup relations are not secure (i.e., perceived as unstable and illegitimate), then low status groups are likely to engage in intergroup competition with the high status group (Doosje, Ellemers et al. 1995). That is, *they are likely to engage in collective action and conflict that is intended to change the social structure* (Wright & Taylor, 1998). Therefore, low status groups are very likely to engage in conflict with high status groups when access to the high status group is not possible and the high status group's behavior seems illegitimate.

This pattern of social creativity and social competition strategies among low-status group members is expected to be even more pronounced when group identification is high (i.e., the ingroup member perceives ingroup membership as central to self-concept and experiences high emotional attachment to the ingroup). Thus, the more committed members are to their group, the less likely they are to choose individual mobility strategies as a response to an unfavorable identity (Ellemers, Spears, & Doojse, 1997). Because a major focus of SIT has been to explain how low status groups engage in collective action and conflict against high status groups, the theory makes relatively few predictions regarding the self-enhancement strategies of **high status** group members. Nonetheless, SIT asserts that such groups are motivated to maintain and extend

their socially-dominant position. To do so, they engage in *expressive biases* – which, in line with social justification theory (e.g., Jost & Banaji, 1994), often involving boasting and justifying their dominance. Although these strategies do not lead to social change, they are akin to social competition because they serve to continue the traditional comparison process. Other possible strategies for high status groups include: assimilation, denial, and “middle-class revolution” – which aims to achieve rights for the low status group (e.g., see *collective guilt*; Branscombe, 1999). In addition, majority groups who experience identity threat or *who react to strategies used by the low status group*, may use the same or similar strategies as low status group members.

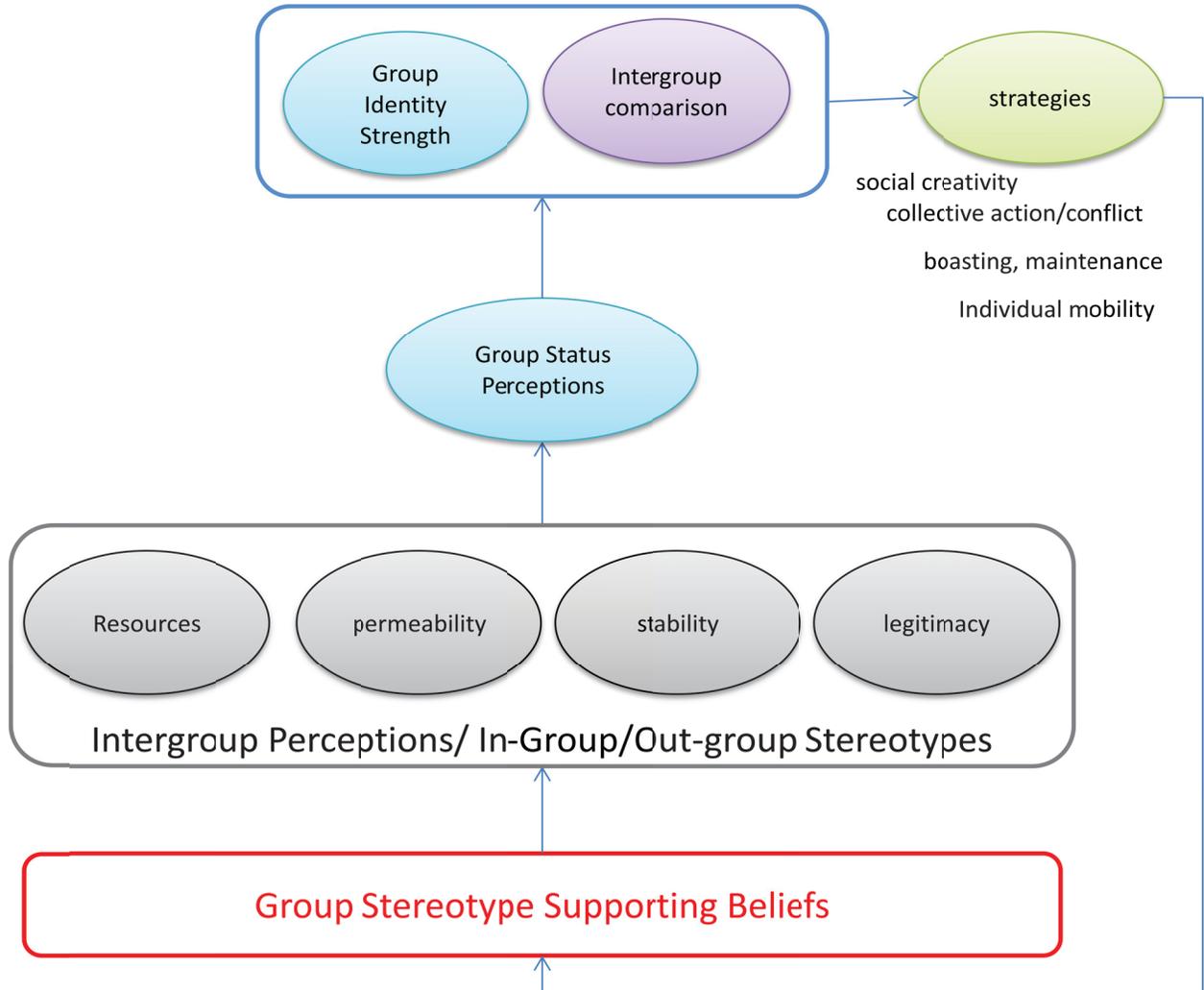
Finally, much like non-threatened low status groups, *equal-status groups* are motivated to carve out positive distinctiveness by using creative biases. Again, these entail creating a different social reality in which the ingroup is more favorable.

### 1.1.2 Perceived Relative Deprivation

In the effort to further understand responses to perceptions of inequality, Relative Deprivation Theory (RDT) proposes that the impetus behind feelings of discontent and subsequent collective action is the perception of a discrepancy between what one’s group currently has/experiences (e.g., access to resources) and what one’s group expects. Although there may be a range of different sources of this perceived discrepancy, the most pertinent to intergroup relations research is social comparison with other groups. Social Identity Theory has been important in revealing how discontent fuelled by perceptions of relative deprivation is affected by the social identity process. For instance, some studies show that group identification moderates the effects of deprivation, such that identity salience increases felt deprivation (e.g., Smith, Spears, & Oyen 1994). Other studies have shown that group identification directly impacts feelings of deprivation (Hogg 2005). In sum, ingroup identification (and its maintenance) rests heavily on perceptions of permeability, stability, legitimacy, and level of resources that the comparison groups possess (i.e., perceptions of relative deprivation). Depending on the type of intergroup relations that an individual perceives (i.e., the degree of permeability, stability, and legitimacy), either individual or collective identity management strategies will ensue (e.g, social mobility vs. social creativity vs. social competition). In general, ingroup identification mediates the relationship between perceived intergroup status relations and strategy.

## 2. Working model

Figure 1 below graphically summarizes key components of our working model of social identity dynamics. It shows that intergroups perceptions of group resources, group permeability, group stability, and legitimacy affect people's perceptions about status differences between the competing groups. A group member's perceptions of status difference between her ingroup and outgroup along with member's affiliation for her ingroup determines the group identity management strategy she is likely to adopt. These strategies in turn affect the intergroup perceptions by affecting the beliefs that underlie these perceptions.



*Figure 1: A graphical Representation of the socio-cognitive model of the social identity dynamics.*

## Strategies Used as a Function of Group Status and Perceptions of Intergroup Structure

The top part of the Table 1 outlines the strategies adopted by lower status group members given various levels of group permeability, stability and legitimacy while the bottom part specifies the group identity management strategies used by higher status group members.

<b>LOWER STATUS GROUP MEMBERS</b>	<b>Stable</b>	<b>Unstable</b>	<b>Legitimate</b>	<b>Illegitimate</b>
<b>Permeable/Open</b>	High Mobility. A higher percentage of agents move. (very low ingroup identification)	Low Mobility. A lower percentage of agents move (low-moderate ingroup identification)	High Mobility. A higher percentage of agents move. (very low ingroup identification)	Either mobility or collective action. Some agents consider mobility while others consider collective action (high ingroup identification) **direction may depend on group efficacy (Mummendey et al., 1996)
<b>Impermeable/Closed</b>	Either social creativity or individualization (Mummendey et al., 1996)	Intergroup conflict and collective action (high ingroup identity)	Either social creativity or individualization (Mummendey et al., 1996)	Intergroup conflict and collective action (high ingroup identity)
<b>HIGHER STATUS GROUP MEMBERS</b>	<b>Stable</b>	<b>Unstable</b>	<b>Legitimate</b>	<b>Illegitimate</b>
<b>Permeable/Open</b>	Boasting and justification (moderate prejudice)	Strong boasting (High prejudice)	Very strong boasting (Very high prejudice)	Boasting and justification
<b>Impermeable/Closed</b>	Justification (moderate prejudice)	Justification (moderate prejudice)	Strong boasting (High prejudice)	Collective guilt (low prejudice, positive outgroup perceptions)

*Table 1: A table summarizing the 3-way interaction between stability, legitimacy, and permeability.*

## 3. Algorithm for Agent-based Simulations

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The next section specifies how we have operationalized the socio-cognitive model of social identity dynamics into an algorithm for agent-based social simulation. First we describe the data structures used in the algorithm and then we detail the main steps of of the algorithm.

### 3.1 Data Structures:

#### Agent

- ❖ **Identity Number, I** : INT [1...NumAgents]
- ❖ **Ingroup** : INT [0,1]
- ❖ **Outgroup** : INT [0,1]
- ❖ **Group\_Identity\_Strength**: INT [1..100]
- ❖ **Perceptions**:
  - Legitimacy of status differences **DOUBLE** [0...1]
  - InGroup\_Permeability: **DOUBLE** [0, 1]
  - OutGroup Permeability: **DOUBLE** [0, 1]
  - OutGroup Resource Perceptions/Status Factors
    - Political\_resources: **INT** [1...100]
    - Economic\_reources: **INT** [1...100]
    - Social\_resources: **INT** [1...100]
  - InGroup Resource Perceptions/Status Factors
    - Political\_resources: **INT** [1...100]
    - Economic\_reources: **INT** [1...100]
    - Social\_resources: **INT** [1...100]
- ❖ **Status Wts**:
  - Pol\_Wt
  - Econ\_Wt
  - Soc\_Wt

## 3.2 Main Algorithm

- 1- Initialize() the society by randomly placing **NUMAGENTS** agents on the board.
- 2- For each agent *i* do:
  - a. Compute the in-group and out-group perceived\_status values for that agent based on the agent's perceptions of in-group and outgroup resource levels.
    - i.  $\text{Ingroup\_status} = \text{ingroup\_political\_resources} * \text{Pol\_Wt} +$   
 $\text{ingroup\_economic\_resources} * \text{Econ\_Wt} +$   
 $\text{ingroup\_social\_resources} * \text{Soc\_Wt};$
    - ii.  $\text{Outgroup\_status} = \text{Outgroup\_political\_resources} * \text{Pol\_Wt} +$   
 $\text{outgroup\_economic\_resources} * \text{Econ\_Wt} +$   
 $\text{outgroup\_social\_resources} * \text{Soc\_Wt};$
    - iii. If ( $\text{In\_group\_status} < \text{Out\_group\_status}$ ) then
      1. If ( $\text{Outgroup\_permeability} = 1$ ) *{i.e., Outgroup can be joined by inGroup Members}* then
        - a. If ( $\text{Status\_diff\_legitimacy} = 1$ ) *{status differences between two groups are perceived to be legitimate}* then  
*{Follow Cell (1, 1) in Table 1}*
          - i. Decrease group\_identity\_strength by MAX
          - ii. If ( $\text{group\_identity\_strength} < \text{mobility\_threshold}$ ) then
            1. Move *i* to Outgroup
        - b. else *{i.e., if status\_diff\_legitimacy = 0 then}*  
*{Follow Cell (1, 2)}*
          - i. Decrease group\_identity\_strength by MIN
          - ii. If ( $\text{group\_identity\_strength} < \text{mobility\_threshold}$ ) then
            1. Engage in mobility() *{i.e., move i to Outgroup}*
          - iii. Else If ( $\text{group\_identity\_strength} >$   
 $\text{collective\_action\_threshold}$ )
            1. Engage in collective\_action()
      2. else *{i.e., if Outgroup\_permeability = 0 then}*
        - a. If ( $\text{status\_diff\_legitimacy} = 1$ ) then  
*{Follow cell(2, 1)}*
          - i. Decrease group\_identity\_strength by MIN

- ii.If (group\_identity\_strength > creativity\_threshold) then
        - 1. Engage in group\_creativity()
      - iii. Else if (group\_identity\_strength < individuation\_threshold) then
        - 1. Engage in individuation()
    - b. else {i.e., if status\_diff\_legitimacy = 0 then}
      - {follow cell(2,2)}
      - i. increase group\_identity\_strength by MAX
      - ii.if (group\_identity\_strength > collective\_action\_threshold) then
        - 1. engage in collective\_action()
  - iv. else {i.e., if Ingroup\_status > Outgroup\_status then}
    - 1. If (Outgroup\_permeability = 1) {i.e., Outgroup can be joined by inGroup Members} then
      - a. If (Status\_diff\_legitimacy = 1) {status differences between two groups are perceived to be legitimate} then
        - {Follow Cell (3, 1) in Table 1}
        - i. Increase group\_identity\_strength by (MAX \*1.5)
        - ii.If (group\_identity\_strength > boasting\_threshold) then
          - 1. Engage\_in\_boasting()
      - b. else {i.e., if status\_diff\_legitimacy = 0 then}
        - {Follow Cell (3, 2)}
        - i. Increase group\_identity\_strength by MAX
        - ii.If (group\_identity\_strength > boasting\_threshold) then
          - 1. Engage\_in\_boasting()
    - 2. else {i.e., if Outgroup\_permeability = 0 then}
      - a. If (status\_diff\_legitimacy = 1) then
        - {Follow cell(4, 1)}
        - i. Increase group\_identity\_strength by MAX
        - ii.If (group\_identity\_strength > justification\_threshold) then

1. Engage in\_justification()
- b. else {i.e., if status\_diff\_legitimacy = 0 then}
  - {follow cell(4,2)}
  - i. decrease group\_identity\_strength by MIN
  - ii. if (collective\_guilt\_MIN < group\_identity\_strength < collective\_guilt\_MAX) then
    1. engage in collective\_guilt()

**Initialize (InG, InG\_Pol, InG\_Econ, InG\_Soc, OutG\_Pol, OutG\_Econ, OutG\_Soc, idStr, Pol\_W, Econ\_W, Soc\_W, InG\_perm, OutG\_perm, Leg)**

1. InGroup = InG;
2. OutGroup = 1-InG;
3. InGroup.resources.political = InG\_Pol + random(-10,+ 10);
4. InGroup.resources.economic= InG\_Econ + random(-10,+ 10);
5. InGroup.resources.social = InG\_Soc + random(-10,+ 10);
6. Group\_identity\_strength = idStr + random(-10,+ 10);
7. Pol\_Wt = Pol\_W + random(-1, 1);
8. Econ\_Wt = Econ\_W + random(-1, 1);
9. Soc\_Wt = Soc\_Wt + random(-1, 1);
10. InGroup\_permeability = InG\_perm + random(-1, 1);
11. OutGroup\_permeability = OutG\_perm + random(-1, 1);
12. Legitimacy = Leg + random(1-, 1);

**Mobility()**

1. Agent's group\_identity\_strength = 100 \* (Outgroup\_status - In\_group\_status)/Outgroup\_status;
2. Swap InGroup\_permeability and OutGroup\_permability
3. Swap agent's InGroup and Outgroup
4. Swap agent's perceptions of resource levels for InGroup and Outgroup
5. Status weights remain unchanged as does legitimacy value

**Collective\_Action()**

1. Increase perceptions of InGroup\_resources by collective\_action\_increment
2. Decrease perceptions of OutGroup\_resources by collective\_action\_decrement
3. Increase group identity strength by collective\_action\_ID\_increment

### **Social\_Creativity()**

1. Search for a small deviation from the existing factors and weights that would increase one's ingroup status and decrease outgroup's status. Initially this could be implemented by each agent generating IDstrength many times random deviations to its weights to see if the modified weights create a scheme that positively affects the group's relative status. If it finds one it starts selling it to others who then compare it to their existing scheme. If the new scheme is better than their existing scheme (i.e., positively affects the difference in status of their group) they replace their existing scheme with this one.
2. If successful in finding a better weighting scheme, the agent's social identity strength increases by social\_creativity\_increment.

### **Individuation()**

1. Decrease group\_identity\_strength by individuation\_decrement.

### **Boasting()**

1. Increase group\_identity\_strength by boasting\_increment.
2. Increase inGroup.permeability by permeability\_boasting\_increment
3. Send a boasting message to InGroup members in the vicinity
4. Send an Outgrp\_permeability\_increment message to all OutGrp members in the vicinity who should increase their Outgrp.permeability values by Outgrp\_communication\_loss \* permeability\_boasting\_increment;

### **Collective\_Guilt()**

1. Decrease the perception of Ingroup resources by collective\_guilt\_increment
2. Increase the perception of Outgroup resources by collective\_guilt\_decrement
3. Increase InPerm by 0.1

### **Justification()**

1. Increase legitimacy value by `legitimacy_increment`
2. Send a justification message to `inGroup` and `outGroup` members in the vicinity
  - a. Ingroup members increase their legitimacy value by `InGrp_communication_loss * legitimacy_increment`
  - b. OutGrp members increase their legitimacy value by `OutGrp_communication_loss * legitimacy_increment`
  - c. `OutGrp_communication_loss` should be set to be less than `InGrp_communication_loss` values e.g., `OutGrp_communication_loss = 0.5` and `OutGrp_communication_loss = 0.9`

## 4. Conclusion & Future Work

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Even though the original work by Tajfel and Turner motivating social identity theory and social categorization theory suggests that people belong to multiple groups, most of the empirical studies carried out to investigate various aspects of the theory, the studies we draw on to develop our model of social identity dynamics, assume an adversarial world consisting of two groups: an ingroup to which the agent belongs and a competing outgroup. While this simple model contains enough complexity that may be worth studying from a theoretical point of view, its findings may have limited applicability in the real world where people belong to multiple groups all of which do not have adversarial relationships with each other. Thus, not unlike many residents of Kabul, the former Afghan foreign minister Abdullah claims multiple ethnic identities, namely, Tajik from his father's side and Pashtun from his mother's side. There is a need to generalize the model we developed here to allow agents to have affiliation for multiple groups. This requires a generalization of Table 1 to identify the strategies that an agent may choose in a multi-group environment. Once such a model is developed, we plan to design an agent-based social simulation society to investigate social identity dynamics to better understand how people's social identity beliefs change over time.

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## **List of symbols/abbreviations/acronyms/initialisms**

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ABS	Agent-based Simulations
DND	Department of National Defence
DRDC	Defence Research & Development Canada
DRDKIM	Director Research and Development Knowledge and Information Management
R&D	Research & Development
SCT	Social Categorization Theory
SIT	Social Identity Theory

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**People's social identity beliefs** (i.e., their beliefs about their own group and other groups in their environment) can and do change over time. It is essential to understand how these changes happen if we are to develop techniques for influencing social identity beliefs of target audiences in expeditionary environments. The DRDC *TIF Project 10az04: Human Terrain Visualization and Simulation* aims to explore the feasibility of the design of a suite of computer tools that could be used to improve the CF personnel's ability to assess the impact of various possible actions on people's shared beliefs including their social identity beliefs. This report documents the results of the first year of work on the project which has resulted in the development of a simulation framework for understanding the dynamics of social identity beliefs in a world that consists of two groups that have an adversarial relationship with each other. At any given time, an agent can only maintain membership in one of the groups, called its ingroup, while the other group is referred to as its outgroup. We also discuss plans for generalizing the model to worlds consisting of multiple groups and agents having affiliations for multiple groups which are more representative of the real world.

Les croyances liées à l'**identité sociale** des gens (p. ex., leurs croyances sur leur propre groupe et les autres dans leur environnement) peuvent changer, et changent avec le temps. Il est important de comprendre comment surviennent ces changements avant de développer des techniques visant à influencer les croyances d'un public cible dans un environnement expéditionnaire. Le projet 10az04 : *Visualisation et simulation de la dimension humaine* du FIT de RDDC a pour but d'étudier la possibilité de concevoir une série d'outils informatiques pouvant améliorer la capacité du personnel des FC à évaluer les répercussions de diverses actions possibles sur les croyances d'un groupe, incluant l'identité sociale des gens. Ce rapport présente les résultats de la première année de travail exécuté sur le projet, ce qui a mené à l'élaboration d'un cadre de simulation pour comprendre la dynamique des croyances liées à l'identité sociale dans un monde formé de deux groupes dont les relations sont conflictuelles. En tout temps, les participants peuvent uniquement faire partie d'un seul groupe, soit l'endogroupe. L'autre partie représente l'exogroupe. Il est également question des plans de généralisation du modèle à des mondes formés de divers groupes et d'agents associés à divers groupes afin qu'il représente davantage le monde réel.

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social identity beliefs; computer simulation

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