THE IMPORTANCE OF PRE-EXISTING IDENTITIES IN GROUP EMERGENCE: THE *NO AL CLUB DE GOLF* SOCIAL MOVEMENT IN TEPOZTLÁN, MÉXICO

by

Verónica L. Reyna

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
(Political Science)
in the University of Michigan
2009

Doctoral Committee:

Professor Scott E. Page, Chair
Professor Ken W. Kollman
Professor Ronald F. Inglehart
Associate Research Scientist Rick L. Riolo

To my grandparents who paved the way:

Rafael Reyna, Sr., Eva Casanova Reyna, Marcial Leal, and Zoyla Rodríguez Leal.

To my parents who taught me the importance of politics:

Rafael Reyna, Jr. and Stella Leal Reyna

Acknowledgments

I would like to acknowledge those who made this research project possible. First, I must thank the Tepozteco respondents who trusted me with their time and information about an important part of their town's history. CETLALIC graciously assisted me with excellent, politically-aware Spanish tutoring for two Special Programs and provided research assistants without whom this project never would have gotten off the ground. I would like to specifically acknowledge Jorge Torres, CETLALIC's director, who was my field mentor and advocate, and the following research assistants and language teachers: Roberto Palacios Baeza, Nuvia Balderrama Vara, David Moreno, and Juan Carlos Uribe. You became friends, are great language teachers, and were central to the completion of this dissertation. I would like to thank Dr. Bertha Baeza for her friendship, hospitality, and wonderful conversations during the many months I lived in her house. Maria Reyero and Stella Reyna gratefully helped with several interview transcriptions and translations. Finally, the Center for the Study of Complex Systems (CSCS) sponsored IDEAS-IGERT NSF Program and Fellowship allowed me to conduct fieldwork in Tepoztlán, Mexico.

Next, I would like to thank my dissertation committee for their patience and support throughout my graduate studies. My road to completion of this degree has been non-linear and non-traditional, but in the end I have been able to finish because of my committee's consistent support and belief that I could finish. Prof. Kollman guided my fieldwork planning and IRB approval. Prof. Riolo suffered me through two programming courses, but in the end it was worth it! Prof. Inglehart's consistently positive attitude during my prelim and throughout this process always has been reassuring (and refreshing!). Finally, I would like to especially note that Prof. Page's spot-on understanding of parenthood and motherhood given the realities of academia spurred me on to work every day, even if it was just a few minutes during naptime or completely sleep-deprived. Endless thanks to Lili Kivisto for her support and expertise on the defense process!

Academic Ladder, a dissertation and academic writing support program, should be given much thanks, especially the ABD Moms Group and Jayne London. I was able to work through many personal and professional "bumps" this last year because of your guidance and support. I learned a lot about myself in the process and I know that I would not have been able to find the ability to finish without y'all! I truly appreciate your friendship and openness in sharing the difficulties of writing and having a family.

Thank you to my friends in the Department who shared many laughs with me. We got through those classes! Thank you to my friends at Legal Services of South Central Michigan for keeping me sane and grounded. My employment there was more than just a job; it was an escape from academia and my reminder as to why I needed to finish this degree. Thank you to my other friends, Anna Park, Joy Evans, and Aneetha Jayaraman and the Goddess Club. I enjoy your friendship and I miss those fertility festivals! Our craziness at Michigan was a nice balance to the craziness of school.

Finally, I would like to thank my family for their support and encouragement. My parents and sisters have been the solid foundation for me to always fall back on when everyone else seems to waiver (including myself). You never lost hope! Mummy, Papa, Shiku, and Taru watched Raj so I could work. Ms. Joyce Holmes--the expert nanny—took care of Raj for most of the writing of this dissertation. She took care of me, too, and became a good friend and one of the only adults I talked to on a regular basis! Thank you to Tanmoy Kumar for giving up evenings and weekends to take care of Raj 100% so I could work. I know academia and the writing process is an anathema to you, but you have provided this support nonetheless. I could not have finished without a "room of my own" and everyone who helped with Raj provided this opportunity for me. Last, but not least, thank you to Raj for opening my heart, providing the inspiration to finish, and for having patience all those times I had to say, "Sorry, momma has to work."

Table of Contents

List of Figures

List of Tables

List of Illustrations

List of Images

List of Graphs

Chapter One

The Importance of Pre-existing Identities in Micromobilization

> **"Well, look, I think that [the reason] for participating [in the social movement against the golf club] was the feeling of your cultural identity… [this] was what mostly decided people's participation…and to defend your natural resources, your historical heritage, your cultural heritage—these [reasons] were the most important elements. There are other people who did not participate….What I perceived [then] is that there were people who were already interested [in the club] because they were going to sell [construction] materials to it. They were going to work in the golf club as masons….There were people who were already seeing the economic opportunity even though it would be temporary…. So, these people wanted the golf club. Others did not participate…because they sold out to economic motives. They were bought by the government or by the company K.S.…Yes, there were people that really sold us out… What were their reasons, because they, too, are Tepoztecos?"[1]**
>
> --Juan Ortega, *El C.U.T.* officer.[2]

At the end 1994, the small town of Tepoztlán in the state of Morelos began what was to become known as the *No al Club de Golf* (No to the Golf Club) social movement to fight the company Kladt-Sobrino's (KS) development of a luxury golf resort. The majority of Tepoztlán wanted to protect their communal land, local economic and political interests, and to safeguard their honored cultural traditions. Juan Ortega's words

[1] Pués, mira, yo creo que para participar el sentido de su identidad cultural—fue lo que you creo lo que más decidió participar a la gente. Y a defender sus recursos naturals, su patrimonio históricos, patimonio cultural—esos fueron los elementos más importantes. Hay otra gente que no participó…pero lo que yo percibí es que había gente que ya estaba interesada porque ellos iban a vender material al club de golf. Ellos iban a trabajar en el club de golf como albañiles. Así es que había gente que ya estaba viendo la oportunida económica aunque sea temporal en el club de golf. Otros no participaron…porque traicionaron por motivos económicos. Fueron comprados por el gobierno or por el impresa….Sí hubo gente que sí nos traicionó…¿Cuàles fueron sus razones porque también son Tepoztecos?" Interview January 2005.
[2] All respondents' names are pseudonyms.

summarizes the multi-dimensionality of the social movement—it was at once a movement about culture, a movement about ending political corruption, a movement about steering their own development, and a movement about protecting their natural resources. Each facet of the movement was rooted in the already existing Tepozteco cultural identity, about which asked each person: "How does a 'good' Tepozteco envision social, economic and political development for the town?" The *No al Club de Golf* movement became a movement contesting the Club, but at its root was the subtle contesting of the meaning of "Tepozteco."[3] Ortega highlights an elemental change in contemporary Latin American social movements, and movements in the development context in general: the unprecedented dependence upon recognizing political inequalities as simultaneously based upon race, class, gender, nationality, and other social and political identities. Participants identify their political problems as rooted in these *pre-existing* identities not only in a national context, but also within the larger context of globalization.

Indeed, this change in movement dynamics has occurred throughout the developing world. Social movements have adapted from primarily liberation and anti-imperialist movements, to movements "attempting to evolve a *participatory society* to improve the *quality of life"* (Oommen 1997). The main social movement actors are the marginalized, that is, "the women, the youth, the unemployed, the Blacks, the foreign migrant workers, the cultural minorities" (Ibid).

What makes these actors different from those in European and U.S. movements is that they seek democratization and enfranchisement in order to *simultaneously* challenge

[3] "Contesting" is used as in Abdelal et al (2006).

political, economic, and cultural institutions (Randall 1981; Miller 1991; Lavrin 1995; Palanco 1997; Rubin 1997; Womack 1999; Isbester 2001; Selverton-Scher 2001). Who they are *before* the movement begins determines their institutional relationship with the state, and ultimately informs their movement choices—how they categorize the particular grievance, how they decide to view the movement, how they participate, and, most importantly, how they align themselves into movement groups.

These movements push to the forefront theoretical questions about how, when, and why identities are important to social movement. It can be argued that these questions should be applied to movement theories in general, and not just to movements in developing countries. Key theoretical concepts at the heart of this dissertation are rooted in the following questions: What are the roles of multiple, interacting identities within micromobilization and social movements? What are the relationships among these identities, micromobilization, group formation, and larger social movement activities? What assumptions are held with respect to these concepts?

Fieldwork established the following main components of micromobilization in the *No al Club de Golf* movement: 1. grievances were framed *before* any movement activity: as the people processed the information about the club, reasons for and against the club organically surfaced becoming the movement's main themes; 2. individual interactions led to group formation of neutral, pro-, and anti-club groups or sides: the people discussed the club and influenced each other's individual decisions about being neutral, for, or against the club; and, 3. the spontaneous creation of a loosely-organized social movement group, *El Comité Unida de Tepoztlán (El C.U.T.)*, did not occur until after the movement began and most did not feel it influenced their group choice decisions.[4]

The next important component in micromobilization to the *No al Club de Golf* movement was the emergence of groups, or the neutral, pro- and anti-club sides in the movement. Social pressure via the social networks was coordinated according to how one was aligned with a movement side; participation was not part of people's primary concern. Once one chose a side, one was socially accepted as a proper Tepozteco, and one would participate if and when one could. Group choice was equal to choosing a modern definition of "Tepozteco."

As long as one could say "I'm against the Club," one gained the rights of social protection. Interviews showed that those who chose to support the club identified more as Mexican; those who were against the club identified their Tepozteco identity as primary or in conjunction with their Mexican identity. Part in parcel with this Mexican vs. Tepozteco identification included, among other variables, an understanding about how political economic development should occur for Tepoztlán. Those who felt development was desperately needed for Tepoztlán and Mexico tended to place their Mexican identity higher. Those who felt that development should be directed by the terms of the town's cultural needs placed their Tepozteco identity on par with or higher than their Mexican identity.

Fieldwork corroborates many of the same theoretical issues that Oommen and other theorists have highlighted about contemporary movements in developing countries. How are multiple identities incorporated into the sociology and political science

[4] The United Committee of Tepoztlán.

literatures on social movements? When are the important and how? How do they relate to group formation and to micromobilization in general?

This chapter begins with a review of relevant literature that helps to build the exploratory models in Chapters Four, Five, and Six. Three areas within social movement research are focused upon as necessary for this understanding of how pre-existing identities influence group choice and group emergence: how identities are important to micromobilization, how identities relate to group emergence, and how individuals utilize identities. These questions often overlap theoretically, especially when considering how they give rise to higher levels of organization within a social movement.

This project also turns toward other disciplines to further inform political science's approach to micromobilization. Social psychology has wrestled with collective identities—how they are defined, how they affect behavior, and how they interact with other identities. Economists are beginning to theorize about identities and economic decisions. Race and feminist theories also offer insights into how multiple identities interact. Research in cognitive psychology, the domain of how people make decisions, is utilized as a source to better conceptualize individual decision-making. Finally, the growing complex adaptive systems (CAS) literature offers a new perspective of the emergence of micromobilization and of individuals' interactions, and provides a methodological vehicle via agent-based modeling to explore these issues.

1.1 Literature Review

When one examines how best to study the roles of pre-existing identities in micromobilization, one should focus upon not only how collective identities are important, but also upon *when* they are important within the group emergence process. Given the Tepozteco field case, the literature on social movements in Latin America may address the role of multiple identities and put the movement into a regional context. The biggest grievance is that existing social movement theories, while separately addressing fundamental components of contemporary movements, do not quite measure up to capturing the development context. Therefore, researchers seek better-honed theories about social movement identities to reflect the interconnectedness of contemporary social, economic, and political realities in developing countries (Eckstein 1989; Escobar 1992; Lindberg 1997). For example, Escobar et al (1992) highlight the trends in social movement research with respect to Latin America and show that there are few theoretical options in which to locate the region--especially theories that can account for the post-transition period of the 1990s (1-5). Given the main options of resource mobilization theories *or* NSM theories *or* political process theories *or* rational choice theories, the current political realities in Latin America need "a 'cross-pollination' of research--between identity-centered and resource mobilization approaches, quantitative and qualitative methods, endogenous and external theories..." (5-6). Current social movements in Latin America are concerned with strategy and identities at once.

In the larger context of social movements in developing countries, many theorists similarly call for more inclusive theories. T. K. Oommen (1997) classifies current movements as belonging to the "fifth revolution" of global social movement waves. The previous revolutions were "the aristocratic, the bourgeois, the proletarian, and the anti-colonial revolutions" (8). These movements, too, are “multi-dimensional” (8) and need theories that reflect these complexities. Rather than breaking down social movements to their smallest parts, theories should begin to *reincorporate* strategies, organization and individual behaviors, and identities to understand better contemporary movement dynamics. In short, how do the various levels of a social movement interact (i.e. micromobilization, mobilization, and the social movement writ large)? This dissertation fits into this debate by focusing upon joining the interaction between individuals to group emergence within micromobilization.

Accordingly, how should one conceptualize these contemporary movements to focus upon multiple identities and group emergence? First, this project calls for a change in the locus of analysis: a bottom-up perspective allows one to see how individual dynamics connect to collectivities, how these collectivities connect to organizations, and how the whole schematic gives rise to a social movement. This point where identities, collectivities, and organizations meet is captured best by studying local-level interactions. This means that a better understanding of the *emergence* of micromobilization is crucial.[5]

Micromobilization is defined by the local level interactions of individuals that give rise to larger group collectivities that eventually form into a larger social movement or social movement organization (SMO). Micromobilization is the strength of social movement analysis in sociology (Zald 1992). However, micromobilization is viewed from the top-down: how social movement organizations can obtain membership and retain movement participants through successful framing of issues and participation incentives (Zald 1992).

Micromobilization is the domain of organizers, professional or otherwise, who must assist individuals with collective action. For example, framing is a strategy used by

---

[5] Analysis on why the groups are seen as emergent follows under the section "Group Emergence."

organizers to get people to participate (Snow 1986). It is considered a part of micromobilization because organizations are dealing with individuals, but framing is still a central responsibility of social movement organizations. Fundamentally, a top down approach to micromobilization assumes the existence of a social movement organization (SMO) industry which may weakly exist in the development context or not at all. A bottom-up approach forces us to start with individuals and build a social movement from the ground up.

1.2 The Role(s) of Identities

Recognition of the importance of social and collective identities to social movements is nothing new. Nor is this importance isolated to developing countries. Again, these contemporary movements simply push the role of identities in social movements to the forefront of theory-building. We can draw upon the strengths of social movement theory "standards"–resource mobilization theory, new social movement theory, and collective action theory, etc.—and more tailored theories can be created that successfully incorporate a better approach to individuals' interactions, multiple identities, and group formation, improving explanatory capabilities (Foweraker 1995). Most of these theories have attempted to add individuals' identities within their frameworks, however, to varying degrees of success.

For example, new research addressing the shortfalls about incorporating non-rational individuals or their identities, for example, debate not whether or not to include more multi-dimensional theories, but *how* best to incorporate these dimensions (Zald 1992; Stryker 2000a). Indeed, Abdelal's et al recent article (2006) heralds not only the realization that identities are important in the social sciences, but it also offers avenues for consolidation of definitions and methodologies. Political Science is now willing to "deal" with the previously-considered slippery subject of identities.

Until recently, resource mobilization and collective action theorists have viewed identities as universal characteristics which cancel out of utility equations or organizational strategies (Stryker 2000a). Collective action theories do focus on individual behavior, but how the individual is conceived has drawn criticism from many social movement theorists. As a result, some disciplines have tended to stay away from truly local, individual interactions because of how these interactions are usually studied: collective action by rational, maximizing agents without identities (Stryker 2000a).

Other social movement theories locate the individual within social movement organizations or potential organization members. Political process and resource mobilization theorists have focused on how the social movement organizations interact with individuals, but again from the *organizations'* perspective. These theories were responding to a pre-1960s, social psychology rendering of activists as irrational deviants; as a consequence, they, too, utilized a fundamental concept of the rational participant model—the professional social movement organization that maximizes resources (Stryker 2000, 2-3).

Key to both collective action and resource mobilization approaches is that "theorists can assume the essential equivalence of all persons entering movements. Since every person is the equivalent of every other, the theorists can remain largely indifferent to the entering humans and concentrate on structural constraints and opportunities affecting movements and on the mobilization of resources to achieve social movement objectives" (3). In traditional collective action and resource mobilization theories, there is no role for identities in group formation or participation decisions.

Recasting the rational actor to take into account her social networks and identities as non-material incentives has been one method to deal with rational actor criticisms (Muller 1986; Friedman 1992). For example, while Chong (1991) expands the definition of rational to include psychological and more social forms of incentives found in the U.S. Civil Rights movement, the history of what it meant to be black in the 1960s and 1970s (and growing up in the U.S. before then) and how this evolving identity determined group formation and participation decisions is missing. He writes about psychological incentives:

> Members of a group, I argue, are enthusiastic about contributing to collective action or are pressured to do so, only when such collective action has a realistic opportunity to achieve the desired public good. When collective action is widely regarded as futile, or as an ineffective symbolic protest at best, these social and psychological incentives vanish (Chong 1991).

What in the history of African-Americans, especially given life experiences in the South, would indicate from the start that this participation would generate different results or success? In how many "failed" attempts did people *participate* in the continuum of participation leading to the 1960s? How does an individual separate herself from her embedded identity networks (if they are acknowledged) to differentiate between a public vs. private good? In short, what we do not know is how racial identity and its history influenced group choices before participation or participation decisions.

Does incorporating identities and networks into the definition of rational incentives address the fundamental problem about the role of identities? Ferree (1992) writes:

> For rational choice theory, and [resource mobilization] theories based on it, the ability to come to any sense of the collective good at all is made problematic by beginning with individuals out for themselves and searching for reasons they should 'enter' a community rather than with people who from infancy are already part of a number of communities of greater and lesser salience. Even the definition of a collective good is biased by this assumption (27).

Research that views individuals embedded within social networks shows that incentives to participate (and overcome the free-rider problem) are only incentives if the individual does not think that preserving her group is important (at all "costs") (Ferree 1992). Even though collective action theories deal with participation and resource mobilization theories focus upon organizations, what this analysis demonstrates is that individuals' identities matter in a different manner than non-material incentives can embrace and that identities may matter *before* participation even occurs.

Next, new social movement (NSM) theories tend to focus upon the importance of collective identities as they develop during the social movement or upon the identity of the social movement overall (Johnston 1995).[6] For example, Taylor and Whittier (1995) show that a movement culture develops and expresses itself within social movements via "emergent norms and collective action frames, collective identity, ritual, and discourse" (164). For example, they show from previous research that the oppositional culture that developed within the feminist circles in the First Wave of the women's movement held the activists and overall movement together after WWII and laid the groundwork for the Second Wave of feminism in the 1960s (Rupp 1987; Taylor 1989).

Collective identity theories also highlight that identities are of central importance to social movements and are "constructed, activated, and sustained only through interactions in social movement communities" (Taylor 1995). A successful movement

[6] For a definition of "collective identity," I will use Viktor Gecas' (2000) succinct definition: "…shared definitions in the service of collective effort" (93).

creates a collective identity that then explains why people choose and continue to choose to participate (Melucci 1989). Movement organizers can also utilize tenets of this collective identity (through framing) to further the needs of the movement. Moreover, collective identities, previously ignored by collective action theorists, even inform cost benefit analysis and can be incorporated into a more strategic understanding of participation (Gamson 1992).

Gamson (1992) explains the relationship between the individual and a social movement's collective identity:

> Collective identity is a concept at the cultural level, but to operate in mobilization, individuals must make it part of their personal identity….Adopting a collective action frame involves incorporating a product of the cultural system—a particular shared understanding of the world—into the political consciousness of individuals. Individual and sociocultural levels are linked through mobilizing acts in face-to-face encounters (74).

Gamson further defines "face-to-face encounters" as part of the micromobilization process, including "recruitment meetings, internal meetings, mass media encounters, encounters with allies, encounters with countermovement groups, and encounters with authorities" (72). From these encounters develops a common way to understand a particular grievance which forms into the movement's collective identity. However, fieldwork in Tepoztlán showed that it was people's pre-existing identities (collective or otherwise) that helped them interpret and choose which side of the movement to which to belong. There was no recruitment by a SMO or other group meetings that already championed an interpretation about the golf club's affect on the town. The people interpreted the grievance vis-à-vis their pre-existing identities.

There is a fine line, but it exists, between when the pre-existing identities influence group choice and when these groups participate as a movement.[7] The SMO that eventually developed, *El C.U.T.*, did well in picking up on the cultural theme the movement took and furthered this movement collective identity by choosing cultural events and symbols through which to view and participate in the movement. Yet the movement could have taken on an environmental or economic tenor just as easily, too. It is therefore important to differentiate the influence from the pre-existing identities on group choice from the influence of the cultural collective identity that later developed.

New social movement theories also highlight how individual identities change through experiencing and participating in social movements (Gecas 2000; Kiecolt 2000; Pinel 2000). The ideologies that are championed in a social movement become part of an individual's identity and values (Gecas 2000). The influence from the values in the collective identity can even go as far as changing an individual's moral code, such that participation and failure are more moral obligations than just political interests like in the Republican *Sinn Féin* movement (White 2000).

Kiecolt (2000) further delineates the psychological process that occurs when one undergoes self-concept change because of social movement participation. An individual's identity salience hierarchy can change in three ways: structural change, level change, or ipsative change. She writes:

> Structural change occurs when identities are either added or discarded. For example, one might add an identity such as "activist" or discard an undesirable identity such as "victim" (Ebaugh 1988; Fein 1990). Second, level change involves change in the importance of a role identity or in the level of an attribute, without a change in their ranking. For example, one's identity as an activist might become more important as one becomes more involved in a social movement organization, but its importance relative

[7] One could argue that when the town threw out the local council members, the movement had already began.

> to other identities would not change. Finally, ipsative change refers to a change in the ranking of one's role identities or in 'the relative strength of behavioral dispositions' (Mortimer 1982). That is, some identities or traits become more prominent (higher ranking) than others (Kiecolt 2000, 112).

During participation within a social movement, individuals incorporate aspects of the movement's ideologies and values into their own self-concept. Participation can also change how an individual views herself; however, the process in which this change occurs necessitates an identity salience or identity hierarchy view of multiple identities. Moreover, these theories that examine the relationship between an individual's identities and a social movement only look at this relationship *after* the social movement begins. Again, the *No al Club de Golf* movement shows that an individual's identities before movement participation determine initial group formation.

Another approach to understanding the relationship between individual identities and a social movement claims that individuals whose identities match the closest with the identity and values of the movement will choose to participate in that movement. The movement provides self-verification of an individual's social identity (Pinel 2000). The strength of one's commitment to a particular identity (via identity salience) determines participation. Social movement organizations pursuing participants, too, attract more participants when they use framing techniques which capitalize on this self-verification process (Snow 1986; Snow 2000). While this perspective is the closest to fieldwork data, there are two theoretical assumptions: one, group choice and participation are the same process; and, two, the movement, SMOs, and groups exist first and participants come later (especially with the help from an SMO).

Collective action frames created by the SMO ("framing") is considered the standard link from individual-to-social movement in the micromobilization process (Benford 2000). Snow and McAdam (2000) explain:

> As Hunt et al (1994) have noted, "not only do framing processes link individuals and groups ideologically but they proffer, buttress, and embellish identities that range from collaborative to conflictual" (185). Framing processes do this in two ways: at a general level, "by situating of placing relevant sets of actors in time and space and by attributing characteristics to them that suggest specifiable relationships and lines of action" (Hunt 1994); and , at a more concrete level, during the course of identity talk among adherents and activists (Hunt 1994) and other movement activities, such as preparing press relatives and making public pronouncements. Framing processes are not the only mechanism that accounts for the correspondence between personal and collective identities, of course, but it can be argued both theoretically and empirically that it is one of several mechanisms that facilitates this alignment and thus the enlargement of personal identity in movement contexts (632).

Even if people identify with a movement or its causes, it is the SMO that delivers membership and participation by increasing this identification (McAdam 1993).

Table 1.1 Relevant Assumptions in Social Movement Theories

Resource Mobilization	**New Social Movements**	**Collective Action**
Rational Actor	Collective Identity central	Rational Actor
SMO is main actor	Focus on identities after movement begins	Universal actor with no identities nor socially embedded
Universal Individual with no identities nor socially embedded	Individuals' identities or social networks are considered in how movement changes individual (after movement begins)	Small/Large Groups already formed (focus on incentives for participation)
Identities and social networks may be used by SMO in framing strategy	Groups already formed	Narrowly rational benefits (psychological benefits) still devoid of identity or social (historical) context
Already-established SMO industry	Individual-level and movement-level linked via identities after movement starts (and for the purpose of forming collective identity)	Collective action linked to individuals' decisions but group level aspect of individuals forgotten
SMO institutionalization is goal		Participation is main decision
SMO weakly tied to individual-level		Individuals need SMO for incentives
Individuals need SMO to organize them		Top-down perspective about local decisions because of importance of SMO
Groups organized by SMO		Conflates participation and group choice
Often conflates participation and group choice		
Fundamental top-down perspective		

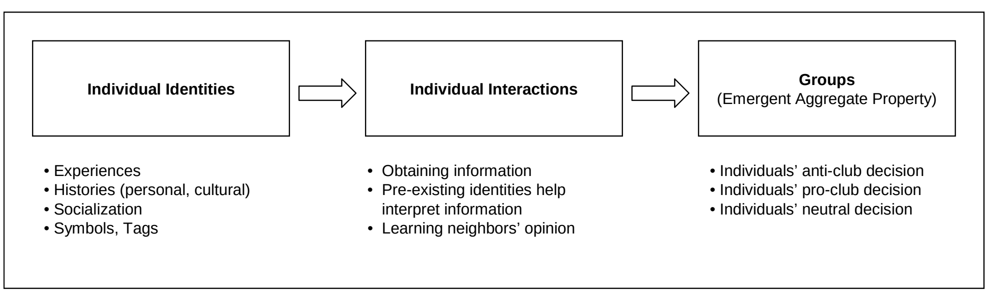
Overall, the focus in most of the social movement and collective action literature is upon identities during or after a social movement or by maximizing participants without identities. Table 1.1 presents relevant assumptions in the major social movement theories with respect to group formation and identities. How multiple identities are utilized by individuals is typically considered a process of identity salience and multiple identities cannot be conceived of or used simultaneously (as in a supra-additive definition). Moreover, SMOs are responsible for making individuals identify with movements and for obtaining participants in the already-existing movement groups. In sum, when and how identities affect group formation before a movement begins remains inadequately addressed.

1.3 Group Emergence

The Tepozteco case also draws attention to the relationship between identities and group emergence before participation. Respondents indicated that groups for, against, or neutral about the golf club materialized after they interacted with neighbors, attended the *asembleas*, and made their individual final decisions about the club. These individual decisions aggregated—without a SMO steering organization—throughout the municipality into the pro-club opinions, anti-club opinions, and neutral-club opinions. The anti-club sentiment emerges as the majority opinion; as the town realizes this outcome, the anti-club sentiment becomes “a group.” When the town realized the dominance of the anti-club opinion, the town then decides take action by throwing local government out. It is after this action, that the standard social movement activities begin to take shape (protests, marches, framing, press releases, etc.). Finally, *El C.U.T.* is started after the group emerged to help organize more collective actions.

This process of aggregation—of individuals interacting and influencing one another, of individuals being influenced by their pre-existing identities, of individuals making decisions about the club for different reasons, and, finally, in these decisions totaling into separate groups—is emergence. Aggregation that leads to emergence in CAS is considered a basic property of CAS (Holland 1996). "Emergence" can be defined as "the emergence of complex large-scale behaviors from the aggregate interactions of less complex agents (11)". In this case, individuals with their own perspectives, identities, and reasons for choosing to be for, against, or neutral about the club end up becoming groups based upon their similar opinions. Illustration 1.1 uses Holland's (1996) terminology to explain group emergence in the *No al Club de Golf* movement.

Illustration 1.1 Aggregation Process Leading to Group Emergence



The emergent groups take on their own characteristics and do not resemble the diverse individuals that form it. A collective action group is much more effective and adaptive than an individual trying to bring about change. However, the anti-club group, for example, was still decentralized. Many individuals did not participate even though they were part of the anti-club group. Even though these people did not participate, the anti-club group still existed. Miller et al (2007) explain that "aggregate patterns should be immune to reasonable variations in individual behavior" (46). Moreover, most respondents claimed that *El C.U.T.* did not influence their participation decisions, though it helped organize events.

The emergence of groups is part of the larger self-organization of a social movement. As more groups emerge and interact with one another (a SMO industry for and against an issue) and with state groups (police, government institutions), for example, a movement system becomes more ordered and coherent. Group formation for this project is emergent and an example of self-organization because of there is no invisible hand directing the process (i.e. the SMO). As several emergent properties become more ordered, the entire system begins to self-organize at the macro-level, too (De Wolf 2004). Group emergence in this sense is still one of the micro-level phenomena that eventually give rise to a self-organized social movement. It is possible for group emergence not to lead to a social movement; this would be an example of emergence without self-organization, or failed collective action.

What do the social movement and collective action literatures say about group formation? Collective action in political science assumes the group has emerged already. Olson's work begins at the small and large groups already assembled and from here his theory begins about incentives and social pressure in participation decisions (Olson 1965). It is unclear as to where these groups are located within the larger social movement.

Resource mobilization theory assumes that the social movement organization (SMO) already exists or is created with the purpose of organizing groups (Zald 1987). A larger emergent property at a higher level of organization (the SMO) attempts to organize local-level groups (individuals into groups). In general, sociology research considers framing the link between individuals' identities and getting people to join the already existing groups. Again, this linking process is carried out by the SMO.

Tarrow explains (Tarrow 1998), "Framing not only relates to the generalization of a grievance, but defines the 'us' and 'them' in a movement's conflict structure. By drawing on inherited collective identities and shaping new ones, challengers delimit the boundaries of their prospective constituencies and define their enemies by real or imagined attributes and evils (Hardin 1995: ch. 4)." He states further that the media and the state also frame issues. Tarrow does acknowledge that collective identities exist before SMOs get a hold of them, but the framing of groups (us v. them) results from the SMO capitalizing upon those identities. These pre-existing identities do not seem to have a clear role in group emergence even though the SMO finds these identities important in their organizing efforts.

Fieldwork for this project showed that we must not assume the need for SMOs in group emergence nor that group formation is somehow linked to participation incentives. Is it possible for social movement groups (the different sides of a social movement) to emerge without an overarching SMO to guide formation? Just how does Olson get the small and large groups to assemble in the first place? The theoretical puzzle is that pre-existing identities are important for micromobilization and social movements in general. However, *how* they are important for group formation and under what environmental circumstances is not fully addressed by the social movement or collective action literatures.

Current research on group formation shows that individuals can successfully organize themselves even without the help of an outside source, organization, or activist, and with limited information (Brichoux 2002). This organic formation of groups is key to many contemporary social movements in developing countries and highlights the importance of viewing micromobilization from the individual level from the inception of movement activity. A SMO industry may not exist or may hinder movement efforts, especially in the development context (Piven 1977). A bottom-up approach modifies the fundamental components of micromobilization. Social movements are based more upon the peoples' perspective.

1.4 Conceptualizing Multiple Identities

Next, this chapter considers the literature on conceptualizing multiple identities. How pre-existing, multiple identities are defined and then methodologically implemented remains debated; our assumptions about these definitions are still open to examination. This project examines possible differences between an Identity Salience conception of multiple identities and a Supra-Additive conception of multiple identities. An Identity Salience approach to multiple identities acknowledges that an individual maintains many identities at once—social, ethnic, group, individual—and that these different roles a person inhabits are categorized within their minds (cognitive schema) in a ranked order of importance (Stryker 1980; Howard 2000; Stets 2000). This approach implies that all the identities in a sense add up together to form the individual. That is, the multiple identities, no matter how strongly one identifies with each identity, can only add up to form 100% of the person. A person only utilizes one identity at a time depending upon which role is being expressed.

Judith Howard (2000) contextualizes this theory for role identities in a larger literature of symbolic interactionism, where people define their identity roles through social interaction. She explains:

> Interactionist approaches to identity vary in their emphasis on the structure of identity, on the one hand, and the processes and interactions through which identities are constructed, on the other. The more structural approach relies on the concept of role identities, the characters a person develops as an occupant of particular social positions, explicitly linking social structures to persons (Stryker 1980). Role identities are organized hierarchically, on the basis on their salience to the self and the degree to which we are committed to them, which in turns depends on the extent to which these identities are premised on our ties to particular other people (Howard 2000).

In short, the stronger one identifies with an identity, the more one is committed to maintaining it socially or politically (Stryker 2000b). Identities can intersect within this ranked order, like race and gender, but there is always one identity to which one is more committed. There is a clear "winner" and the second interacting identity is "subsumed," as in her literature example of research on working class women in Beckwith (1998). That is, even though race, class, or gender interacts in a person's life, one is more committed to the racial identity more than the gender, for example. Howard also points out the majority of research on the intersection of identities only examines two identities at once and does not broach the subject of how more identities might intersect (381).

Multiple identities have been added to utility functions, too (Akerlof 2000). Akerlof and Kranton examine various situations in which identity can affect economic decisions. They apply their model to cases like gender relations in the home and in the labor market, race and ethnicity and behavior choices, and poverty and social exclusion. They write:

> Identity affects economic behavior in our models through four avenues. First, identity changes the payoffs from one's own actions….Second, identity changes the payoffs of other's actions….Third, the choice, or lack thereof, of different identities affects an individual's economic behavior….Finally, the social categories and behavioral prescriptions can be changed, affecting identity-based preferences (748).

The utility function underscores individuals' interactions and how these interactions impede or reinforce one's identity. This is a bottom-up approach to identity interactions even though identity is defined via social categories. While the basic model only provides interaction between two people and two identities, Akerlof and Kranton acknowledge that the model can be expanded to utilize more actors and more identities. As the social, political, or economic environment changes, so too does the utility function and an individual's self-definition.

What is useful about this model is that it adds local level interactions, environmental influences and context, and provides a way to incorporate social pressure into individual decisions about identity. This latter benefit—social pressure affects on decisions—is important to understanding group choice decisions in the *No al Club de Golf* movement. For example, in Akerlof's and Kranton's basic model there are two identities, Green and Red. Greens should choose Activity One and Reds should choose Activity Two as socially defined. If a Green chooses Activity Two, their utility function decreases because the social pressure of going against the definition of "true Greenness."

It is important to note, however, that this type of social pressure comes from a societal prescription of "Green," not directly from other actors be they Red or Green. In Tepoztlán, there was social pressure at the societal level (the current definitions of what a good Tepozteco does), but this was defined and reinforced at the local level by interactions with neighbors. Knowledge of the neighbors' group choices put pressure on individuals' group decisions, and this pressure from the neighbors' choices interacted with the individuals' own definitions of pre-existing Tepozteco and Mexican identities.

Another important facet of Akerlof's and Kranton's model is that "Activities One and Two could have different meanings for different people" (731). This expansion of the model provides for choices that may appear suboptimum, but are rational to the individual either given other behavior choices or other identities (within an environmental/social context that defines the "suboptimum" choices as such). Their case example provided—an unemployed man's loss of self-respect and identity as a provider—demonstrates how leaving one's family to hang out with friends on the street corner attempts to ameliorate this man's sense of self. It made more sense for this man to leave the identity of "provider" all together, than to punish himself as a failed provider.

This utility expansion helps to describe why some Tepoztecos who were in favor of the golf club chose to publicly identify as anti-club or to even goes as far as joining in protests against the club. However, it does not provide a way to explain why some Tepoztecos against all odds and costs chose to remain publicly steadfast in support of the club, tearing families apart, losing friends, or being kicked out of town.

Even though the model provides for some "suboptimum" choices, the actors remain fundamentally neoclassical economic actors and their choices remain rational (Davis 2007). Davis has two concerns: one, the use of aspects of a social identity approach to identity (social categories defining self-image); and, two, porting other disciplines' identity approaches and trying to fit them into neoclassical economics. He states, "…neoclassical economics lacks an adequate account of the identity of the individual, because the utility function analysis lacks the resources to explain the individuation and re-identification of individuals" (350).

Davis continues that Akerlof's and Kranton's focus on identity as self-image in comparison to social categories (and this self-image in comparison with others' identities) does not include personal identity defined as "apart from others" (351) or even a combination of the two (independent identities plus social identities) (354). Utilizing social identity conceptions of individual identity also precludes "the idea that individuals identify with others through social structural phenomena such as groups, institutions, and interpersonal relationships" (351).

This difference between the social identity approach and the sociological approach (which Davis suggests to use instead) is important because the social identity approach cannot explain why people with the same characteristics might identify with different social categories (or identify to differing degrees). Davis writes:

> The fact that like individuals can seem themselves as members of the same social groups, but differ in how they give precedence to some groups over others, suggests that social identity does not exhaust individual identity, and that personal identity and social identity must be understood in relation to one another (354).

A sociological approach to identities acknowledges "an interactive reciprocal relation between the self and society in the sense that each influences the other…and individuals can be seen to have a status apart from how they are understood in social terms" (355). Ability to explain these differences is central to understanding the *No al Club de Golf* movement because it is precisely these differences that caused variation in anti-club, pro-club, and neutral club group choices among respondents who were all "good" Tepoztecos (and highlighted in the quote at the beginning of the chapter).

Davis offers a new model that incorporates personal identity into Akerlof's and Kranton's social identity model. A person's identity utility function is the process of "negotiating his/her multiple social identities" (359). Davis considers this utility reflective of a true socially embedded individual—one that has multiple and differing identities in relation to others and independent from them. However, he fundamentally questions whether a utility function can best capture the nature of personal identity because it would necessitate a "multiple selves/multiple utility function" approach to how personal identity works (361).

However, some feminist and racial theorists view multiple identities with another approach and offer insight into this 'multiple selves/multiple utility function' issue. Drawing upon this research (examples follow), this project offers an alternative to an Identity Salience or neoclassical view of multiple identities: a Supra-Additive approach. A Supra-Additive approach, like Identity Salience, acknowledges that an individual operates on many identities at once. How an individual utilizes these identities is markedly different than the Identity Salience conception. It is difficult for individuals to ordinally rank separate multiple identities in part because how these identities are experienced (and therefore defined) are simultaneously (i.e. hyphenated Americans). Viewing race as a gendered category (Liu 1994), and vice versa, is quite different than viewing race and gender in an ordered rank and only utilizing one at a time. It is possible for an individual to identify with both (or more) identities equally strong.

For example, Evelyn Nakano Glenn (1994) explains that "recent scholarship of African American, Latina, Asian American, and Native American women reveals the complex interaction of race and gender oppression in their lives. These studies expose the inadequacy of additive models that treat gender and race as separate and discrete systems of hierarchy (Collins 1986; King 1988; Brown 1989)." Giddings (1984) adds, "One of [my research themes], clearly exposed in the experience of Black women, is the relationship between sexism and racism. Because both are motivated by similar economic, social, and psychological forces, it is only logical that those who sought to undermine Blacks were also the most virulent antifeminists. The means of oppression differed across race and sex lines, but the wellspring of that oppression was the same. Black women understood this dynamic" (6).

Two points should be made here. First, this project separates how individuals utilize multiple identities from how multiple oppressions might work. Doing so acknowledges that how oppressions systemically interact may have different dynamics than how individuals understand and use their identities on a daily basis. However, if structural social interactions form identities, then multiple oppressions (multiple "-isms") form multiple identities.

Patricia Hill Collins' "Matrix of Domination" is a analytical tool that is helpful in understanding this connection (Collins 1991). This matrix is "structured along axes such as race, gender, and social class" (227). She explains:

> Embracing a both/and conceptual stance moves us from additive, separate approaches to oppression and toward what I now see as the more fundamental issue of the social relations of domination. Race, class, and gender constitute axes of oppression that characterize Black women's experiences within a more generalized matrix of domination. Other groups many encounter different dimensions of the matrix, such as sexual orientation, religion, and age, but the overarching relationship is one of domination and the types of activism it generates" (226).

Understanding the interconnections among race, class, and gender, for example implies that women utilize these identities simultaneously, too. An alternative conception of multiple identities should embrace this interconnectedness and also allow for variance in experiences with oppressions and therefore variance in identity strengths (Zinn 1997).

The main identity type considered vital in social movement research is *collective* identities (Melucci 1989). Klandermans et al (2000) differentiate collective identity from social identities by where the group is located: "…collective identity concerns cognitions shared by members of a single group, whereas social identity concerns cognitions of a single individual about his or her membership in one or more groups" (74). They maintain that is it important to understand the difference between these two identity types, but also realize that social and collective identities are related via group identification by the individual. Therefore, while the level of analysis is different for social (individual level) and collective (group level) identities, the link to constructing group identity is how the individual identifies with the one group level identity (74-75). It is at this analytical location that the affect of pre-existing identities on group emergence and other facets of micromobilization will be examined.

Modern social psychology is the domain of individual decisions--decisions that are not made in a social vacuum and that are not necessarily assumed to be "rational."[8] Even though social psychology offers identity salience as a way to conceptualize identity, it is a starting off point for this dissertation. That is, its approach to locating individual identities and group identities provides an alternative to collective action or resource mobilization theories. Social psychology places the root of an individual's identity within a social context of many individuals and groups, and from this context most of the

[8] The emphasis on modern social psychology is important because social psychology was the discipline that initially claimed that movement participants were maladjusted deviants (Stryker 2000). Thanks in part to the *success of* resource mobilization theories and rational actor theories, social psychology has changed its views on activists and participants.

types of identities are formed, i.e. role, group, and collective identities (Gecas 2000).

Stryker's (2000, edited book) identity theory also maintains that the "self must be seen as multifaceted, composed of parts sometimes highly interdependent and sometimes not, some conflicting and some reinforcing, a self organized variously" (27). Doing so allows theories to delve deeper than the usual fundamental concept within sociology of "society shapes self shapes social behavior" (ibid). However, the assumptions about how the identities are utilized, i.e. a salience hierarchy, in group formation before a social movement begins is what is being questioned and is being compared to a Supra-Additive approach.[9]

When identities within a social movement become important is also a key theoretical question. New Social Movement theories utilize collective identity as central to movement success (Melucci 1985; Johnston 1995), and resource mobilization theories, too, have been incorporating collective identity (Zald 1992). Again, collective identities are formed as the movement takes off and while the movement is taking place (Melucci 1989). Moreover, if individual identities are considered, it is from the perspective of how the movement's collective identities changed an individual's self-concept (Johnston 1995; Pinel 2000; White 2000).

Collective identity as a concept seems separated from the influence of the individual, a-historical, and "indifferently describing movement participants" (Stryker 2000, 23). Collective identities are more *movement* identities rather than the different types of already-existing group identities that individuals bring to the movement *before* the movement begins. Fieldwork demonstrated that group formation in the *No al Club de*

[9] Nuttbrock and Freudiger (1991) is an example of Identity Salience refinement within social psychology, "Identity Salience and Motherhood: A Test of Stryker's Theory," *Social Psychology Quarterly*, Issue 54, Volume 2:146-157.

Golf movement was based upon a collective identity which already existed—the Tepozteco identity—and the main decision participants made was whether or not to belong to one of the three groups based upon their definition of a "good" Tepozteco. Overall, respondents' identity ranking determined their views on political economic development and how this would or would not affect the Tepozteco culture. Those who held their Tepozteco identity highest were most often against the club because it would bring unwanted cultural, environmental, political and economic change to the area. The majority of the pro-club respondents held their Mexican identity higher than their Tepozteco identity, and believed that the club would bring needed development to the region and to Mexico. Change was a part of this development and progress. Those who were neutral about the club tended to be foreigners or Mexicans not from Tepoztlán. Most did have a perspective about the club, but felt they had no say about this development project because they were not Tepozteco. Therefore, they were neutral about their belonging to the identity-based social movement group, not about the club specifically.

Abedlal et al (2006) fine tune the process of what may occur when pre-existing collective identity is called upon during a social movement and helps explain the connection between pre-existing identities and similar movement identities.[10] They define collective identity as a constantly changing *social* category that varies along two components: contestation and content. Contestation is the process through which the content of a collective identity is agreed upon by group members. The content is how the

[10] In this case, the Tepozteco pre-existing identity influenced group formation; the movement that emerged also used the Tepozteco culture as a rallying point, but the movement's collective identity could have easily been something entirely different given the importance of environmental, economic, and political concerns. It should be made clear that this project separates the two uses of the Tepozteco identity: before the movement and after the movement began.

collective identity is defined. Abedlal et al explain that "the content of social identities may take the form of four, non-mutually exclusive types:

- *Constituitive norms* refer to the formal and informal rules that define group membership.
- *Social Purposes* refer to goals that are shared by members of a group.
- *Relational comparisons* refers to defining an identity group by what it is not, i.e., the way it views *other* identity groups, especially where those views about the other are defining part of the identity.
- *Cognitive models* refer to the worldviews or understandings of political and material conditions and interests that are shaped by a particular identity" (696).

Fieldwork interviews expressed that the movement not only utilized an existing collective identity, but that what occurred during the movement was a process of contesting the social purposes and cognitive models of what it means to be a modern Tepozteco in an era of globalization and increased democratization. The movement used the Tepozteco identity strategically during the movement, too. Group formation was dependent on this changing definition of the collective identity as was evidenced through social pressure on those who were in favor of the club to be anti-club.

Methodologically, there are two concerns that surface when addressing pre-existing identities, groups, and individual interactions: how individuals understand their multiple identities and how they make their behavior decisions accordingly. Most identity theories consider that multiple identities are conceived by the individual within a "salience hierarchy"—"the likelihood an identity will come into play in a variety of situations as a function of its properties as a cognitive schema" (Stryker 2000a). However, when asked to rank the social and categorical identities that were important in making their decisions to participate in the *No al Club de Golf* movement, many respondents had identities with the same ranking. In their minds, their identities were not ordinally ranked; they were concurrent and influenced their decisions thusly. This difference in conceptualization influences the methodology for how multiple identities are studied.

Another methodological concern is conceptualizing how individuals make their behavior decisions. Rational choice theory offers maximization by rational actors, but this perspective has been repeatedly challenged by social movement theorists (Ferree 1992). If we turn to cognitive psychology as a source of understanding how people process decisions, we find that the rational actor model does not support how people utilize information in their complex environments. "Satificing," or making decisions with limited or "good enough" information, not only provides a more realistic understanding of the circumstances under which individuals make decisions, but also corresponds with people's abilities to still act in a world of imperfect, incomplete, or too broad information (Kaplan 1983).

Chapter Three will consider the methodological assumptions we have about Identity Salience and Supra-Additive conceptions given the fieldwork data (Identity Salience and Supra-Additive models). Will individuals' group choice decisions change if they conceive their multiple identities as supra-additive? Will groups still emerge if individuals use limited information on which to base their decisions? Knowing how individuals interact allows us to consider how their pre-existing identities inform these interactions.

1.5 Complex Adaptive Systems (CAS) and Agent-based Modeling (ABM)

In attempting to better locate the individual in micromobilization and to better understand how individuals behave given their pre-existing identities, this dissertation utilizes the theoretical and analytical tools of CAS and ABMs as the best way to approach flushing out the micromobilization process based upon truly local-level interaction. When one considers micromobilization from the bottom-up, incorporates local-level interactions, and embraces the emergence from local-level to higher level organization (groups, social movement organizations, a full-blown social movement, etc.), this complicated organization lends itself to using CAS and ABMs to better understand dynamics. Tarrow's (1998) analysis of the entire social movement process yields many insights that demonstrate the cyclical and adaptive nature of movements and participants writ large. His vision of a social movement reflects many tenets of complex adaptive systems. However, utilizing CAS as an epistemological framework for the analysis of the emergence of a movement from local-level micromobilization will bridge the gap to research only considering larger social movement systems. Doing so incorporates more characteristics of social movements in developing countries by eliminating the assumptions about functioning political institutions, pre-existing and institutionalized social movement organizations, and necessitates viewing social movements from their inception—before people even consider whatever local grievance they are trying to ameliorate as a "social movement."

CAS is a theoretical structure that provides a good fit to pre-existing identities and to the process of micromobilization and can include even more social movement phenomena. Lars-Erik Cederman (1997) best summarizes a definition of CAS (50-51):

> ...a complex adaptive system can be defined as *an adaptive network exhibiting aggregate properties that emerge from the local interaction among many agents mutually constituting their own environment.* [original italics]

Characteristics of CAS include: emergent properties and behavior based upon local-level interactions, interactions among many diverse agents, and adaptation (with feedback) (Cederman 1997).

Social movements and collective action exhibit all of the major CAS characteristics. Social movements self-organize as local-level collective action emerges. Interactions among individuals, communities, organizations, and state actors engender social and political change (emergence leads to multi-level aggregation) (Waldrop 1992; Kauffman 1995; Holland 1996; Cederman 1997; Wolfram 2002). Within fruitful environments, as demonstrated by political environment/political process research (McAdam 1982; Tarrow 1998), it is from these interactions that social movements organize.

As a social movement self-organizes, the movement as a whole takes on different dynamics and characteristics from its local level activities. For example, Julia Paley (2001) shows how a local level community health organization identifies itself with the fight for increased democratization in post-transition Chile. While the overall movement becomes one for democratization and regime change, the health clinic's activities started off and remained centered around increasing quality public health services. It is the onslaught of diverse and varied organizations, communities, and individuals—all with different goals—that leads to a larger movement that can be quite different from the sum of its parts.

Another characteristic of CAS, interactions among many diverse actors, is a crucial difference from standard collective action models. While most collective action models model decision-making for one to a few actors, the assumption that the results will be similar when a community or several towns participate in these decisions is a stretch. CAS modeling shows that very different dynamics occur when many actors interact with one another (Kelley 1995; Epstein 1996; Holland 1996; Axelrod 1997; Casti 1997; Cederman 1997). Technology now permits more complicated models over N iterations to better understand underlying behaviors. With respect to social movements, they do start with local level interactions, but the local interactions occur among many individuals and organizations—too many to make the same assumptions about outcomes from one- or two-person games. Models can demonstrate the effects from diverse individuals, even within collectivities.

The final characteristic of CAS, adaptation, is crucial to social movements. Many authors demonstrate that social movements are not only adaptive to what they are going to encounter, but also to the social and political change they have already brought about. For example, Tarrow (1998) describes the adaptation necessary by organizations to better frame grievances as opportunities for contention and organizing actors rise and fall. These kinds of adaptations occur during a social movement. McAdam (1982) shows how the Civil Rights Movement of the 60s adapted from change brought about from collective action in the 1950s and even at the turn of the century. This kind of adaptation comes from historical analysis of the continuum of movements and of social changes (the U.S. Women's Movement and its various waves is very similar).

A main tenet of adaptation for CAS is identifying agent “tags” to communicate among agents and levels (Holland 1996). Tags are any kind of symbol, mark, cue, or identifier--explicit or subtle--which provides a short cut for agents to decide to interact with one another. Holland explains:

> Tags are a pervasive feature of *cas* because they facilitate selective interaction. They allow agents to select among agents or objects that would otherwise be indistinguishable. Well-established tag-based interactions provide a sound basis for filtering, specialization, and cooperation. This, in turn, leads to the emergence of meta-agents and organizations that persist even though their components are continually changing. Ultimately, tags are the mechanism behind hierarchical organization—the agent/meta-agent/meta-meta-agent/...organization so common in *cas* (14-15).

Tags are used in social movements in several ways. The movement itself utilizes symbols of the struggle—signs, banners, slogans, flags, etc. With respect to micromobilization, agents follow social cues from local-level interactions about framing the new grievance and eventual movement success from peers, community, etc. Moreover, the decision to join a movement group is also based upon whether or not the agent identifies with the movement and with the participants.

In Tepoztlán, tags were vital at every stage of the micromobilization process. Individuals followed cues from their social networks and rising social pressure to join the anti-club side. The movement reinforced its cultural protection component by using cultural cues for everything from signaling town meetings via church bells, to capitalizing on the town's *barrio* structure and competition to further provide a sense solidarity and secure participation. All the tags used in the social movement were established by the pre-existing, Tepozteco collective identity.

Next, movements then build upon a new level of change from adaptation. This type of feedback is difficult to demonstrate in traditional theories. Moreover, while social movements are cyclical, there are few times in which there is an official stopping point of activity—equilibrium. That is, activists continue to fight for change even after the heightened movement activity has waned or democratic transition has occurred (Randall 1981; Collier 1999; Edelman 1999; Womack 1999; Paley 2001; Selverton-Scher

2001). The movement has not "died;" it has only adapted to a new environment. In the West, it is common for some movements and their organizations to become institutionalized and more formal. Adaptation is extremely important in unstable political contexts with a retaliatory state or a state undergoing a democratic transition. Not becoming co-opted or institutionalized is central to the success of movements in developing countries and poor peoples' movements in the West (Piven 1977). Participants, too, must be able to change their tactics not only for success, but also for group safety, particularly if there is a militant state reaction.

Another characteristic of CAS found in social movements and collective action are the local level interactions among participants as individuals *and* groups, *and* their social and political economic environments. Individuals interact with levels of state retaliation, community organizing, or other examples of social movement environments, and these interactions influence their decisions to participate and when to participate (Levine 1993; Hale 1994; Stokes 1995; Collier 1999; Castells 2000). This particular aspect of CAS again permits forgoing the assumption of democratic institutions or even that a state can absorb agitation from the population. CAS locates individuals in collectives and as individuals at the same time, and views one's environment as an independent actor.

The core usefulness of utilizing CAS theory in modeling lies in its ability to allow researchers to question theoretical assumptions through experimentation otherwise not permitted with humans or with certain political phenomena. The main emergent tenets of micromobilization considered in this dissertation—framing and group formation, and interactions among individuals embedded in social networks—question how we usually conceptualize politicization of grievances and how local-level interactions yield social movement groups. Models of micromobilization based upon CAS can incorporate multiple, interacting identities, and independent and influential social networks. Moreover, it allows us to not assume that a social movement organization is doing all the work, nor that participation is synonymous with group identification.

For this project, agent-based models (ABM) built from fieldwork data are used to increase the explanatory power of micromobilization theories. Agent-based modeling is one of the principal tools for modeling CAS. One of the benefits of ABMs compared to other forms of modeling is that ABMs allow researchers to model dynamic and inclusive environments of numerous agents who interact with one another based upon simple behavior rules. Gilbert and Troitzsch conclude the following:

> In comparison with some other methods of analysis, computer simulations are well able to represent dynamic aspects of change. A second important feature of simulation is that it can help with understanding the relationship between the attributes and behavior of individuals (the 'micro' level) and the global ('macro') properties of social groups (Gilbert 1999).

With respect to social movements, linking micromobilization to larger collectivities and social movement organizations (and vice versa) is one area in the literature that can be improved. Overall, the results of ABM simulations can be used to generate new theory or better hone existing theories.

The biggest advantage of ABMs is the opportunity for systematic experimentation that would otherwise be restricted because of the rights of human subjects. In this case, social movement research usually occurs during or after the height of a movement, or it is conducted as historical analysis. It is impossible during a social movement or collective action to have organizations or individuals modify their behavior according to the researcher's needs just to see what outcomes are generated. Moreover, analyses of collective action by ABMs are better suited for complex adaptive systems with many interacting agents because they do not assume linear behavior. Many other methodologies are dependent on this assumption.

Some CAS models differ from other models because they utilize induction for outcomes and because they focus on understanding totalities of systems, not on breaking systems down to their smallest, working parts. Induction further allows models to incorporate path dependency and historical contexts, and equilibira are not automatically assumed or forced (Waldrop 1992; Resnick 1994; Epstein 1996; Casti 1997; Cederman 1997; Watts 1999; Wolfram 2002). These models remain unrestricted with the exception of agents' simple behavioral rules, thus allowing opportunities for thought exercises about theories.

1.6 Theoretical Contributions

Conceptualizing micromobilization and the effect of pre-existing collective identities on group emergence with this new CAS perspective and utilizing agent-based models to experiment with the micromobilization process provides the opportunity for one to ask questions about substantive and methodological assumptions about the effect of pre-existing identities on local interactions. Theory about the micromobilization process can be honed to encompass the unique attributes of social movements in developing countries. Substantively, the CAS framework and agent-based models allow this project to understand more clearly the influence of non-ranked, pre-existing multiple identities on group emergence. Individuals interact within social networks, and social networks influence individual behaviors. Individuals do not have perfect information, nor are they necessarily always rational and maximizing.

At higher levels of interactions, we do not need to assume that social movement organizations are always the movers and shakers of successful social movements. How do movements form when there are no institutionalized organizations ably using resources? How does micromobilization link up with social movement organizations and when do organizations become helpful? Furthermore, how does participation fit in if we do not assume that group membership necessitates participation?

Methodologically, because this project emphasizes the importance of pre-existing identities, it grapples with the best way to operationalize non-ranked, multiple identities. Do supra-additive identities significantly affect micromobilization? This dissertation also highlights the process of model-building and incorporating qualitative fieldwork to build and inform model formation. Fieldwork is a natural partner for agent-based models because of the types of questions needed to be asked about intricate processes but from a more "whole" perspective. Fieldwork allows one to view individual behavior and the larger, group (whole) behavior simultaneously. Moreover, once the model begins to yield information and potential theories, model results then better inform subsequent qualitative and quantitative research following more of an explicit grounded theory approach to modeling.

Overall, this dissertation provides insight into four important tenets of micromobilization: framing, local-level interactions within social networks, linking these local-level interactions with group formation and social movement organizations, and participation. In doing so, it embraces the characteristics of social movements in the development context and provides more specific theories about them, specifically the influence of pre-existing identities on group formation. Finally, this dissertation experiments with the best way to incorporate the process of group formation into a model, given identities and social networks. Questioning methodological assumptions also provides suggestions about carrying out subsequent qualitative and quantitative research stemming from model results.

The fundamental questions this dissertation addresses are: 1. do different conceptions of multiple identities—Identity Salience and Supra-Additive—produce different results (and if so, why)? 2. how can CAS modeling inform research on social movements? and 3. how do pre-existing identities influence group emergence? The three main hypotheses for this project are: H_1, agent totals for each GroupID are different between the Identity Salience and Supra-Additive models; H_2, group emergence patterns and total groups formed for each GroupID are different; and, H_3, predicted probabilities of group choice for each GroupID are different. At a basic level, it is important to compare the two major approaches to multiple identities. Social pressure, social pressure tolerance, and agent interaction will help further understanding of how people make group choices given pre-existing identities.

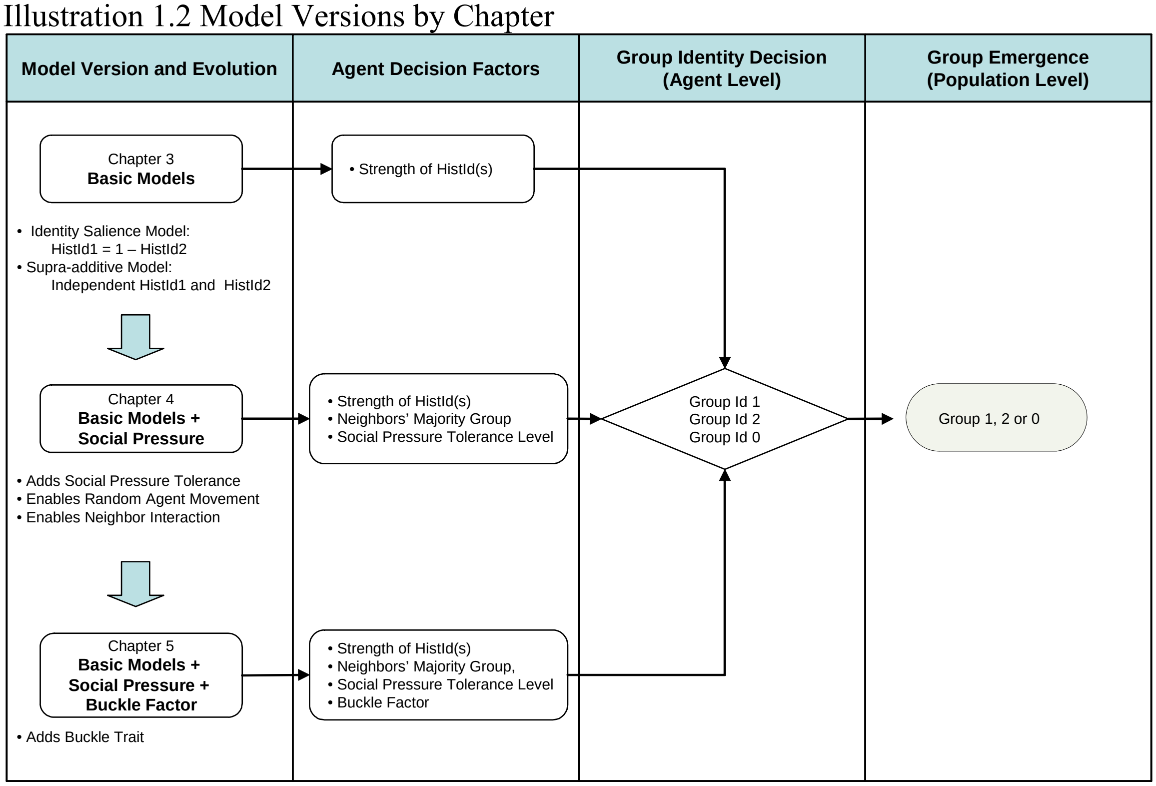
1.7 Overview of Chapters

Chapter Two describes the case of the *No al Club de Golf* social movement and the process of carrying out fieldwork. It details the fieldwork results on which the models are built. Chapter Two also places this social movement in the larger context of

Mexican politics and uses it as an example of a typical movement in a development context.

Chapter Three presents each model version used in Chapter Four through Chapter Six. The Basic Model, the Social Pressure Tolerance model, and the Buckle Factor model are introduced and detailed. Chapter Four tackles the micromobilization tenet of group formation from local-level interactions. Each individual has *pre-existing*, multiple identities and interacts with other individuals within social networks. This model experiments with not only how to operationalize identities, but it also sets up the basic model versions for both Identity Salience and Supra-Additive approaches. The models separate the decision to join a group from the decision to participate based upon fieldwork data.

Illustration 1.2 Model Versions by Chapter



Chapter Five adds social pressure tolerance and agent interaction to the basic models. It asks the question: how do local interactions give rise to group formation especially given satisficing agents with limited information? Chapter Six examines the influence the Buckle Factor has on group formation. The Buckle Factor is an agent characteristic representing the ability to maintain a group choice regardless of tolerance levels or group pressure (an ideologue). If an agent has the Buckle Factor, it will buckle to group pressure; if an agent does not have the Buckle Factor, it will maintain its group choice even if it has low social pressure tolerance.

Finally, Chapter Seven provides an overview of model results from Chapters Three through Five. It considers how the Identity Salience and Supra-Additive models changed as social pressure and the Buckle Factor are added into agent decisions. It also provides an intra-model comparison to see how each model changed individually as it becomes more complex. Finally, this chapter considers methodological implications and posits future experiments based upon model results.

Chapter Two

Tepoztlán: *No al Club de Golf* Movement

The motivating factor in choosing Tepoztlán as a case site is how well the *No al Club de Golf* movement represents the new kind of social movements burgeoning throughout the developing world (Oommen 1997). These movements view the peoples' political inequalities based upon race, class, gender, nationality, and other social and political identities *simultaneously*, and organize the movements accordingly. As Chapter One demonstrates, participants identify their political problems as rooted in these identities not only in a national context, but more importantly within the larger context of globalization. The project had a general goal of learning how these identities affected decisions to participate. However, in talking with respondents, two things became clear: the decision to pick a side of the movement held more importance than decisions to participate; and this decision to pick a side of the movement was based upon pre-existing identities and not a collective identity put forth by a SMO or formed after participation began. Moreover, participation decisions were based upon a different calculus.

The *No al Club de Golf* movement fought against political corruption and imposed economic development. The major theme around which participants rallied was cultural preservation: the golf resort would allow another opportunity for their politicians to be corrupted;[11] it would destroy their local economy and they would not be allowed to *fully* participate in the resort's economic opportunities; it would bring in outside values and traditions that might change their own; and it would destroy the local environment and water sources on which many of their traditions are based. This collective theme of cultural preservation developed after the town overwhelmingly formed the anti-club group and decided to be against the club.

Participants in the *No al Club de Golf* movement recognized the shareholders of the development company Kladt-Sobrino (KS) as mostly foreign (United States), but this make-up also included some Mexican investors. The golf course was even designed by Jack Nicklaus. They coupled foreign attempts at development on their land as part-in-parcel of the larger story of globalization, NAFTA, and the repeal of Article 27[12] in the Constitution. Older participants located the *No al Club de Golf* movement as yet another struggle for their land and for their traditions that has a history dating back to colonial days (Rosas 1997; Demesa Padilla 1998; Corona Caraveo 1999).

More practical considerations for choosing Tepoztlán were feasibility for conducting the research and gaining entry in to the town. I worked with Cetlalic, a Spanish language school based in Cuernavaca that offers cultural and language instruction in Tepoztlán; many of their instructors live in the town. This connection to the town provided the infrastructure necessary to live there, gain subjects' trust, and gain

[11] The politicians regardless of party, especially the chosen officer to protect the interests of the communal lands and property (*El Comisariado de Bienes Comunales;* traditionally, this person is an older male considered a "good" Tepozteco who maintains traditions), are expected to put the town and culture before personal political interests. While this sounds like basic democratic practice, Mexican democratization continues to better itself. Historically, the indigenous in Tepoztlán have a deep and long tradition of the people giving power to the leaders in a more direct democratic fashion (i.e. *El Reto de Tepozteco* celebration).

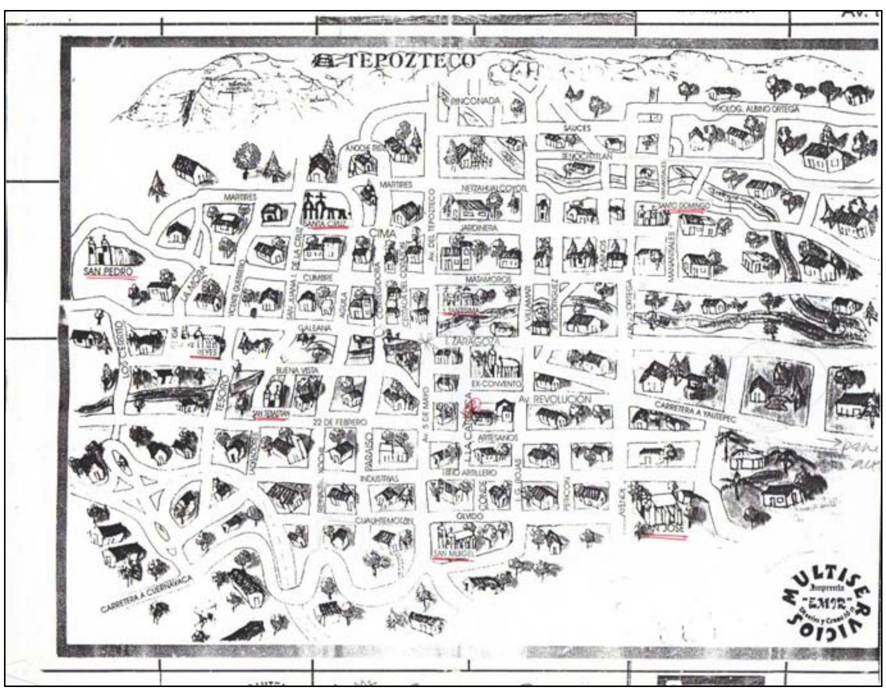
[12] This Article protected communal lands from being sold or developed without the community's permission.

insight into culturally specific concerns locals might have with respect to an outsider asking potentially sensitive questions. Without Cetlalic's trust and expertise, research would not have been possible.

2.1 Qualitative Design

Field research was structured according to quota sampling. Tepoztlán is organized by eight *barrios* (neighborhoods) that have developed over time from the town's inception[13]. The municipality of Tepoztlán[14] is further made up of seven *pueblos* (towns) and seven *colonias* (communities).

Illustration 2.1 Map of Tepoztlán (*barrios* are underlined in red).



13 For early anthropological literature considering the origins of the *barrio*s, consider Robert Redfield (1930) and Oscar Lewis (1951; 1963).

14 The municipality and the town are both called Tepoztlán.

Utilizing these political boundaries, the quotas were set to locate and interview best examples of various movement perspectives within as many of the *barrio*s, pueblos, and *colonias* as I was permitted: people for or against the Club, neutral about the Club, those who participated and did not participate against the Club, natives to Tepoztlán, people not from Tepoztlán, and people living within and outside of the municipality. Demographic variations were also considered, especially age and gender. Because of lack of social access, some *barrio*s are not represented well or not at all. However, information within the interviews quickly became redundant. I also was able to interview several *El C.U.T.* officers and some pro-club politicians.

Table 2.1 Respondents by Demographics

Geography	**Number of Respondents**	**Male**	**Female**	**Anti-Club**	**Pro-Club**	**Neutral**
Barrio de San Miguel	14	6	8	5	7	2
Barrio de San Sebastián	2	2	0	0	0	2
Barrio de Santa Cruz	2	2	0	1	1	0
Barrio de Santo Domingo	9	6	3	3	6	0
Barrio de La Santísima	8	5	3	2	6	0
Barrio de San Josè	3	2	1	3	0	0
Barrio de San Pedro	1	1	0	0	0	1
Barrio de Los Reyes	0	0	0	0	0	0
Pueblo de San Juan	2	2	0	2	0	0
Pueblo de Amatlán de Quetzalcóatl	2	2	0	0	2	0
Pueblo de San Andrès de la Cal	1	1	0	0	1	0
Huilotepec	2	1	1	1	1	0
Cuernavaca	2	1	1	2	0	0

Interviews were relatively structured, following pre-written questions specifically about inhabitants' thoughts on the *No al Club de Golf* movement and their participation decisions. However, for the sake of conversational flow, some questions were not always asked in the same order if the respondent answered several questions at once, or if the question did not apply to their particular situation. There were two sets of interview questions, one for movement organizers and one for everyone else. The questions were tested and refined during the first few weeks of fieldwork to make sure that their translation was valid and appropriate. Interviews were taped, and notes were taken with the respondent's permission if they did not want to have the interview taped.

In conjunction with interview questions, respondents were asked to complete a questionnaire that obtained their political participation history, their general views on politics, and other important variables like access to political information and their self-ranking of social identities. The questionnaire was field tested to validate its translation. During most meetings with subjects, the questionnaire was given first to help them recall events from the movement, and then the interview was conducted.

While interviews asked questions specifically about the role of identities during the movement, it is fair to be concerned about correctly tapping into feelings about identities during the movement or incorrectly assessing feelings about current identities. It is a familiar methodological problem with social movement research, which is usually conducted after-the-fact. Would identities forged and strengthen during the movement fundamentally affect current identity perceptions? Two reasons prevail that provide some support for correctly tapping into pre-existing movement identities: 1. respondents who were ousted from Tepoztlán during the movement because they supported the golf club had similar answers to pro-club respondents who were able to remain in Tepoztlán; 2. anti-club respondents who did not participate in movement activities that would strengthen Tepozteco collective identity had similar answers to anti-club respondents who heavily participated in the movement. It is acknowledged that the Tepozteco identity would be greatly transformed by the movement, but it would be a situation of strong sentiments only becoming stronger. Finally, anti-club respondents chose to be anti-club before any movement participation occurred. At the very least, the difference between pro-club and anti-club respondents provides a good jumping off point for questioning the theoretical assumptions about multiple identities.

To gain entry into Tepoztlán, Cetlalic provided several research assistants who lived in Tepoztlán and who were able to find subjects according to the quota parameters. Admittedly, gaining trust of some respondents was difficult because of the volatile nature of the social movement. Even though more than ten years have passed, many are still fearful of government or social retaliation; some respondents refused to speak with me for fear of my not being able to prove I was with the C.I.A. Gratefully, most Tepoztecos were happy to speak with me about their experiences, especially those who were pro-Club; it was an opportunity for them to tell their side of the story.

2.2 Movement Background, 1993-1994

The first day of 1994 initiated across Mexico a resurgence of resistance to imposed political economic development by citizens wanting to maintain their cultural identities, their hard-won lands, and their self-determination to decide the type of development that best suited their needs. The most widely known social movement, the

Zapatistas or *Ejércitio Zapatista de Liberación Nacional* (EZLN), sparked their unique form of resistance on January 1, 1994, confronting the start of the North American Free Trade Agreement (NAFTA). The EZLN's national efforts to protect indigenous lands and to incorporate the indigenous into the Mexican political and economic landscape continues to herald smaller, though no less paramount, local social movements throughout the country. The *No al Club de Golf* movement should be located in this increase of resistance to protect communal lands and to challenge imposed political economic development.

A fundamental antecedent to this increase of resistance occurred in 1993, when President Carlos Salinas de Gortari and Congress hastily modified Article 27 of the Constitution to allow previously protected lands to be sold and developed. Many acknowledge that President Salinas was compelled to change Article 27 to increase the foreign and domestic development needed to have a running chance in appeasing the political and economic demands of the U.S. and Canada so that Mexico could join NAFTA (Wilson 1997).

The revolutionary 1917 constitution granted protection for and redistribution of the people's land—land central to their primarily agricultural livelihoods and fundamental to their cultural traditions. Land redistribution was a core mobilizing tenet in the 1910 revolution and was felt the strongest in the southern front, led by Emiliano Zapata. Zapata was from Morelos, the state in which Tepoztlán is located. This revolutionary hero and the principles for which he stood are still very much alive in the popular imagination and cultures in the south. Many farmers argue that *"Tierra y*

Libertad"[15] and the redistribution of land to the people in Zapata's *Plan de Ayala*[16] have yet to come into fruition. In the eyes of many farmers and indigenous peoples, the changing of Article 27 effectively eliminated their political rights to their promised lands.

NAFTA and losing the protection of Article 27 are only modern chapters in a long drama since the Spanish invaded—the government once again is trying to take communal and *ejido* lands. It is important to recognize this perspective because the legacy of the fight for the peoples' land informs so many of these contemporary social movements. As foreign and domestic companies begin to propose more development projects across Mexico, threatened, individual communities continue to organize against these projects to protect their land and their way of life. This history is alive, it is more importantly *current*, and it is maintained through the generations.

2.3 *No al Club de Golf* Movement, 1995-1999

Unknown to the inhabitants of Tepoztlán, during the end months of 1994, the PRI Morelos state government leaders had made a deal with the development company Kladt-Sobrino (KS), selling almost 200 hectares of government-protected land to create a golf resort rivaling the size of Tepoztlán itself. The mega-project was to be named "*El Tepozteco* Golf Resort," and was to include an 18-hole golf course designed by Jack Nicklaus, about 800 resort-style homes, a hotel, a man-made lake, a spa, a professional

[15] "Land and Liberty" became Zapata's battle slogan during the 1910 revolution.
[16] Zapata created the Plan de Ayala (1911) as part of the new revolutionary law for the state of Morelos. In it, all land would be redistributed to the people effectively ending the hacienda system of land ownership. Some land was devolved at the time of the revolution, but it was not fully attempted until the 1930s under President Lázaro Cardenas. The *ejido* system was the policy outcome.

business center[17], a heliport, and a commercial center with stores and supermarket (Guzman n.d.).

While the image of the Club is magnificent and modern, the problem was the land—specifically *whose* land. The prime area chosen by KS is called *Montecastillo* by the locals. It is not only communally owned by the residents of Tepoztlán, but it is also federally protected land. The land in Tepoztlán was given back to the people by a Presidential decree in 1929, making good the many revolution-based promises to the people. In 1937, this area was decreed to be a national park by Lázaro Cárdenas, and was also named an ecological corridor, *Ajusco-Chichinautzin,* by Miguel de la Madrid in 1988. Moreover, the National Institute of Anthropology and History officially recognized this area to contain important archeological artifacts and named it the archeological zone, *Tecuescontitla.*

Federal, state and local governments knew that *Montecastillo* was protected land and owned by the Tepoztecos. Popularly, the town of Tepoztlán is known as a sacred area with "magical vibes," in part because of the sacred pyramid, in part because of the strong traditions held by the people. Drawn by this mystical atmosphere, many visit Tepoztlán, and over the years, many have moved there from other parts of Mexico and from other countries. There are New Age types and seasoned hippies, UFO sightings, stores selling items from India, and enrichment courses in yoga and vegetarian cooking. Tepoztlán hosts more fiestas and celebrations than there are days in a year. Religious holidays, historical and cultural celebrations, plus birthdays, funerals, *quinceñeras*, baptisms, first communions, weddings—all involve the entire community. Tepoztlán is at

[17] GE wanted to make the Club its North American headquarters.

once both traditional and cosmopolitan, albeit largely segregated between "true" Tepoztecos and *"Tepoztizos."*[18] This juxtaposition is part of its tourist draw. It is this unique ambiance that attracted other development companies in the 1960's and KS in the 1990's.

Hoping to capitalize on this tourist gold mine, KS did considered the potential reaction of the entire municipality of Tepoztlán. They knew the land would be a liability, so KS offered Tepoztlán jobs constructing the club, rent for the land and water use, improved infrastructure like water tanks and electricity, jobs in the Club, and the perk of more tourists coming to Tepoztlán. KS had the benefit to learn from the mistakes of the companies that attempted to build tourist projects in Tepoztlán in the 1960s; land was "bought" and plans were made to make a scenic train to travel throughout the area and a cable car to offer panoramic views. However, these projects met great opposition from the town, though no movement arose comparable to the 1990s movement. In the 1960s the other development companies backed down from further development for the most part because a prominent local leader was killed during protests.

With this knowledge of previous development attempts, KS garnered state government approval in 1994 to develop *Montecastillo* and then set out to get local approval. By the end of 1994, rumors circulated throughout the municipality that construction was going to take place; few who lived by *Montecastillo* claim they found out about the development project because KS already had begun to clear the land with

[18] "*Tepoztizo*" is a combination of the words "Tepozteco" and "*poztizo*," or fake Tepozteco. It shows the ambivalence of locals about accepting people not traditionally from Tepoztlán. There is only a little differentiation between foreigners and non-Tepozteco Mexicans. They live in different neighborhoods and in large part lead separate social and political lives than the "true" Tepoztecos. More about this cultural dynamic will be explained later.

bulldozers.[19] On January 23, 1995, the municipal council (also majority PRI) passed an act to deny KS the use of the communal land and the development of the golf club. However, shortly after, the municipal council passed another resolution stating the exact opposite.

2.4 A Time Line of Action

Incensed by what many people considered the consummate betrayal, the town began to organize over the next few months to find out more information about the affects of the club on the town. The town hall meetings, or *asembleas*, became focal points for people to discuss the pros and cons of the club. People were still deciding about which group to join: are you for or against the golf club? This was the main question circulating throughout the municipality of Tepoztlán and the town of Tepoztlán. In the series of *asembleas*, concerns arose about the environmental and economic consequences the club would have on the land and local economy. Others had enough of political corruption and were angered that the council would give away their communal land.

Club opponents had a three-fold argument: 1. the club would destroy the local economy and only offer casual, service-sector, and labor sector employment; 2. the club would further indebt the local politicians to the development company and corrupt state politicians; and, 3. the combination of losing their communal land and the numbers of foreigners coming to Tepoztlán would initiate an influx of cultural and social change that would threaten their beloved traditions. Given the number of other similar developments

---

[19] Cetlalic program meeting on Tepozteco traditional medicine with Don Tomás, January 2005.

throughout Mexico, the locals knew they would not be welcomed as club *members*. Golf is a U.S. sport for the middle and upper classes. A general joke in Tepoztlán is that Mexicans do not play golf, they play soccer!

Opponents also were concerned about the affect of the club on the local economy. They felt that resort members would be in a self-contained economic bubble, with their own grocery store, houses, and hotels. There would be no need for them to venture outside. The local economic effect would be similar to when 'Walmart comes to town.' Moreover, locals understood the types of jobs they would be offered at the club. They would be hired as temporary construction workers, caddies, gardeners, cooks and waiters, and housekeepers—not managers or other, more permanent, positions.

Many Tepoztecos' political concerns at this time were standard for most Mexicans: they were fed up with PRI domination, lack of further democratization, and corruption throughout all levels of government and civil service. With respect to the club, many residents felt that Tepoztlán's local politicians had sold them out: first the municipal government officially said they would not permit the selling or development of *Montecastillo* (after a town meeting and vote), but quickly retracted its word in favor of the state government and KS. Even the bishop of Cuernavaca claimed that the golf club was "a gift from God" for Tepoztlán (Rosas 1997).

In response to this corruption, locals felt the only way to prevent further political betrayal was to oust the local government (Rosas 1997; Demesa Padilla 1998; Guitérrez 1998). It is at this point that the *asembleas* began to change from a venue of information to decide about what to do about the club, to meetings about collective action and movement participation. The anti-club group emerged, the majority of the town had chosen a side, and the *No al Club de Golf* movement took off. Figures of the politicians were hung in effigy in the main square. The politicians were socially ostracized and threatened; they were finally pressured into moving out of Tepoztlán.

Image 2.1 Politicians Hanging in Effigy (photo courtesy of R. Bertschin Sr.).

Image 2.2 Evening Protest (photo courtesy of R. Bertschin Sr.).

The town successful threw out the municipal government and held direct, democratic elections to fill the posts. From September 14-21, 1995, elections were held according to local customs, many whom believed were traditional to their indigenous roots. The elections were organized by *barrio, pueblo*, and *colonia*, according to tradition. The *barrio* system and corresponding *barrio* identities turned out to be an important organizing strategy for the anti-golf club movement. Politically, a democratic structure is built into *barrio* life. *Barrio* leaders are elected and frequently rotated, money for *barrio* fiestas and the *barrio* church are collected from residents, and the *barrio* leadership is considered the base of representation for the town.

All materials and man-power for the election were volunteered. The elections did not cost the provisional town government one peso. A voting fraud watch group, *Alianza Civica*, and other international election groups were called in to monitor the elections. *Alianza Civica* declared the elections fraud-free. The truly significant factor about the 1995 elections is that they were run without political party affiliation. *No* candidates had a political party. The ballots only consisted of candidates' names and biographical data (Rosas 1997; Demesa Padilla 1998). This insistence to have government without political parties speaks to the towns' disgust with national Mexican politics in general, the parties' weak institutionalization even though they have been around since the 1910 revolution, and the disgust the majority of the municipality felt about the local government. The choice to run without parties was not so much to run as independents as it was to honor an indigenous way of choosing leadership (Ortega Interview 2005).

Opponents' environmental concerns included destruction of some of the only land that produces plants locals use for traditional medicine and the depletion of already scarce water sources. The opponents' final concern about the golf club was the cultural impact it would have on the town. Juan Ortega connects the realities of the club to cultural change (January 2005):

> We were thinking that [the club] would change our way of life, right? Because we were going to have a monster next to us. It's through influence [from depletion of natural resources and temporary service sector jobs]…we would have lost many traditions, for example, those dealing with issues that are a part of the future identity of Tepoztlán.
>
> *So how do you lose a tradition?*
>
> No, you do not lose a tradition, do you understand? If the golf club were here now, it is possible that it would start to modify these traditions.
>
> *How does this process happen?*
>
> From influence, right? From influence from a new way of life, a new style of living.[20]

The cultural concern became a universal rallying point for the municipality because it drew the strongest reaction from inhabitants' pre-existing identity concerns—they all wanted to be "good Tepoztecos." Graffiti slogans, poster themes, and main arguments against the club all stemmed from preserving Tepoztlán's way of life. While it was the last argument to surface in discussions about the impact of the Club—political and environmental concerns were addressed first—cultural preservation became the most effective catalyst for group emergence and eventual political participation.

While the majority of the municipality was against the Club, views were by no means monolithic. Club supporters focused upon the potential jobs and the hope of increased tourism. The unemployment rate around this time was almost 10%, and many

---

[20] Pero iba...pensamos que nos iba modificar la forma de vida, ¿sí? porque ibamos a tener un monstruo a lado. Así es. Eso por influir…iba perdida de muchas tradiciones, por ejemplo. De cuestones que son parte de la identidad futuro de Tepoztlán.

¿Y còmo perdió una tradición?

No, no se perdieron. ¿sí me entiendes? Si el club de golf estuviera ahora, es posible que se empezarían a modificar esas tradiciones.

¿y cómo es este proceso?

Por influencia, ¿sí? Por influencia. De una nueva forma de vida. Uno nuevo estilo de vivir, ¿sí?

families had been torn apart by emigration to the United States and other countries.[21] Rafael Hinojosa shares his family's experience with unemployment and why he supported construction of the club:

> In a certain way, yes, [my family and friends influenced my opinion about the club]. Because something that I was able to perceive is precisely the question about the lack of employment in Tepoztlán. I was able to perceive the worry about immigration…our people mainly going to the United States. Ten years ago immigration was strong. In these days it is much worse. There is not a house in Tepoztlán that does not have a family member in the United States. And this [unemployment and immigration] is a concern. It is worrisome for someone like a Tepozteco because you always develop a town. I have a sister that was living… in California, in Anaheim. And well, she left over 10 years ago, a little bit before the golf club movement. And she obviously still thinks a little bit different [from anti-club Tepoztecos] now, right?[22]

Mr. Hinojosa experienced first hand his family be torn apart by unemployment in Tepoztlán and supported the club because of the potential for jobs and increased tourism. He thought the club would only benefit the town's economy and keep families together.

Other benefits from the club discussed in interviews included improved infrastructure throughout the municipality. KS would take it upon themselves to improve streets, drainage and plumbing, water storage, and electricity for the town, albeit for the maintenance of the club. Some *pueblos* and *colonias* overshadowed by the resources in larger town of Tepoztlán were happy to receive promises of development from KS. Many of these surrounding pueblos like San Juan, were overwhelmingly in favor of the Club after basics like running water and electricity were promised (Rosas 1997). Overall, the supporters interviewed felt that *any* kind of development not only in

[21] http://www.centroprodh.org.mx/Publicaciones/Informes/info_htm/informes%20prodh/tepotzln.htm

[22] En cierta parte, sí [mi familia y mis amigos influyeron en mi opinion del club]. Porque algo de lo que yo alcansé a percibí es precisamente la cuestión de la falta del empleyo en Tepoztlán. Alcansé a percibí la preocupación por la imigración…al principalmente a los estados unidos nuestra gente. Hace 10 años era fuerte. En esta èpica es mucha mayor. No hay casa en Tepoztlán que no tenga miembro en los estados unidos. Y eso es una preocupación. Es preocupante para uno como Tepozteco porque siempre desarroya un pueblo….Yo tengo una hermana que vivía…en California, en Anaheim. Y bueno pues, ella se fue hace 10 años…poquito antes del movimiento del club de golf. Y ella obviamente, pues, piensa aún tanto differente ya ahora, ¿no?

Tepoztlán, but in Mexico in general, would bring rewards for people in the long run. Fundamentally, proponents trusted KS and their promises of the good the resort could bring to Tepoztlán.

2.5 Pre-Existing Identities and Group Emergence

In the above history of events in the *No al Club de Golf* movement, there are two distinct times identities are important. Before the movement began, the pre-existing identities of Tepoztecos shaded their understanding of the information about the club as they learned about it during the *asembleas.* Even though people heard about the club in various ways (rumors, friends, family, etc.), most attended the *asembleas* to learn more about the club and to come to a decision about whether or not the club was good for the town. In this process of attending meetings, gathering and discovering information, and discussing this information with others, individuals overwhelmingly chose to be against the club. Others chose to support its construction, while others chose to remain neutral.

At this time, there was no SMO to utilize identity as an organizing tool; therefore, the pre-existing identities influenced group decisions and group formation. Juan Ortega explains not only that there was no SMO before the movement began, but also the centrality of the *asembleas:*

> Well, in the beginning, [the organization *El C.U.T.*] was not properly "*El C.U.T.*" like it ended up becoming. It was an informational meeting that we had every week. In this meeting, we handed out committee work to different people to investigate some information about the golf club….The [organizing] mechanism most important was the informational meeting--the meeting in the *zócalo*. This was the most important mechanism (Interview January 2005).[23]

[23] "Bueno, primero no era propriamente "CUT" como tal. Era una asamblea de información que se tenía cada semana. En esa asamblea de información, pues se distribuían comisiones a diferente personas para investigar alguna información sobre el club de golf…. El mecanismo más importante fue la asamblea--la asamblea en el centro. Esa fue el mecanismo más importante."

These sides of the social movement (for, against, neutral) emerged organically without a social movement organization utilizing a framing strategy or other SMO tools to steer decisions. Group formation was dependent upon current definitions of Tepozteco, Mexican, gender, or other identities not influenced by an SMO; the identities were the lenses through which Tepoztecos understood the effects of the club on Tepoztlán. Therefore, with respect to group formation, pre-existing identities were central.

Table 2.2 Crosstab Results, Group Choice and Identities

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Group Choice * Tepozteco ID Strength	46	82.1%	10	17.9%	56	100.0%
Group Choice * Mexican ID Strength	46	82.1%	10	17.9%	56	100.0%

For Golf Club * Tepozteco ID Strength Crosstabulation Count

		Tepozteco ID Strength from 0-10							Total
		0	2	5	7	8	9	10	
Num. of Respondents	For Club	6	1			2	1	3	13
	Against Club	6		1	1	2	1	18	29
	Neutral	2						2	4
Total		14	1	1	1	4	2	23	46

For Golf Club * Mexican ID Strength Crosstabulation Count

		Mexican ID Strength from 0-10					Total
		0	5	8	9	10	
Num. of Respondents	For Club	1			1	11	13
	Against Club	2	1	1	1	24	29
	Neutral	1			1	2	4
Total		4	1	1	3	37	46

Table 2.2 shows crosstab results based upon a survey given to each respondent before I interviewed them. Respondents were asked to rank, from one to ten, their most important identities that informed their group choices. Respondents were given the

choice to ranks identities with the same score if they felt several identities equally as strong, for example, or all equally as weak. Some did rank identities with simultaneous strengths; some did not.

The crosstab results clearly show respondents who were against the club ranked their Tepozteco identities very strongly versus respondents who were for the club. That is, respondents who did not want the club constructed strongly identify with being Tepozteco. Respondents who did want the club constructed only weakly identified, if at all, with the Tepozteco identity.

Respondents who were against the club strongly identified with the Mexican identity, too. That is, they simultaneously identify as Tepozteco and Mexican. Whereas respondents who were for the club only strongly identified as Mexican. Therefore, it was the strength of identification with the Tepozteco identity that informed respondents' group choice to be against the club.

Tepozteco identity and culture was also important during the movement, especially as a mobilization tool by *El C.U.T.*, the movement's only SMO. There were two separate decisions—one to join a movement side and one to participate. While the culture did not serve as a way to change people's ideas about which side to support, the cultural events utilized by *El C.U.T.* mobilized people already against the club. Using already existing resources like *barrio* organizational committees, inter-*barrio* competition, and using each *barrio's* church bells as a communication tool all worked towards creating the movement's new collective identity. Use of Tepoztlán's social structure was an economical use of resources, but it also reinforced the idea that the movement was to preserve its culture.

An *El C.U.T.* organizer explains how they used cultural aspects within the movement:

> Well, look, one of them was various elements of us, of the culture of Tepoztlán. For example, for the first *asemblea*, what they did when they took the government, here in Tepoztlán it is a custom to ring the bells when there is an emergency situation. So when we decided to take over the local government and kick them out because they authorized the golf club, they rang the bells, the politicians left, and this form of communication was used from August 23rd. And [ringing the bells] was used throughout the movement….This moment was an emergency because [the local government] had already given the authorization to begin work on the golf club. So we started to ring the bells in all the [*barrio*] churches…the emergency bells....This was one [cultural] element.
>
> Well, I think that another resource that was utilized was various aspects of the cultural identity that there is in Tepoztlán, like these [church] bells, like the *barrio* organization. [The *barrio*] is also important and something that I think is very relevant, something that helped the movement succeed, to succeed in starting off, to succeed in rescuing that which there still is in Tepoztlán—the sense of community, to work together. [The sense of community] is something that helped the movement succeed, too. [This sense of community] is part of *las fiestas* here in Tepoztlán. Everyone participates in these celebrations, the *barrio* parties. This is also something that served us as an element of unity in the movement—this participation precisely by the *barrio*s (Interview January 2005).[24]

Using the church bells were literal signals but also cultural queues that reinforced the sense of cultural community during the movement (à la CAS). As a new Tepozteco identity was being forged again, utilizing traditional methods of communication, political and social organization, or representation (i.e. elections without political parties and the giving of power to the politicians via the *El Rey Tepozteco* ritual) all helped to define

---

[24] Pues, mira, una de ellas fue, este, yo creo que las...como varios elementos de nuestra, de la cultura de Tepoztlán. Por ejemplo, para la primera asemblea, que se hizo cuando se tomó la presidencia, se...aquí en Tepoztlán se acostumbra a sonar las campanas cuando hay una emergencia de una terminada forma. Entonces para...cuando decidímos nosotros tomar la presidencia y desconocer al alcalde, de ese entonces, porque ya había autorizado el club de golf, se tocaron las campanas, quedamos, este, se convocó a los medios de comunicación desde el 23 de agosto. Y lo hice a través del congreso, ¿sí? …. Era una emergencia porque ya había una autorización para empezar a trabajar el club de golf. Entonces, así se empezó a tocar en todas las iglesias...las campanas de emergencia….Eso fue un elemento. Pues, yo creo que un recurso fue aprovechar varios aspectos de la identidad cultura que hay en Tepoztlán, como este de las campanas, como la organización por *barrio*s, eso también es importante, y algo que yo creo muy...este...muy relevante, es que se logra en este movimiento, se logra sacar a flote, se logra rescatar lo que ya hay de... lo que todavía en Tepoztlán que es el sentido de comunidad, de trabajar en colectivo. ¿sí? Eso es algo que se logra también. Y que, es parte de las fiestas aquí en Tepoztlán. Las fiestas se hacen entre todos, las fiestas del *barrio*. Pues es algo que también nos sirvió como un elemento de unidad en el movimiento, y de acción, precisamente por *barrio*s.

what were important norms. The *barrios* have their own representative body made up of rotating volunteers. They obtain money from *barrio* residents for the *barrio's* saint's day, for example. Each *barrio* has its own animal mascot and distinct pride and history (Redfield 1930; Lewis 1951; Lewis 1963). *El C.U.T.* used the *barrio* organization to get representative members to participate in the SMO and used the inter-*barrio* competition to drum up participation, i.e. the town guards (Rosas 1997; Demesa Padilla 1998; Corona Caraveo 1999).

While both the Tepozteco identity and culture were important before and during the movement, they were not the same foundations. Before the movement, individuals decided to be for, against, or neutral about the club for many different reasons. During the movement, the newly forged collective identity was one of resistance and about political economic self-determination. Cultural queues further unified the town to fight for cultural preservation and this redefined Tepozteco identity.

The roles Tepozteco identities played during the movement correspond directly to existing theories about SMO behavior (Zald 1987), framing (Snow 1986), and collective identity formation (Melucci 1985; Johnston 1995). *El C.U.T.* drew upon experienced activists to head its ranks, it drew upon other social movements like the Zapatistas to learn from their successes and failures, it drew upon existing social and cultural infrastructure to organize and mobilize the town, and it drew upon championing the "new" Tepozteco culture to bolster collective identity formation. This new identity formation included women's participation and youth participation, for example, whereas before these populations were usually excluded in politics (Rosas 1997; Balderrama Vara n.d.).

Today, Tepozteco identity is still being contested. Two experiences illustrate this continuation of constant contesting of the Tepozteco identity versus other identities (like Mexican or being *"chalango"*—from Mexico City). During fieldwork, I had the honor of being invited to a home renovation completion celebration attended by family and friends of the homeowners. Brightly decorated tables and chairs adorned the front yard while a mariachi trio serenaded us. I joined my senior dinner partner, Alberto Díaz, at a table of his friends, mostly the grandparents and grand-relatives of the family. After everyone finished the traditional party dish, *molé*, the mariachi group joined us at our table. Mr. Díaz greeted the young musicians by immediately asking them what their last names were and the last names of their parents and grandparents. The elders then deliberated in front of the youths about the validity of their descent—only one of the musicians was determined to have an "original" Tepozteco family name. This not-so-subtle social investigation and trial served as a way to determine how authentic the young musicians were in their claim to be from Tepoztlán. It was also a way to establish a social hierarchy, a way to remind the kids that the building blocks of the Tepozteco identity were already deeply-rooted and sacred ground, and that the cultural rules were not to be toyed with. The youth, in particular, are the ones seen as having the potential to forsake the cultural the most, bringing in traditions from other Mexican cities and the United States. As more young adults leave Tepoztlán for school or work, they return with different ideas and potentially new traditions; many kids watch U.S. television shows or have lived in the U.S. for a stint, and parts of the U.S. culture attempt to seep into Tepoztlán, too.

Another example of this battle for tradition was seen in fieldwork during *Los Días de los Muertos*, from November 1-3rd, to honor family members who have died. Many kids want to dress up in costumes like Halloween, and there has been a growing town reaction to prevent another U.S. custom from taking root. Signs were put up all over town telling people to celebrate the authentic holiday of *El Día de los Muertos*, not Halloween.

Image 2.4 "A Town is Characterized by its Traditions—Say 'No!' to Halloween!"

The *El Día de los Muertos* traditions for the children are similar to Halloween's: kids make lanterns out of an indigenous squash, and go door to door asking for candy. However, they do not dress up in costumes. Some elders felt so strongly about respecting their traditions, that I witnessed some children skipped over for candy because they were wearing costumes. Costumes were being sold in the neighboring city of Cuernavaca without protest, so the effort to keep *El Día de Los Muertos* as a Mexican and Tepozteco tradition was localized to Tepoztlán.

Indeed, Tepoztecos have a love-hate relationship with outsiders. They are fiercely proud of their culture, and are feeling increasingly threatened by these foreign and Mexican-born visitors coming to partake in the uniqueness of the town. Tourism has become the main source of income, and since the 1960s, more and more outsiders have been staying (Lewis 1951; Lewis 1963). The tourists and transplants are needed for town survival, but their very being there slowly changes the town's cultural norms. Tepoztecos have a name for these ex-pats and wealthy, Mexico City transfers: *"Tepoztizos."* This word is a combination of "Tepozteco" and *"postizo,"* which means fake, false, or artificial. *Tepoztizos* are therefore fake Tepoztecos.

Tepoztizos know their place in Tepoztlán. Many *Tepoztizos* rent houses and land in town, and visit only on the weekends. They tend not to participate in the local economy, bringing their groceries and staples from their main home. They usually are wealthy urbanites from the capital city, another Tepozteco disdain. Some make a sincere effort to integrate into the town, adopting customs and standard of life and participating in the local economy. However, acceptance is still difficult to come by. Maria Rodriguez explains the difficulty she had during the *No al Club de Golf* movement:

> Well, they gave me many problems in that the people of Tepoztlán took advantage of us by throwing out 35 people that were working here on this street [selling goods]. They took advantage of the *Club de Golf* movement to throw us out with protest, those of us who are not Tepoztecos. So—it was not important to the people of Tepoztlán that we did not agree with the golf club—we were supporting them! They didn't care about our support. In all ways, they screwed us (Interview February 2005).[25]

[25] "Pues que a mi me dio muchos problemas en que aprovecho la gente de Tepoztlan para quitarnos a 35 personas que trabajabamos aqui en esta calle. Aprovecharon lo del Club de Golf para sacarnos con el protesto de que no eramos Tepoztecos. Sea---que no importo a la gente de Tepoztlan que no estabamos de acuerdo tambien con el Club de golf---que los estabamos apoyando. No les importo nuestro apoyo. De todas maneras, nos fregaron."

For Maria Rodriguez, tension about her *Tepoztizo* status was exacerbated during the movement. The town's reaction to her made her even more of an outsider even though she felt part of town and in support of the town's anti-Club movement.

Some consider people from Mexico City, especially the youth, as uncouth and ill-mannered. Permanent *Tepoztizos* socialize within their own circles, a catch-22: Tepoztecos highly prize their social interaction as a cultural tradition but do not wish to intermingle with the *Tepoztizos*, seldom providing an opportunity for them to gain social acceptance.

It should not be surprising then that when the planned construction of the golf club was discovered, those with a strong allegiance to the *current* manifestation of the Tepozteco collective identity felt extremely threatened. However, being from Tepoztlán was not enough to establish a connection with the *pre-existing* Tepozteco collective identity. Being from Tepoztlán did not equate to everyone having the same definition of being a "good" Tepozteco. One's attitude towards future development of the town, and overall, how one viewed the inevitability of cultural change shaped one's definition of the identity and social movement group choice. In short, was the development of the golf club for Tepoztlán or for Mexico? The answer was systematic and based upon if one felt more Tepozteco or more Mexican *before* the movement began.

Respondents who felt that cultural change was an inevitable constant in society, and those who wanted to see *any* kind of economic development in the town, tended to support the construction of the golf club. These two perspectives were composed of several specific elements working in tandem: most of the respondents who were in favor of the club felt that their Mexican identity their Tepozteco identity and many had lived in other places within Mexico or in other countries for brief periods of time. They participated in Tepozteco traditions and fiestas, and by this behavior were good Tepoztecos, but they had a different future outlook given their philosophy about identity and cultural change. In response to the criticisms about cultural change, Alberto Díaz, a senior citizen club supporter shared his view about the inevitability of change based upon his life's experiences:

> Well, you know that to live effectively, progress brings changes…changes, of course, in life—in the way of being, in the way of conducting yourself, in the manner of living. I have a different perception from the majority of Tepoztecos, because, well, much of my life occurred outside from here. I was in Cuernavaca, I was in México [D.F.] for school, and I always considered that there always should be changes…I will consider that if I was educated here, I had to follow the customs from here. Therefore, I went to México [D.F.] to see other customs and to get another type of education….I was not living [permanently] in another place; it never crossed my mind because I was born here in Tepoztlán. I love Tepoztlán very much and I like Tepoztlán very much. What I don't like are the people [and their views about cultural change] (Interview December 2004).[26]

Note that Albert Díaz is the same respondent who grilled the young mariachi musicians about their Tepozteco heritage! Other commonly held views from supporters include that Tepozteco culture has always been changing even if people do not acknowledge it and that the need for employment out-weighed what little cultural change might occur.

These life factors informed their perspectives about political economic development. Their time in other parts of Mexico (usually Mexico City) or in other countries provided the understanding of other levels of economic development and

[26] "Bueno, usted sabe que vive...efectivamente, el progreso trae cambios. cambios, cambios desde luego de vida, de manera de ser, de manera de actuar, de manera de vivir….tengo una percepción diferente del comun de los tepoztecos, porque, pues, mucha parte de mi vida transcurrió afuera de...alguna parte de mi vida transcurrió fuera de aquí. y yo estuve en cuernavaca, estuve en méxico en la escuela, y yo consideraba que siempre debe haber cambios….consideré que si me educaba aquí, tenía que seguir las costumbres de aquí. pero para eso, por eso me iba yo a méxico, para ver otras costumbres y tener otra clase de educación…. no de vivir en otro lugar, no nunca me ha pasado por la cabeza porque yo nací aquí en Tepoztlán. Quiero mucho Tepoztlán y me gusta mucho Tepoztlán. Lo que no me gustan son las gentes."

helped add a more general Mexican identity to their Tepozteco one. This generalization of their identity also informed their relationship to cultural change. It happens. Even the customs expressed and practiced today in Tepoztlán are slightly different than before. There were respondents who had lived outside of Tepoztlán who were against the golf club, but they ranked their main identity as Tepozteco. Their membership in the Tepozteco collective identity was central to their group choice as the social movement began.

The majority of *Tepoztizos* interviewed initially claimed to be neutral about the club but admitted after a little persistence that they had a specific opinion about the club, one way or another. It was their social position as *Tepoztizos* that prohibited them from participating in the movement according to their true beliefs. Some felt unaccepted in the town because they were deemed non-Tepoztecos; others had successfully integrated themselves into the town, but knew they had to stay out of local politics because of the fear of outsiders taking political and/or economic power. Fred Smith, offers his take of the movement and why it was successful:

> I would say, yes [Tepozteco unity is a historical factor that led to the success of the movement]. Even after someone has been here a zillion years, someone is still not Tepozteco. They'll tell me—I've been here 30 years—they'll tell me, 'oh, you're *casi*-Tepozteco.' I now say, 'no—I never will be [Tepozteco]; I'm a *Tepoz-Tejano*. Now I've been here more years than there, but I'm different than you are and I'll never be the same as you.' And because they had that history in common—this is straight across the board—from all the Tepoztecans I've ever known—as an identity, they are Tepoztecan and they are united. *Si el* pueblo *decidió así, pienso yo la misma* [If the town decides like this, I think the same thing]… It is what the *pueblo* has decided (Interview January 2005).

Most respondents who were against the construction of the club were not against political economic development per se. They had ousted the local government and held purely democratic elections. They envisioned political leadership without political parties, akin to more indigenous forms of representation. Moreover, they supported a new development initiative currently spear-headed by the federal government called *Pueblos Mágicos*.

Pueblos Mágicos seeks to increase tourism to many small, traditions-oriented towns throughout Mexico. The goal is to give visitors a taste of "traditional" Mexico. In the planning stages, the federal government worked with the towns by asking them what they wanted done in their towns to improve tourism. Carlos Muñoz describes the development plan and why Tepoztlán approved of *Pueblos Mágicos* and not the golf club:

> It was a good project because there were benefits. There were benefits because one of the important people in the state government from the secretary of tourism office, she was a delegate of tourism—she was a good element [of the project]. She was a person on the Left. So we talked with her and it seemed to be a very good project. It was presented before the federation and we won. We were one of 13 municipalities from 30 or more states that participated; we were one of the winners [to participate in *Pueblos Mágicos*]. With this, we ordered a little proposition…and my intention [with this proposition] was that all the lights, when there are less than two blocks or three blocks in the main part of Tepoztlán, were underground lights so that there would not be visual contamination that we have with the cables. Nevertheless, we finished [putting the light cables underground] only on the first block. Therefore, there are no posts for these lights. This was *our* project. They got rid of the posts and the instrument panel—all the light and telephone cables in the first block are underground….*This* is development. *This* is progress in a town. I saw how [the town] was before…and this is a good project….Isn't it pretty to see Tepoztlán without light posts, right?...Well this will totally change [Tepoztlán] and will return recovering part of that image that [Tepoztlán] has lost.[27]

[27] Fue un bien proyecto porque hubo beneficios…hubo beneficios porque una de las personas emensas en el estado de la secretaría de turismo…era delegada del turismo. Ha sido bien elemento. Ha sido persona a la izquierda. Entonces platicando con ella, le pareció muy bien el proyecto, lo presentó antes de la federación y ganamos. Fuimos de los trece municipios de los treinta y tantos estados que participaron algunos municipios, fuimos uno de los ganadores…Con eso nos mandaron un poquito de propuesto… y mi intención era que toda la luz, cuando menos, de dos cuadros o tres cuadros de la primer parte del cuardo de Tepoztlán, fueran luz subterrano para que no haya esa contaminación visual que tenemos de los cables. Sin embargo, se lo logró solamente en el primer cuadro. Por eso no hay poste en esta luz. Ese fue un proyecto nuestro. Se quitaron los postes y todo el tablero—tanto del cable de la luz, y del teléfono, en el primer cuadro está el enterrado….ese es desarrollo. Eso es progreso en un pueblo. Verlo como era antes…Y ese era un bien proyecto….¡Qué bonito se vería Tepoztlán sin postes! ¿verdad? …pues eso cambiaría totalmente y regresaría recobrando parte de aquella imagen que ha perdido.

Respondents liked this type of development because it was participatory from its inception; it was not imposed—especially by a foreign country. Moreover, they feel that *Pueblos Mágicos* rewards their efforts to conserve the very traditions that make Tepoztlán such a tourist draw. This development plan protects and nurtures their customs and way of life, rather than potentially threaten them. It is development according to the definition of a "good" Tepozteco as defined once the *No al Club de Golf* movement began.

In this era of globalization, most respondents understood their location on the ladder of power politics involved between the United States and Mexico, and Mexico and its people. The golf club was the same story of foreign-owned companies using Mexican resources. They knew of neighboring towns whose local economies failed and traditions weakened when Costco or Walmart came to town (citation for towns).

Locating their social movement within the larger context of globalization and the international political economy is characteristic of contemporary movements in developing countries. In sum, however, those against the club were not against development in general, just not *that* kind of development. Ironically, the aftermath of the social movement stigmatized Tepoztlán as a violent and unsafe town, and tourism declined drastically. The usually fat profits from the weekly markets dried up and families had to close their stores. *Pueblos Mágicos* provides hope for Tepoztlán as a happy medium that respects their autonomy and cultural history; the goal is that this type of development will reinvigorate the tourism, even if Tepoztecos remain suspect of it.

2.6 The Role of Social Pressure in Group Emergence

While one's strength of historical identity determined their group choice and ultimately the dynamics of group emergence, effective social pressure also accounted for not-so-subtle swaying of some neutral or pro-club persons (social pressure is examined in Chapter Five). Social pressure influences available resources and information, and sways or reinforces people's decisions about group choice or participation. In Tepoztlán, social pressure even forced long-time residents to leave town. This "buckling" under pressure from their social network made some respondents participate against the club even though they wanted the club built (this is considered more in Chapter Six).

This buckle factor clouds participation motives. That is, group choice does not always directly match a linear participation path and vice versa. One's personal tolerance level provides an element of diversity in group choice behavior, and is important to decisions only when one disagrees with the majority in their immediate social networks. Some people stuck to their convictions to be for the club and suffered the consequences (ideologues); others chose to counter their beliefs because of economic, family/social cohesion, or personal safety concerns.

2.7 Conclusion

Juan Ortega's question that began Chapter One highlights the intricate relationship between pre-existing collective identity and corresponding behaviors in micromobilization. Why were some Tepoztecos for the construction of the golf club, even if they participated in the local traditions and had long family roots to the town? Fieldwork uncovered that what was a more important determinant to one's group choice within the movement was the strength of one's allegiance to the current norms of the Tepozteco collective identity. When this large development opportunity came to Tepoztlán, the effects of the golf club made Tepoztecos question this identity and its relationship to economic and political growth. The social movement served as the back drop for this contention: can a town maintain its traditions if political economic development occurs? Both sides in the movement wanted what was best for Tepoztlán, but they disagreed upon what exactly how this "best" was envisioned. Those who were for the club identified more with a national identity than local, though they still considered themselves Tepozteco at the same time. This simultaneous understanding of their identities creates the foundation for Juan Ortega's insightful question—they participated in Tepozteco traditions, but saw different development future on the horizon.

The *No al Club de Golf* movement shows the importance of better understanding the dynamics of pre-existing identities and how they impact micromobilization as a social movement develops. The strength of one's allegiance to these pre-existing identities, in conjunction with how much social pressure one can tolerate, helps determine group choice. This movement is a prime example of contemporary movements in developing countries where multiple identities come into play in not only individual decision making about the grievance at hand, but also in social movement group formation.

The next chapter presents fieldwork data from interviews and surveys, and builds the simulations accordingly. Chapter Three presents the computational models that incorporate multiple identities, social networks, and personal social pressure tolerance which all interact to initiate group formation. Two separate model versions are presented—one where multiple identities are considered ordinally ranked (Identity

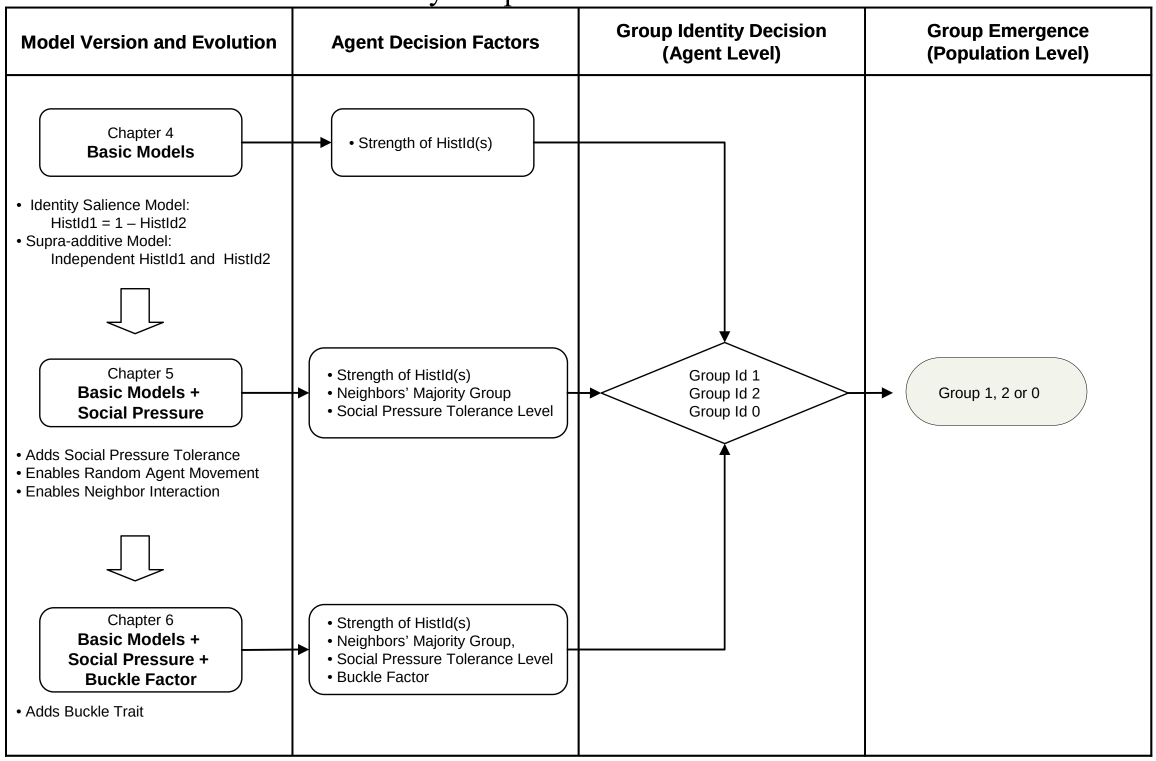
Salience) and one where they can effect decisions independently (Supra-Additive). Each model will consider the assumptions made about the impact of multiple identities, and their relationship to social networks and social pressure in decisions about group choice.

Chapter Three

A Computational Model of Pre-Existing Identities

This chapter presents a computational model of pre-existing identities which examines the differences between the two conceptualizations of multiple identities—as hierarchal and summing to 100% of a person's identity, or as supra-additive, with each identity being independent and with the possibility of each identity summing to more than 100%. As demonstrated in Chapter Two, fieldwork interviews expressed the importance of pre-existing identities in determining peoples' group choices as being for, or against, or remaining neutral about the golf club. How people felt about the club depended on how they connected the club's effect on Tepoztlán's culture, environment, economics, and politics. Their Tepozteco identity in relation to other social and personal identities influenced their interpretation of the effects of the club on the town. These ramifications were categorized by how strongly people felt general development would effect their Tepozteco culture. If they strongly identified as Tepozteco and with Tepozteco history, the club would be a negative event for the town and municipality. If their other identities were stronger than their Tepozteco identity, most respondents were ambivalent about the club's consequences and had a difficult time deciding to which group to belong.

Illustration 3.1 Model Versions by Chapter



This chapter will first explain the Basic Model for the Identity Salience and the Supra-Additive perspectives of multiple identities (used in Chapter Four). Group choice is made by considering only pre-existing identities. Next, the Basic Model is extended by adding social pressure and agent movement (Social Pressure version) to group choice in the Basic Model (used in Chapter Five). Agents begin to move, interact with neighbors, and take into account their neighbors' group preferences before group decisions are made. Finally, the Buckle Factor version further extends the Social Pressure version by adding the Buckle trait to all agents (used in Chapter Six). This final version incorporates the tendency to give-in to (the Buckle Factor is present) or remain steadfast against social pressure at all costs (the Buckle Factor is not present). The Buckle Factor trait captures the behavior of the ideologues who refused to give into the anti-club social pressure and pragmatists who gave into social pressure against their own opinion of the club. Illustration 3.1 shows each model version by chapter.

3.1 The Basic Model

To begin to capture group choice in this Tepozteco context, the Basic Model of pre-existing identities bases group choice upon the pre-existing identity (HistID1 or HistID2) with which the agent more strongly identifies. There is a Basic Model option for each of the two approaches in how identity is operationalized: identity salience, where identities are hierarchal and in sum make up one person; and supra-additive, where identities can be equally important at the same time and each sum to 100%. The Basic Model versions (Identity Salience and Supra-Additive) consider the impact on group decisions from pre-existing identities only. That is, there is no agent interaction or any awareness of what group choices other agents are making. Group choice is solely an individual decision based upon personal identity preferences.

This Basic Model assigns each individual agent the following variables through the following agent attributes:

- **Group ID** = 0 (neutral), 1, or 2: representing the group options with which agents can identify; all agents start as 0, neutral (at t = 0). Groups can be considered similar to sides within a social movement (for, against, or neutral) and group formation is defined by four or more adjacent agents.

- **HistID1** = 0-100%: representing how strongly an agent identifies with a pre-existing identity. In this case, agents have two competing historical identities that influence their behavior. HistID1 is the strength of identification to the historical identity components of Group 1. A strong HistID1 preference leads to choosing GroupID1. HistID1 is randomly assigned from a normal distribution with a set mean and standard deviation. Substantively, the standard deviation is considered similar to the diversity of allegiance within a population.

- **HistID2** = 0-100%: the second variable representing pre-existing allegiance to the historical identity of Group 2. Depending on the model, HistID2 is determined either by HistID1 as |1-HistID1| (Identity Salience model) or independently from its own normal distribution with a set mean and standard deviation (Supra-Additive model). Again, "identity" can be social, ethnic, national, class etc. to represent the simultaneity of personal and social identities that make-up an individual's overall identity. For this case, examples are drawn from primarily ethnic and national identities.

The model environment is a standard checker board (11 x 11 world) with wrap-around torus. There are 100 agents in all model versions, for all runs. Only one agent can occupy its cell (patch) on the grid. There is one run for each combination. Each run lasts until either there are no more agents with GroupID0 or until t = 10,000 (enough time such that the agents' group choices are simply varying around an equilibrium). In the model's set-up procedure, each agent is assigned to a list that is randomly shuffled. Agents are then placed on the board in this shuffled list order. When the model runs, the agents are also randomly called to make their decisions.

In this Basic Model, agent's decision rules only consider their pre-existing identity preferences, HistID1 and HistID2. The model procedure for the Identity Salience and Supra-Additive versions and the agent's decisions rules are as follows:

1. Set up world, assign agent attributes, and place agents on board.
2. Pick a random agent.
3. Agent determines which historical identity preference is higher, HistID1 or HistID2.
4. If agent's HistID1 > HistID2, Group 1 is chosen (GroupID = 1). If the agent's HistID2 > HistID1, Group 2 is chosen (GroupID = 2). If the agent's HistID1 = HistID2, then the agent remains neutral and Group 0 is chosen (GroupID = 0).
5. If there are agents which have not set their GroupID, return to step 2.

Given these rules, the outcome expected should be pretty straight forward: the larger HistID determines GroupID choice. This GroupID will have the advantage for larger numbers in group formation.

It is also important to note two more rules that determine agent characteristics: a HistID upper and lower bound and a neutrality definition. All models have these two rules:

1. If HistID > 1 or HistID < 0, because of the standard deviation at the extremes, HistID will be forced to equal one or zero respectively. In the models that have Social Pressure Tolerance levels (Chapters Five and Six), the same 0-1 boundary applies.
2. If the difference between HistID1 and HistID2 is ≤ 0.005, then the two HistIDs are considered equal. Similarly, if the difference between an agent's Social Pressure Tolerance levels and the MaxNeighID (the percentage of the highest GroupID among the neighbors) is less than 0.005, the tolerance levels and the social pressure are considered too close to call, and the agent keeps the current GroupID. It is acknowledged that 0.005 is an arbitrary cut-off.

The first definition forces agents to remain between zero and one with their HistID strengths (including zero and one). It is possible, albeit difficult to theorize, that someone could identify with an identity positively and strongly (over 1) or negatively and strongly (under 0). Doing so, however, would take this project in a different direction. This boundary creates more zeros and ones at the extreme HistID values, and therefore, increases the chances that agents will have equal HistID1 and HistID2 in the Supra-Additive model. Logically, however, if two agents have small negative HistID values or values greater than one, they would be very similar in *intensity* anyway. The neutrality definition creates an arbitrary cut-off between very similar numbers between zero and one (including zero and one), and calls them equal. Fieldwork responses include individuals who considered their identities independent and equal, and this neutrality definition makes it mathematically possible.

Table 3.1 Decision Rules in Code.

Explanation	Computer Code
Create and define a local variable to see if the difference between the two HistIDs is so small that the agent would be essentially neutral.	let DiffHistIDCheck 0 set DiffHistID abs (HistID1 - HistID2)
Ask the agent if difference between the two HistIDs is so small they are essentially neutral; sets DiffHistIDCheck to 1 if the agents' HistIDs can be considered neutral (neutrality definition #2).[28]	if (DiffHistID <= 0.005) [set DiffHistIDCheck 1]
If the agent is not neutral and its HistID1 strength is stronger than its HistID2 strength, the agent chooses GroupID1	if (DiffHistIDCheck = 0) and (HistID1 > HistID2) [set NewGroupID1]
If the agent is not neutral and its HistID1 strength is weaker than its HistID2 strength, the agent chooses GroupID2	if (DiffHistIDCheck = 0) and (HistID1 < HistID2) [set NewGroupID2]
If the agent's HistIDs are so close as to be considered neutral or if they are equal, the agent chooses GroupID0 and remains neutral.	if (DiffHistIDCheck = 1) or (HistID1 = HistID2) [set NewGroupID0]

Table 3.1 details the code for decision rules for all agents in both Basic Model versions. The difference between the two versions is how HistID1 and HistID2 are defined. In the Identity Salience model (IdentSal), the concept of identity salience is represented by the *strength* of two dependent identities—HistID1 and HistID2—and how they are calculated. HistID1 is set by drawing from normal distribution with a pre-determined mean and standard deviation and HistID2 is defined by the absolute value of

[28] The code for setting the upper and lower boundaries for HistID1 is:

```
if HistID1 > 1
        [set HistID1 1]
if HistID1 < 0
        [set HistID1 0]
```

This is written right after assignment and before the agents run through their decisions so the initially assigned characteristics are in place before agents make their group choice.

1-HistID1. The two identities equal 100 % of an agent.[29] In the Supra-Additive model (SupraAdd), identity is defined with HistID1 and HistID2 independent from each other. Each HistID is defined by its own mean and standard deviation. Each identity could have a strength equal 100%.

Table 3.2 Example of Agent Group Choices

	Basic Model Version	
	Identity Salience	**Supra-Additive**
	Agent X	Agent Y
Agent Characteristics	GroupID = 0	GroupID = 0
	HistID1 = 0.6	HistID1 = 0.6
	HistID2 = 0.4	HistID2 = 0.8
Final Group Choice	GroupID = 1	GroupID = 2

It will be helpful to illustrate the Basic Model by following group choice decisions for two agents, one according to the Identity Salience decision rules and the other according to the Supra-Additive decision rules. Table 3.2 shows the assigned characteristics for each hypothetical agent. Agent X will make its group decision based upon the Identity Salience definition of HistID1 and HistID2. It starts off with its GroupID = 0, its HistID1 = 0.6, and its HistID2 = |1-HistID1| = 0.4. Following the code in Table 3.1, the DiffHistIDCheck is set to zero because the two HistIDs are not equal. Agent X's HistID1 > HistID2 so its final group choice is GroupID = 1.

Agent Y follows the Supra-Additive definition of HistID1 and HistID2. Its initially assigned characteristics are GroupID = 0, HistID1 = 0.6, and HistID2 = 0.8. Remember that HistID2 is drawn from its own distribution and is considered independent

[29] Each model was further verified by modifying the equation total to .75 or .25. The model was stable across these different totals and presented similar results.

from HistID1. The DiffHistIDCheck is set to zero because the two HistIDs are not equal. Agent Y's HistID1 < HistID2 so its final group choice is GroupID = 2. Neither Agent X nor Agent Y could be considered neutral by any of the definitions and so each chose a different GroupID than their initially assigned GroupID = 0.

The main expectation for the Basic Model is that the two different identity definitions, Identity Salience and Supra-Additive, will yield significantly different totals for each GroupID. These different GroupID totals would then generate different group emergence patterns. GroupID totals and group emergence patterns are examples of aggregate-level differences. Finally, how HistID1 and HistID2 effect group choice at the level of individual agent decisions would be considered significantly different, too.

3.2 Social Pressure

Social pressure, too, was an important factor for group choice. The second and third model versions examine two different ways social pressure exhibited itself in fieldwork. The second model version, the Social Pressure version, just looks at how agent interaction and social pressure from the largest GroupID in an agent's neighborhood might affect group choice. Social pressure to choose a certain group often manifested itself in culturally specific ways, like the social networks in which people traveled with information. *Fiestas*, weddings, birthdays, *barrio* festivals, etc., were central avenues for people to give information, to see who had chosen which group, and to realize how many people were identifying with each group.

These cultural interactions were also opportunities for social punishment. Relatives and friends were not invited to events, were gossiped about around town, and were debated with about their group choices. Most respondents said their actual group decision was made autonomously. However, these decisions were made in a social environment with limited information (most the information available was anti-club) and with visible high stakes for those identified as pro-club (i.e. politician images burned in effigy and thrown out of town, threats to lose job, etc.). The social pressure, whether conscious or not, weighed in favor of being anti-club.[30] Unconscious and environmental effects of social pressure are also important even when an agent agrees with the social pressure from the largest GroupID. The agent's HistID preference may be the same as the largest GroupID, but social pressure is still affecting its decision.

This model version adds to the Basic Model agent movement, social pressure tolerance levels (a random number 0-100% signifying the maximum threshold for an agent to withstand social pressure), and agent knowledge of the group choices for each neighbor to simulate social pressure through networks and interaction. If an agent is able to withstand the social pressure to choose the GroupID chosen by the most neighbors, its group choice is based upon their larger HistID. If an agent cannot withstand social pressure to choose the GroupID chosen by the most neighbors, its group choice is this popular GroupID.

Agents follow the following procedures to begin the model: first, set up world, assign agent attributes (including social pressure tolerance levels), and place agents on board; second, pick a random agent. Once the agent is chosen it then randomly moves to another grid patch according to the code below (Table 3.3).

[30] Social pressure as described here is similar to Olson's small group pressure. However, the big difference is that Olson's small group pressure is to increase participation, not group choice.

Table 3.3 Agent Move Code

Explanation	**Code**
Agent moves right a random number of degrees.	rt random-float 360
Agent moves forward a random number of steps between 0 and 1.[31]	fd random-float 1
Agent asks if any other turtles are at its new chosen location. If not, agent moves; if so, agent repeats process until it finds an empty patch.	if any? Other-turtles-here [move]
Agent moves to the center of the new patch.	setxy pxcor pycor

Once an agent finds a new location, it then begins to determine its group choice. The first step is to consider the group choices of its neighbors.

Agents are all given the ability to consider the four von Neumann neighbors. This attribute is called "vision," and stays constant throughout the model. Illustration 3.2 presents the neighbors within an agent's vision.

Illustration 3.2 Vision of Neighbors

	Neighbor	
Neighbor	AGENT	**Neighbor**
	Neighbor	

Vision represents limited information with which agents make their decisions to join a particular group. Agents are not aware of group choices of any other agents outside of their vision.

Agents first determine which is the GroupID of the largest percentage of its neighbors. The GroupID with the largest percentage exerts the largest social pressure. To do this, agents follow the following procedure:

[31] It is possible for the turtle not to move at all. Also, "turtles using this primitive can move a maximum of one unit per time increment. So fd 0.5 and fd 1 both take one unit of time, but fd 3 takes three" (Wilensky 1999).

1. Count the number of neighbors within field of vision (TotalNeighbors).
2. Determine how many neighbors have chosen each GroupID (IDCounter, one counter for each GroupID).
3. Calculate the percentage of each GroupID (IDCounter/TotalNeighbors).
4. Determine which GroupID has the largest percentage (HighestMaxID).

If there is a tie for HighestMaxID, the neighborhood is considered split but the HighestMaxID is set to the percentage of the tied GroupID. However, no social pressure is exerted for either of the tied groups because there is no clear winner, so agents keep their current GroupID in the end.

Next, the each agent determines which of its own HistIDs is the largest (MaxHistID). This is done the same way as in the Basic Model and includes the same neutrality parameters. Agents are now able to compare their social pressure tolerance (SPTol) levels with the largest GroupID and their larger HistID. Table 3.4 shows the code for determining if an agent can withstand the social pressure from the largest GroupID percentage. If an agent's social pressure tolerance level is less than the percentage of the largest GroupID (HightestMaxID > SPTol), then the agent's new GroupID is automatically the largest GroupID of its neighbors ([set NewGroupID MaxID]).

Table 3.4 Choosing a GroupID in Social Pressure Version

Explanation	**Code**
Tests to see if the % of the highest GroupID among neighbors is below Social Pressure Tolerance threshold (agent does not given in to social pressure).	If (HighestMaxID < SPTol)
If agent has higher tolerance level, the agent's GroupID is determined by pre-existing HistIDs. If the agent's identity strength of HistID1 is greater than HistID2, then the agent's new GroupID = 1.	[if (HistID1 > HistID2) [set NewGroupID1]
If the agent's identity strength of HistID2 is greater than HistID1 (or the difference is so small as to be neutral), then the agent's new GroupID = 2.	if (HistID2 > HistID1) [set NewGroupID2]
If the agent's identity strengths of both HistIDs are the equal, then the Group ID = 0, or neutral.	if (DiffHistIDCheck = 1) or (HistID1 = HistID2) [set NewGroupID0]]

The following example helps elucidate group choice in this Social Pressure version for Agent Z with the following randomly assigned attributes (Supra-Additive assumption): HistID1 = 0.3, HistID2 = 0.8, SPTol = 0.2, GroupID = 0. Agent Z's neighborhood can be described as:

	Neighbor GroupID = 2	
Neighbor GroupID = 0	**AGENT Z**	**Neighbor GroupID = 2**
	Neighbor GroupID = 1	

There are four neighbors total (TotalNeighbors = 4). There are two neighbors (ID2Counter = 2) with GroupID = 2 (HighestMaxID = ID2Counter/TotalNeighbors= 0.5). The other two neighbors have GroupID = 1 (ID1Counter = 1) and GroupID = 0 (ID0Counter = 1); for these, each GroupID percentage is only 0.25. Agent Z then compares the HighestMaxID to its SPTol threshold to determine if it can withstand the social pressure to choose GroupID2. Agent Z's SPTol (0.2) < HighestMaxID (0.5) so it will choose the more popular GroupID, GroupID2. If Agent Z's SPTol had been higher than 0.5, its stronger HistID (HistID2) would have determined its group choice (GroupID2). Finally, an agent whose HistIDs were determined by the Identity Salience definition would go through the same decision rules to determine its group choice. The only difference is in how the two HistIDs are determined.

It is possible for an agent to have its pre-existing identities "agree" with the GroupID advocated by the social pressure. This does not mean that there is no social pressure just for that agent. Again, social pressure exerts itself regardless if the agent agrees with it or not; it is everywhere. Essentially, agreeing with the social pressure is the other side of the coin compared to disagreeing and caving into social pressure.

As the Basic Model becomes more complicated by adding agent movement, social pressure tolerance, and agent interaction, it would be expected that agent group choice would be greatly affected by the identity assumptions between Identity Salience and Supra-Additive. Again, differences in the aggregate outcomes (agent totals for each GroupID and group emergence patterns) would be significantly different. It would be expected that social pressure tolerance levels would significantly influence agent decisions at the individual level differently, too.

3.3 The Buckle Factor

Even though some Tepoztecos wanted to see the club constructed, they did not give in to the extreme social pressure to be against the club. They also paid the price for their steadfastness with family clashes and loss of friends or jobs. Some even had to leave Tepoztlán for their own safety. A few respondents indicated that they thought the club would be an advantage for Tepoztlán's future, but they had to give in to the social pressure for various reasons, so they identified themselves as being against the club publicly. One respondent even participated in protests against the club! Some of the reasons to go against personal beliefs included preserving family and community harmony, maintaining their financial investments, and protecting their personal and family's safety.[32]

[32] Similar reasons were given by respondents who publicly identified themselves as being "neutral" about the club, when in fact they were proponents of it.

These respondents represent another facet to social pressure that does not have to do with simple social pressure tolerance thresholds—ideologues and pragmatists. Even though someone might usually have a stronger tolerance of social pressure, to pragmatists, "giving into" the social pressure made more sense given the personal, social or economic circumstances of the *No al Club de Golf* movement. In contrast, an ideologue might be usually persuadable towards popular opinion, but the beliefs in the benefits of the club (personal or for Tepoztlán) were so strong that one was willing to put oneself at great risk.

The Buckle Factor is one way to symbolize this ideologue/pragmatist trait. The Buckle variable is randomly assigned to all agents and is either present (1) or not present (0). This version of both the Identity Salience and Supra-Additive models builds upon the Social Pressure version. The set-up procedure is the same and only the agent decision rules are modified to include the Buckle Factor. If an agent agrees with its neighbors, whether or not an agent "caves" to social pressure does not matter and the Buckle Factor does not come into effect. The Buckle Factor becomes important to agent decisions only when the agent's social pressure tolerance is lower than percentage of the highest neighbor GroupID *and* the agent disagrees with this largest GroupID. At this point, the ideologue and the pragmatist must make a decision—does the agent maintain its stance against the social pressure or does it buckle to the pressure? The code will be presented first, and then examples of each agent scenario will illustrate the code.

The code is the same as in the Social Pressure version (Table 3.4) up until an agent's social pressure tolerance is smaller than HighestMaxID percentage. That is, once it is determined that an agent can withstand the neighbors' social pressure to choose the largest GroupID, the agent bases its group choice upon its larger HistID preference. However, if the agent cannot withstand the neighbors' social pressure, the agent's group choice must consider its Buckle Factor trait.

Table 3.5 Code for Buckle Trait Version

Explanation	**Code**
If the neighbors' HighestMaxID % is greater than tolerance threshold, the agent gives in to the social pressure and might change her GroupID.	if (HighestMaxID > SPTolerance)
First, check if agent agrees with neighbors: HistID1 is the larger HistID and the only HistID to be taken into consideration in buckle decision	if (MaxHistID1 = 1) and (MaxHistID2 = 0) and (MaxHistID0 = 0)[33]
If the neighbors' MaxID % is equal to the agent's pre-identification % with HistID1, then there is no problem with agreeing with the group.	if (MaxID = MaxHistID1)
Then agent's new GroupID is 1.	[set NewGroupID MaxID]
If the agent disagrees with its neighbors,	if (MaxID != MaxHistID1)
And its Buckle Factor is present, its new GroupID is the neighbors' largest GroupID.	[if Buckle = 1 [set NewGroupID MaxID]
But, if its Buckle Factor is not present, the agent's GroupID is based upon its stronger HistID preference.	if Buckle = 0 [set NewGroupID MaxHistID]
Same process for determining GroupID if agent's larger HistID is HistID2 or the agent is neutral (HistIDs are equal).	Same code except variables change accordingly to reflect HistID2 and neutral HistIDs.
Code change for determining if HistID2 is preferred.	if (MaxHistID1 = 0) and (MaxHistID2 = 2) and (MaxHistID0 = 0)
Code change for determining if HistIDs are equal.	if (MaxHistID1 = 0) and (MaxHistID2 = 0) and (MaxHistID0 = 0)

Table 3.5 provides the agent decision rules which incorporate the Buckle Factor. If the neighbors' largest GroupID percentage is larger than the agent's social pressure tolerance level, then the next step is to see if the agent's larger HistID preference is the same as the neighbors' largest GroupID. If the agent's larger HistID is HistID1, then it proceeds through the code in the Table 3.5. If HistID2 is larger or if the agent's HistIDs

[33] There is no HistID0, but MaxHistID0 is just a way to show and ask if HistID1 and HistID2 are equal and therefore the agent is neutral.

are neutral (equal), then the agent follows similar code for these circumstances. The code for HistID2 and neutral HistIDs is the same process as the code in Table 3.5., but the variables reflect HistID2 or HistID0 when necessary.

Once determining that the agent's larger HistID is HistID1, the agent then checks to see if it agrees with its neighbors. That is, the largest GroupID corresponds with the agent's larger HistID. So if the largest GroupID is GroupID1 and the agent's larger HistID is HistID1, then the agent agrees with the largest GroupID. The agent essentially has no problem switching its GroupID to match its neighbors' largest GroupID. Again, just because an agent agrees with the GroupID advocated by the social pressure, does not mean that there is no social pressure.

However, if the largest GroupID does not correspond with the agent's larger HistID, the agent then must decide if it is an ideologue or pragmatist depending upon its Buckle Factor trait. If the Buckle Trait is present, Buckle = 1, then the agent's new GroupID is the neighbors' largest GroupID; it "gives into" the social pressure to choose the largest GroupID. If the Buckle Trait is not present, Buckle = 0, then the agent remains steadfast to its larger HistID and determines its GroupID accordingly.

Consider Agent W with the following assigned characteristics (Identity Salience assumptions): HistID1 = 0.3, HistID2 = 0.7, SPTol = 0.63, Buckle = 1. Agent W's neighborhood looks like this:

	Neighbor GroupID = 1	
Neighbor GroupID = 0	**AGENT W**	**Neighbor GroupID = 1**
	Neighbor GroupID = 1	

The neighbors' largest GroupID is GroupID1, HighestMaxID = 0.75. Agent W's social pressure tolerance level, SPTol = 0.63. It cannot withstand the social pressure to choose GroupID1. Agent W now must determine if it naturally agrees or disagrees with the largest GroupID depending upon its larger HistID. Its larger HistID is HistID2, which would make Agent W inclined to choose GroupID2. Therefore, Agent W does not agree with its neighbors. It must now decide if it will give into social pressure and be a pragmatist or remain stalwart. Agent W's Buckle = 1, the Buckle Factor is present. This means that Agent W will buckle to the social pressure and its new GroupID becomes that of the neighbors' largest GroupID, GroupID = 1.

The Buckle Factor could effect group choice and group emergence in two seemingly opposite ways. The Buckle Factor might make group formation more difficult or at least slower given the addition of agents who remain steadfast regardless of social pressure levels. That is, the steadfast agent could stop a group cascade (where one group quickly overtakes the grid) if it is in the middle of an emerging (largest) GroupID. In contrast, these agents might also influence other agents' group choices because the steadfast agents will never change their minds regardless of the neighborhood circumstances. This could make group emergence faster if the steadfast agent agrees with the neighborhood's emerging GroupID leading to a cascade.

3.4 Group Emergence

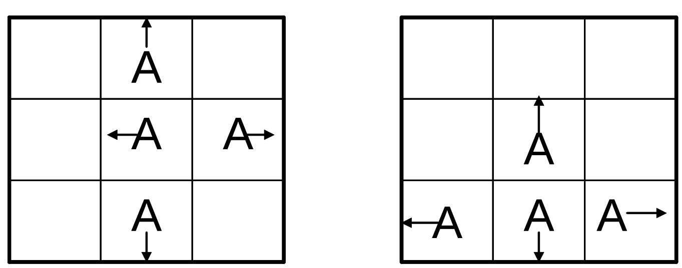
The final aspect to comparing Identity Salience and Supra-Additive assumptions about multiple identities is the identities' affect on group choice and group emergence. In Tepoztlán, group formation emerged as more and more individuals chose one group, increasing the numbers of this group within their social networks. Moving within these networks allowed individuals to perceive numbers for and against the club, and to receive the latest information about the club. Group gatherings like the public assemblies, marches, *barrio* meetings, etc., provided the visual cues to experience the magnitude of those numbers. Moreover, as Chapter Two detailed, after the movement began these cues reinforced Tepozteco pride and the need to save the culture because many cues were cultural events (*El Rey Tepozteco*), common Tepozteco customs (*barrio* competition), or were customs reclaimed in the name of tradition during the social movement (direct democratic elections without political parties). Central to the dynamics of group emergence was the dependence on individuals' interactions within their social networks.

It is important to clarify that this project assumes that group choice and resulting group emergence *does not* directly lead to participation. A common theme in fieldwork interviews was that the most important decision for respondents was their group choice. Their support of the *No al Club de Golf* movement was more vital for personal and social reasons, than their actual participation. Many respondents only participated in one or two events, some in all of the events, and some not at all. However, they could at least publicly declare they were against the club, and so their families and social networks were satisfied.

Participation decisions were separate, secondary to their group choice, and were somewhat dependent upon the effectiveness of the social movement organization *El C.U.T.* In this respect, participation followed standard collective action procedures more closely. However, the groups emerged first, and *then* they were organized for participation. Because field interviews demonstrated so many definitions of “participation,”[34] the question of what citizens mean when they say “they participated” is an interesting one for another venue.

Group emergence occurs after enough agents have identified with one group and are clustered together. On the model grid, several agents may have the same group choice, but they may be isolated from one another or may not be joined together in enough numbers to have a significant influence on the other agents’ decisions. Given the importance of numbers and location, for the sake of this project, groups are defined as four or more conjoined agents (not on the diagonals). A minimum of four agents assures that the group can exert social pressure in all other directions. That is, an agent can influence their neighbors’ GroupID decision. This allows the group to increase in size in any direction as agents randomly move, not biasing the interpretation of the group’s growth to any particular direction. Examples of some of the possible, minimum of 4-agent groups are below (Illustration 3.3).

Illustration 3.3 Possible Group Formations (arrows indicate social pressure direction)



The minimum of four agents does not diminish the potential impact of fewer agents on their neighbors’ decisions, and it has been demonstrated that even one agent can meaningfully influence its environment (Johnson 2002). However, given agents have

[34] Some respondents still considered that they participated in the movement, even though they participated in only a few or no events.

neighborhoods of four, and for visual ease and erring on the side of caution, four agents with the same group choice make a group formation.

3.5 Generality and Extensions of Models

Generalization of the Tepozteco experience would necessitate populations that were either more culturally heterogeneous or populations that were similarly culturally homogenous. Social networks could take on a different role and may be less influential than what occurred during the *No al Club de Golf* movement. These qualitative variations may lead to different dynamics in group choice and group formation. Therefore, diversity in a population's allegiances for pre-existing identities and amount of social pressure is vital for the following these models' portability.

Future experiments would look at the effects from population density, diversity, and environment. However, for the scope of this project, the each model's population diversity will remain limited (standard deviation = 0.2). This low diversity in HistID strength variation best captures Tepoztlán's cultural homogeneity. Extensions can vary this standard deviation to experiment with more diverse populations (populations with more variation in HistIDs and SPTol levels). Population density effects where agents can move. If there are fewer open spaces on the grid, agents will only be able to move to the spaces. In effect, group choices and network information is biased to these open areas and may change the models' overall dynamics.

Other extensions include weighting some individuals' group choices as more "influential" to mimic social power. Individual agents would have more or less influence in determining neighborhood preferences as more powerful members of social groups have in reality. Finally, percentages of the population may reflect certain levels of diversity for each assigned characteristic. For example, 10 % of the agent population would have low variation in HistID strengths, but 90% would have high variation. Moreover, 70% of the population might be assigned strong social pressure tolerance levels, whereas 30% would have weak tolerance levels. These extensions better reflect variations in population make-up and social power that do influence group choice and would make the models more portable to different social and political economic environments.

3.6 Experiments

Experiments in Chapters Four through Six are the same. Each identity variable—HistID1, HistID2, and SPTol—is systematically varied with one another by their means from 0.1 to 1.0 in increments of 0.1. For the Identity Salience model versions, only HistID1 is varied. For the Supra-Additive model versions, both HistID1 and HistID2 are varied. Again, all standard deviations for the means are set at 0.2 for now. These identity variable means set the means (and deviation) for the agents' characteristics for each run.

For example, the Basic Model only varies HistID1 and HistID2 in the Supra-Additive version (Table 3.6). The HistID1 mean—0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, and 1.0—would be varied and combined with the HistID2 mean—0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, and 1.0—making 100 HistID1-HistID2 combinations for 100 runs (one run per combination). When the SPTol mean is added (from 0.1-1.0) in the Social

Pressure and Buckle Factor extensions, there are 1000 HistID1-HistID2-SPTol combinations and a 1000 runs.

Table 3.6 Identity Variables Included and Varied in Each Experiment

Identity Variable	**Basic Model**	**Social Pressure Extension**	**Buckle Factor Extension**
HistID1 (both Identity Salience and Supra-Additive versions)	✔	✔	✔
HistID2 (only Supra-Additive version)	✔	✔	✔
SPTol (both Identity Salience and Supra-Additive versions)	Not Present	✔	✔

Chapter Four examines experiment results for the Basic Model. Only HistID1 and HistID2 means (for the Supra-Additive experiment only) are varied. Chapter Five examines results for the Social Pressure Version. The SPTol mean is added to be varied with HistID1 and HistID2. Finally, in Chapter Six, because the Buckle Factor is pre-assigned to agents as 0 or 1, only the HistID1, HistID2, and SPTol means are varied. Variation of the means for the three identity variables, HistID1, HistID2, and SPTol, provide a way to see how increasing pre-existing identity strengths combined with increasing social pressure tolerance strengths might affect group emergence. Finally, it could be expected that the stronger HistID mean and the stronger SPTol mean would generate more group choices accordingly. A stronger SPTol mean may make up for lower HistID mean strengths. However, as the possible combinations become more complex, group choice predictions are more difficult to visualize, especially in comparing individual decisions to aggregate group formations.

Chapters Four through Six are organized by three hypotheses: H_1, agent totals for each GroupID are different between the Identity Salience and Supra-Additive models; H_2, group emergence patterns and totals of groups formed are different between the two models; and, H_3, predicted probabilities of group choice for each GroupID are different between the two models. These hypotheses consider both aggregate and individual level data. In a complex adaptive systems approach, it is not assumed that both aggregate and individual level dynamics are the same.

Chapter Four

Basic Model

Using the Basic Model presented in Chapter Three, this chapter examines possible differences in group emergence and individual decision dynamics between the two conceptualizations of multiple identities, Identity Salience and Supra-Additive. The Identity Salience approach to multiple identities views all identities as ordinally ranked, summing to 100% of a person's overall identity, and no one identity can have the same salience as another (only one is used at a time). The Supra-Additive approach views multiple identities as interacting simultaneously, though each identity independently influences a person's overall identity at the same time. However, most of the literature experimenting with multiple identities utilizes Identity Salience assumptions (Stryker 1980; Stryker 2000a; Stryker 2000b). There are several theories about a Supra-Additive approach (mostly in feminist and race literatures), but only theories (Collins 1986; Collins 1991).

During fieldwork, most respondents opted to rank their identities with a Supra-Additive approach, with independent identities influencing their group decisions. As demonstrated in Chapter Two, fieldwork interviews expressed the importance of pre-existing identities in determining peoples' group choices as being for, against, or remaining neutral about the golf club. How people felt about the club depended on how they connected the club's impact on Tepoztlán's culture, environment, economics, and politics. Their Tepozteco identity in relation to other social and personal identities influenced their interpretation of the effects of the club on the town. These ramifications were categorized by how strongly people felt general development would effect their Tepozteco culture. If they strongly identified as Tepozteco and with Tepozteco history, the club would be only a negative event for the town and municipality. If their other identities were stronger than their Tepozteco identity, most respondents supported the club. If respondents lived in Tepoztlán but were not Tepozteco, they tended to be ambivalent about the club's consequences and had a difficult time deciding to which group to belong.

The dynamics of group formation and group choice for each model version will be studied to see if it matters how multiple identities are defined. To begin assessing the methodological assumptions about each multiple identity approach, agent totals per GroupID are compared; group emergence is studied by analyzing emergence patterns and the total number of groups formed; and multinomial logistic regressions are used to calculate predicted probabilities of group choice and to assess how each variable influences the dynamics of individual agents' decisions.

Within Chapters Four through Six, the same hypotheses will be considered for each version of the Identity Salience and Supra-Additive models:

H_1: Agent totals for GroupID1, GroupID2, and GroupID0 will not be equal between the two models.

- GroupID totals at the end of each model run will be compared across HistID means for each model.
- Chi-square analysis is used to determine if the totals are statistically different.

H_2: Aggregate group emergence patterns and group totals will differ across comparable HistID mean combinations between the two models.

- Group existence and patterns will be descriptively compared across HistID means for each model.
- Group totals will be counted across comparable HistID mean combinations and a t-test will be used to determine if the group total differences are statistically significant.

H_3: Predicted probabilities of group choice will be different across comparable HistID mean combinations between the two models.

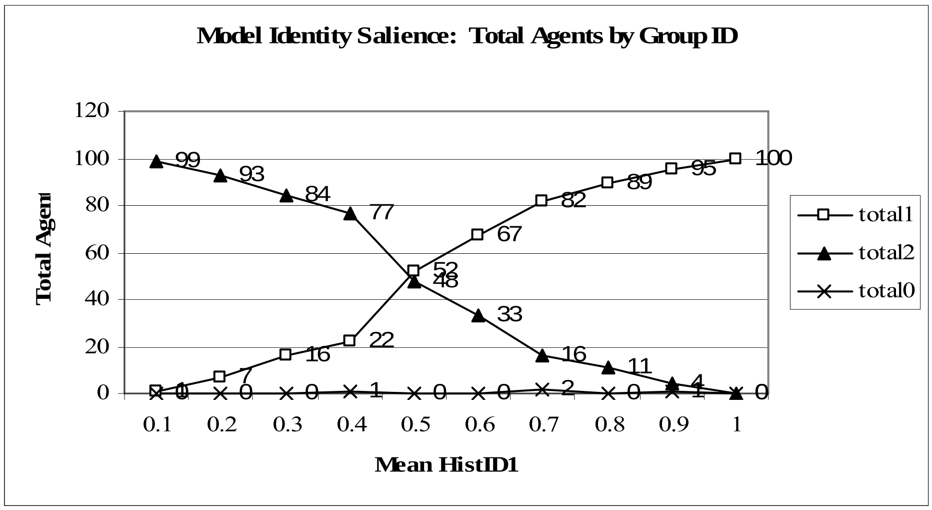
- Predicted probability means for each GroupID will be compared using a two-proportion z-test

Each chapter will be organized by these hypotheses and tests.

4.1 Agent Totals by GroupID: Identity Salience Model

To begin to assess aggregate dynamics, agent totals per GroupID will be analyzed first in the Identity Salience model, second in the Supra-Additive model, and then each model's results will be compared. Again, the Identity Salience model replicates the ranked definition of multiple identities, where HistID1 (the strength with which one identifies with the historical identity "one") is defined with a mean (0.1-1.0) and standard deviation (0.2) and HistID2 = (1-HistID1). HistID2 is the strength with which one identifies with the historical identity "two." In the Supra-Additive model, each HistID is independent and has its own mean and standard deviation. What is expected from this analysis given the different definitions of multiple identities is that the agent totals will be different between the two models, H_1: Agent totals for GroupID1, GroupID2, and GroupID0 will not be equal between the two models. GroupID1 is the group that is formed by agents that identify with HistID1, GroupID2 is the group that is formed by agents that identify with HistID2, and GroupID0 is the group that is formed by agents that have remained neutral about both HistID1 and HistID2.

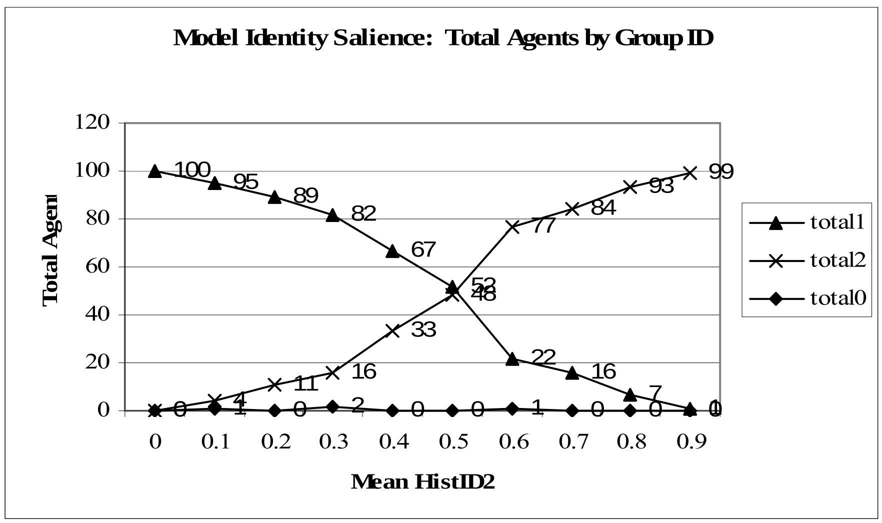
Graph 4.1 Identity Salience Agent Totals for HistID1



In Graph 4.1, the total agents choosing Group ID 1 increases as the mean of HistID1 increases. The total number of agents choosing Group ID 2 decreases as the mean of HistID1 increases. Because HistID2 is defined as dependent on HistID1, these totals logically would be opposite of one another. Graph 4.2 demonstrates the trends in the total number of agents per Group ID according to HistID2. For the Identity Salience model, as the strength of the agents' identification with HistID1 becomes stronger, the agents choose Group ID 1. Similarly, as agents' affinity for HistID1 becomes stronger, fewer choose Group ID2. That is, because HistID2 is defined as (1-HistID1), when HistID1 is low, HistID2 will be high, indicating a stronger affinity for Group 2.

Graph 4.2 also indicates the total number of agents who remain neutral by choosing GroupID0. The numbers are so low and there are so few instances of neutral agents that the GroupID0 agents that do exist cannot be ruled out as decisions influenced by the random HistID assignments. The agents that have GroupID0 for this experiment have HistIDs that are equal (one or zero) or have differences between the two HistIDs so close they are essentially neutral (i.e. the neutrality definition) .

Graph 4.2 Identity Salience Agent Totals, HistID2

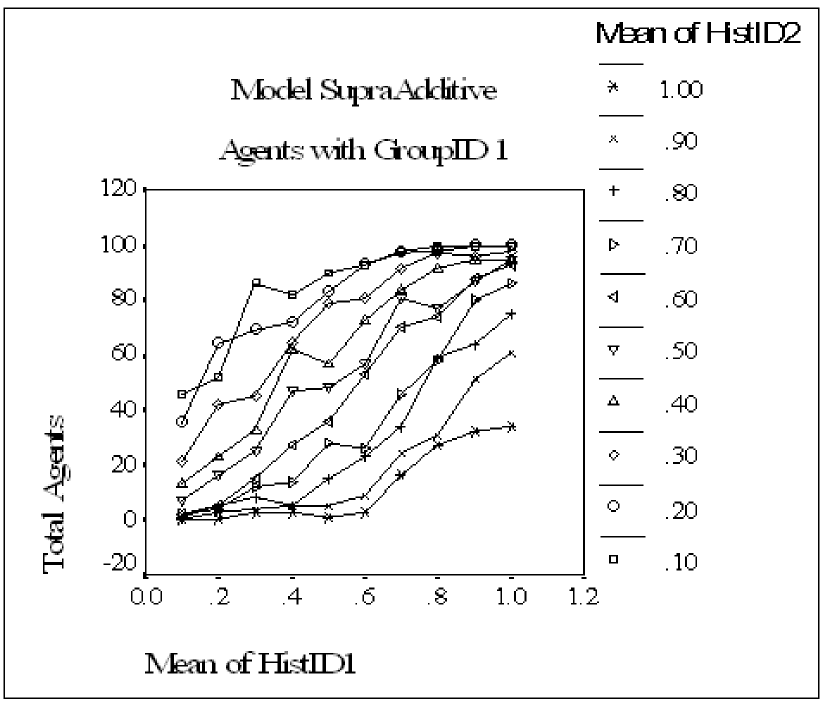


The agent totals for each GroupID for the Identity Salience model follow logical expectations given that the HistIDs are dependent on one another. As the intensity of identification toward one HistID increases, the intensity toward the other decreases. The very low numbers of neutral agents indicate that their exact equality (both HistIDs equaled 0.5) was from the random assignment of agent attributes and that having neutral agents at this point in model construction is difficult.

4.2 Agent Totals by GroupID: Supra-Additive Model

Next, the results from the Supra-Additive model will be examined. This model reproduces the alternative definition of multiple identities—that identities within one person can be independent of one another and simultaneously felt as strong. They are not ordinally ranked. Each HistID is separately drawn from its own mean and standard deviation, whereas in the Identity Salience model, HistID2 was defined by the mean and standard deviation of HistID1.

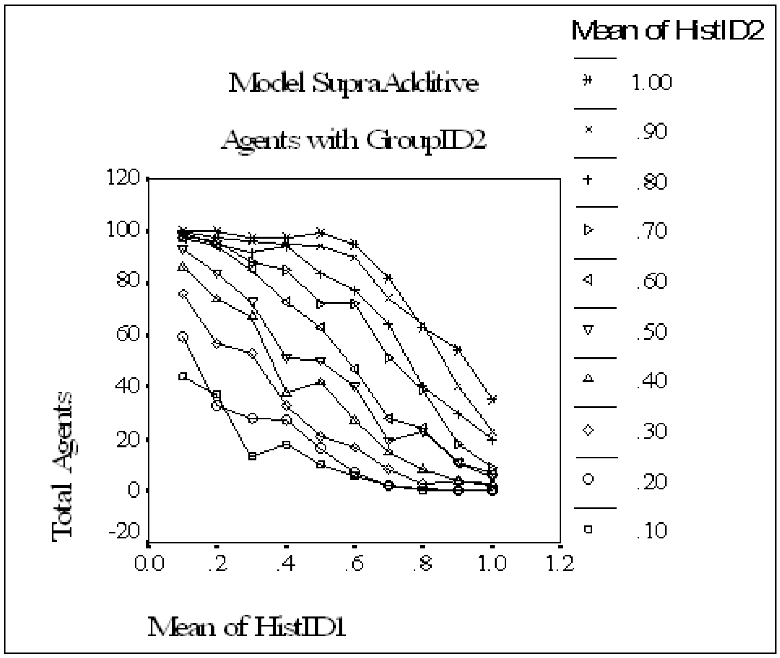
Graph 4.3 Supra-Additive Agent Totals with GroupID1



Graph 4.3 illustrates the agent totals of Group ID1 for the averages of HistID1 and HistID2. Overall, agent totals increase as HistID1 increases and HistID2 decreases.

Each HistID1 and HistID2 combination results in higher totals when the HistID1 averages increase and HistID2 averages decrease.

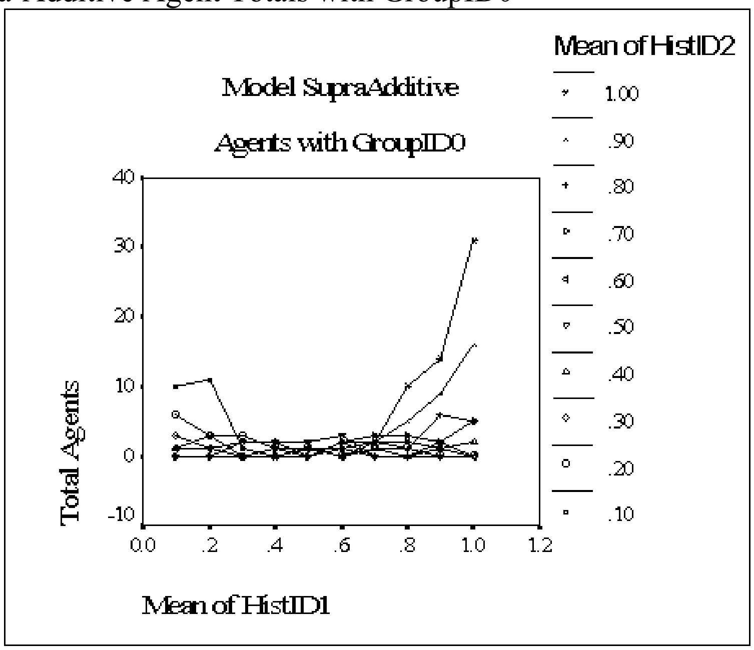
Graph 4.4 Supra-Additive Agent Totals with GroupID2



The opposite is true when we look at the agent totals for Group ID2 (Graph 4.4). Overall, the totals are decreasing. As the mean of HistID1 increases and the mean of HistID2 increases, the agent totals do decrease. However, the highest Group ID2 totals result from the mean combination of a high HistID2 and a low HistID1. As the mean of HistID2 decreases and the mean of HistID1 increases, fewer agents choose Group ID2.

Substantively, when HistID1 and HistID2 are either high or low, this combination results in lower Group ID totals, but there are still many agents with GroupID1 or Group ID2 respectively. For instance, a population with very low affinity for both HistID1 and HistID2 (like HistID strength with a mean of 0.2 for each) can still produce Group IDs for almost half of the total population. The same is true for agents with very strong allegiance to both identities. This opportunity for agents with low HistIDs is important because the resulting agent totals may lead to group formation.

Graph 4.5 Supra-Additive Agent Totals with GroupID0



With respect to the possibility of neutral agents, the Supra-Additive model provides important differences. Graph 4.5 indicates that the agents at the extremes—where the agents have either both low ID means or both high ID means—yield many more neutral agents than in the Identity Salience models. There are two opportunities (two HistIDs) that are influenced by the upper and lower bounds and the neutrality definition. The upper and lower boundaries are more apparent in this model than in the Identity Salience model: if agents' identities are less than zero or more than one, they are essentially zero and one. The neutrality definition is also important: if agents' two identities are so close as to be in essence equal, then their identities are treated as equal.

The possibility of having an increased number of neutral agents seems more realistic and is reflected in fieldwork. People who feel strongly about both identities may choose to opt out of deciding about choosing a group. Defining HistID1 and HistID2 as independent variables provides the *opportunity* for agents to be neutral, whereas when the two identities are dependent upon one another, neutrality is not possible (only if under the rare occurrence that the two identities numerically are equal). Again, neutrality implies that one feels ambivalent about the issue, whether strong or weak, and therefore, cannot decide with which group one identifies.

4.3 Agent Totals by GroupID: Model Comparison

Agent totals for each GroupID for the Identity Salience and Supra-Additive models are compared to verify H_1. Focusing upon only low (0.2), medium (0.6), and high (0.9) mean combinations[35], the HistID1 means used in comparing the two models are:

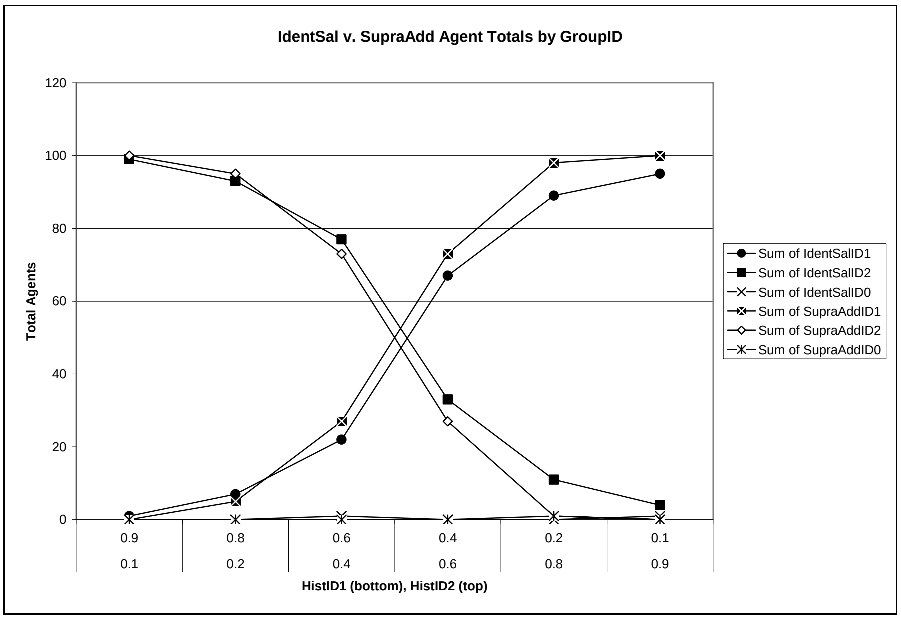
Table 4.1 HistID Mean Combinations for Inter-model Comparison

HistID1	HistID2
0.2	0.8
0.6	0.4
0.9	0.1
0.8	**0.2**
0.4	**0.6**
0.1	**0.9**

[35] These mean combinations have been chosen for ease of comparison, especially because of the number of potential variable combinations that result when the social pressure tolerance mean is added in the next chapter. These fewer means are used for comparison throughout the chapters.

It is important to note that the Supra-Additive model has more possible HistID combinations since the two means are independent. However, they could not be used for lack of comparability with the Identity Salience model (where HistID2 is defined by HistID1).

Graph 4.6 Agent Totals by GroupID, both Models



Graph 4.6 above shows that the GroupID totals for each model are very similar. They have similar trends for each HistID1 and HistID2 mean combination. However, differences in totals between the two models do increase as the HistID1 mean increases. To test H_1 and determine if the differences between the agent totals for each GroupID in the Identity Salience and Supra-Additive models are statistically significant, chi-squares are calculated for each HistID mean combination (Table 4.2).

Table 4.2 Chi-Square Results for Agent Totals

		IdentSal			**SupraAdd**					
HistID1	**HistID2**	**GrpID1**	**GrpID2**	**GrpID0**	**GrpID1**	**GrpID2**	**GrpID0**	**Chi-Square**	**df**	**p-value**
0.2	0.8	7	93	0	5	95	0	0.552	1	0.4577
0.6	0.4	67	33	0	73	27	0	0.355	1	0.5516
0.9	0.1	95	4	1	100	0	0	0.077	2	0.9622
0.8	**0.2**	89	11	0	98	1	1	0.008	2	0.9962
0.4	**0.6**	22	77	1	27	73	0	0.446	2	0.8003
0.1	**0.9**	1	99	0	0	100	0	0.316	1	0.574

For all of the chi-squares and subsequent p-values, none of the agent total differences are statistically significant. The GroupID totals between the Identity Salience and Supra-Additive models for these mean combinations are not significantly different. H_1 is rejected. This comparison goes against initially held predictions that the two different approaches to multiple identities—Identity Salience and Supra-Additive assumptions—would produce different outcomes with respect to agent GroupID totals.

4.4 Group Emergence: Identity Salience Model

Next, we will examine how group totals affect group emergence. The purpose of this section is to gauge when group formation is possible given the appropriate pre-existing HistID traits. The following hypothesis and subsequent tests about group emergence are:

H_2: Aggregate group emergence patterns and group totals will differ across comparable HistID mean combinations between the two models.

- Group existence and patterns will be descriptively compared across HistID means for each model.
- Group totals will be counted across comparable HistID mean combinations and a t-test will be used to determine if the group total differences are statistically significant.

Finally, it is again not assumed that group emergence leads to participation. Group formation precedes participation and the politicization of the groups is dependent upon other collective action factors.

Obviously, more agents of one Group ID increase the possibility of creating the four-neighbor definition of a group. Technically, the minimum number of agents needed with the same Group ID to form a group would be four, but in this experiment they would need to be precisely, though randomly, placed on the grid already in that group formation because there is no agent movement. Therefore, it would be expected that group emergence might be difficult to achieve without agent interaction. These agents might be next to each other, but what is missing is the inter-connectedness of "groupness"—perhaps a local-level collective identity for lack of a better term. However, this experiment would indicate that even based on individual decisions alone, like-minded people can emerge next to one another. Becoming a "group" is a process of interaction and acknowledgment that they have a common goal.

For the ease of presentation, the means of HistID1 will be broken down into three categories again: low (HistID1 = 0.2), medium (HistID1 = 0.6), and high (HistID1 = 0.9). It is also substantively more meaningful to say someone has a strong identification with a particular identity, rather than 0.9 strength of identification. First, the group emergence patterns for each model will be explored. Next, the difference in group totals between the two models will be compared to determine if the Identity Salience model yields significantly different results as the Supra-Additive model.

Illustration 4.1 Group Emergence, Identity Salience Model

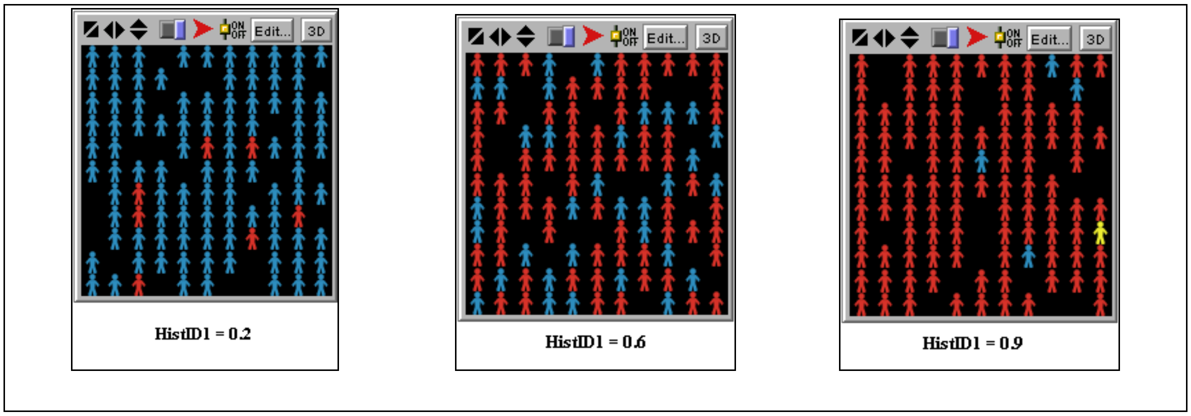


Illustration 4.1 provides the world outputs for each corresponding low, medium, and high HistID1 runs from the Identity Salience model. The red agents are Group ID = 1, the blue agents are Group ID = 2, and the yellow agents are Group ID = 0. The corresponding (dependently defined) HistID2 means are 0.8, 0.4, and 0.1 and are implicit in the emergence output.

Initial descriptive analysis shows that even with a low affinity (low mean = 0.2) for HistID1, enough individuals exist to make GroupID1 emergence possible. However, the great number of agents with GroupID2 makes it difficult for the few GroupID1 agents to be located within the same neighborhood. In a real case scenario, these individuals would need to be able to seek each other out to organize into a group. That is, social interaction is vital for group emergence when the population has on average a low affinity for a relevant HistID.[36]

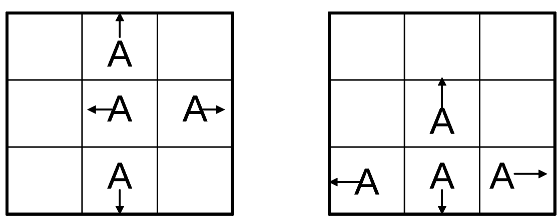
When the mean of HistID1 is set to 0.6, the transition has already been made to having the majority of the agents choosing GroupID1 (past the inflection point as seen in Graph 4.1). Notice that even though there are many blue, GroupID2 agents, there is

[36] Again, agents do not move in this model because social interaction is not necessary for their decisions yet. Agent movement and interaction with neighbors are introduced in Chapter Five.

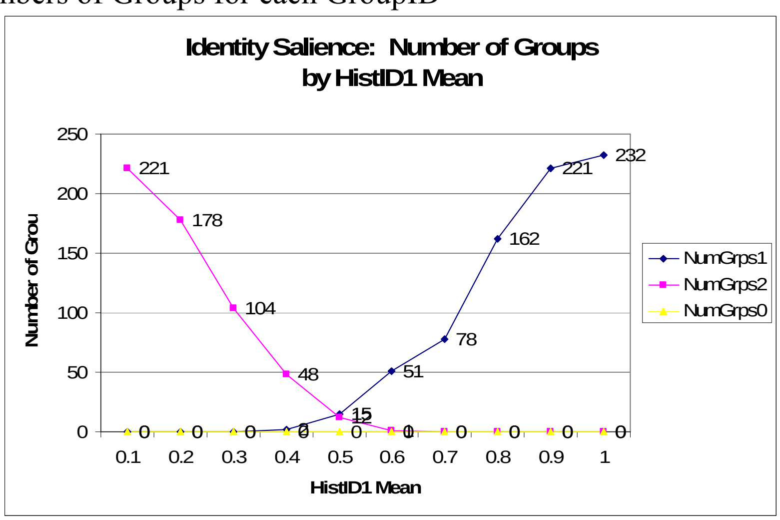
actually only one group. Because of the numbers of agents with the same GroupID, the opportunity for group formation increases. With a high mean of 0.9, the majority of agents choose GroupID1, increasing the number of four-neighbor groups. Again, there are enough GroupID2 agents, but they are not located next to one another to form a group.

Next, group formation will be considered. Again, a "group" is defined as four conjoined agents so that in the models after the Basic Model agents would be able to exert social pressure (influence a neighbor's group choice) at a minimum in all directions. Illustration 4.2 provides examples of possible groups and Graph 4.7 shows how the number of groups for each GroupID varies as the HistID1 mean increases.

Illustration 4.2 Examples of "Group" Definition



Graph 4.7 Numbers of Groups for each GroupID



As the identity strength towards HistID1 increases, the number of GroupID1 group formations also increases. Two groups emerge when the HistID1 mean = 0.4, however, groups really begin to form once the HistID1 mean = 0.5. As with the group agent totals, there are slight diminishing returns when the HistID1 mean is very strong. This implies that there is little difference in group emergence when identifying with the HistID1 at 0.9 versus 1.0. However, there is a big difference between the number of groups when the HistID1 mean = 0.8 (n = 162) versus when the HistID1 mean = 0.9 (n = 221). Therefore, with the exception of HistID1 mean = 0.9 and 1.0, having stronger identification with HistID1 does help GroupID1 emergence.

The number of GroupID2 groups decrease as the HistID2 mean increases. This corresponds with the decrease in overall agents choosing GroupID2. The number of GroupID2 groups is at its highest when the HistID1 mean is low and identification with HistID2 is strong. By the time the HistID1 mean reaches 0.6, there are no GroupID2 groups. Some agents may still choose GroupID2, but there are not enough or they are not located next to each other so that they can form a group.

Finally, there are no GroupID0 groups for any mean value of HistID1. This mirrors the fact that most of the time in the Basic Model of the Identity Salience version, there will be a higher HistID with an agent choosing either HistID1 or HistID2. On the rarer occasion that an agent has equal HistIDs, its group choice would be GroupID0. However, there are too few agents, if at all, to form even one group.

Another phenomenon seen in group emergence patterns is when HistID1 and HistID2 are equal, in this model at 0.5. Either GroupID1 or GroupID2 could become the majority GroupID depending upon the initially assigned agent characteristics. Illustration

4.3 and 4.4 show the possibility of either GroupID becoming the majority GroupID. The model also hits an equilibrium point regardless of HistID combination.

Illustration 4.3 GroupID1 Majority

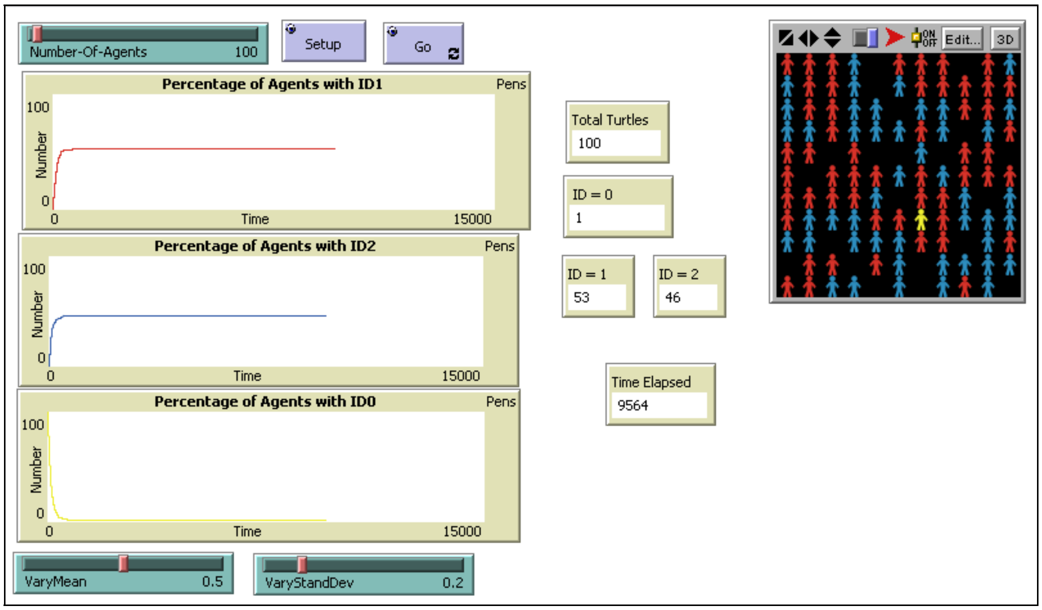
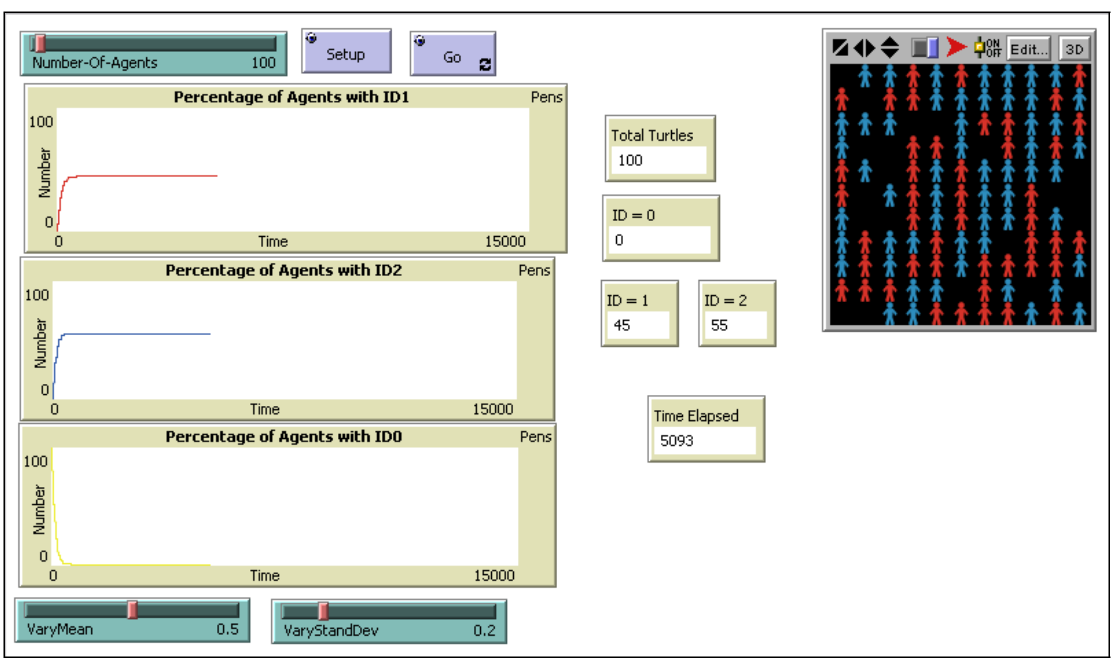


Illustration 4.4 GroupID2 Majority



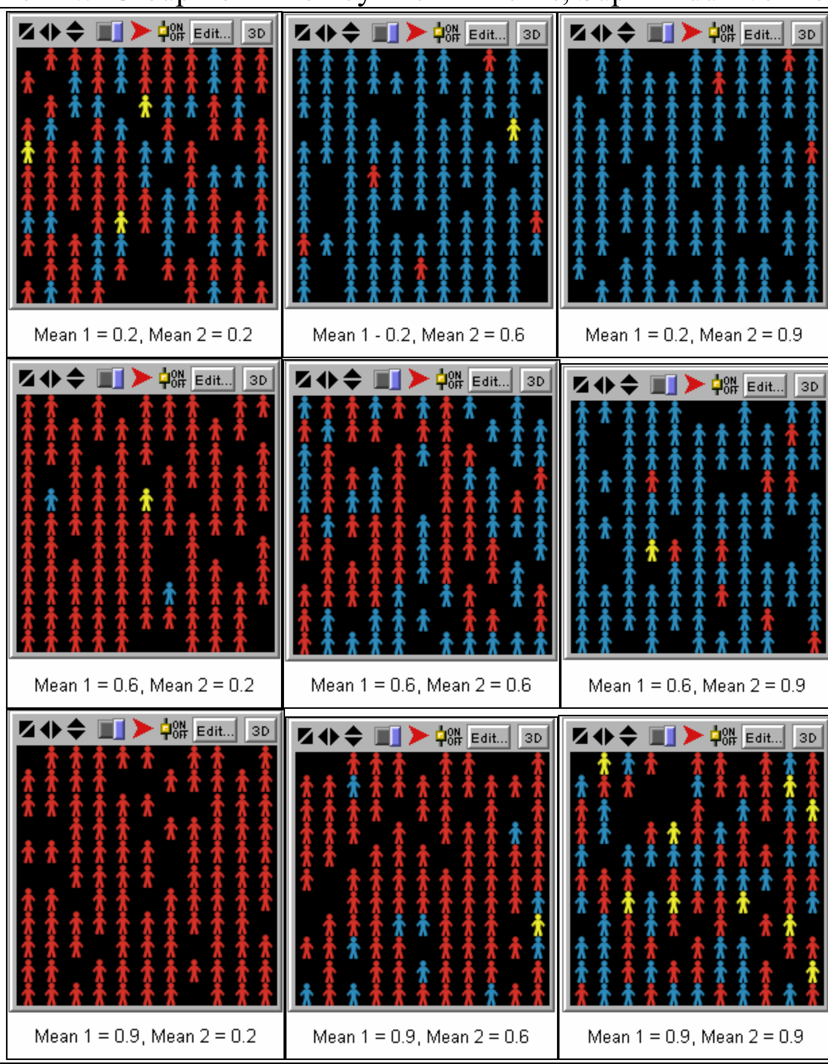
The emergence of groups in the Identity Salience model directly follows the influence of the agents' pre-existing identities. Group formation necessitates enough agents of the same Group ID type to be able to form the groups of four. In this experiment, the agents' locations are randomly chosen, and they do not move around the grid to interact with other agents. Again, in order for groups to form, the agents have to be in the right location and have their HistID1 or HistID2 strong enough to generate the number of agents required. The only variation in group emergence occurs when HistID1 is 0.5 and either GroupID1 or GroupID2 could become the majority GroupID depending upon the initial conditions of the model.

4.5 Group Emergence: Supra-Additive Model

Next, the dynamics of group emergence for the Supra-Additive model will be considered. Illustration 4.5 displays the possibilities for group formation given the various combinations of low, medium, and high means for HistID1 and HistID2. The greater the difference between the two HistIDs, the more prevalent the stronger HistID's GroupID will be. This prevalence can then translate into agent totals and group formations. For example, the combinations of HistID1 = 0.6//HistID2 = 0.2 and HistID1 = 0.9//HistID2 = 0.2 generate the majority of agents choosing GroupID1. The difference between these two means is the greatest. The case where HistID1 = 0.9 and HistID2 = 0.6 still yields more agents with GroupID1, but there are more agents with GroupID2. The difference between the two means is less and so the population's GroupID choices and the number of group formations reflect this.

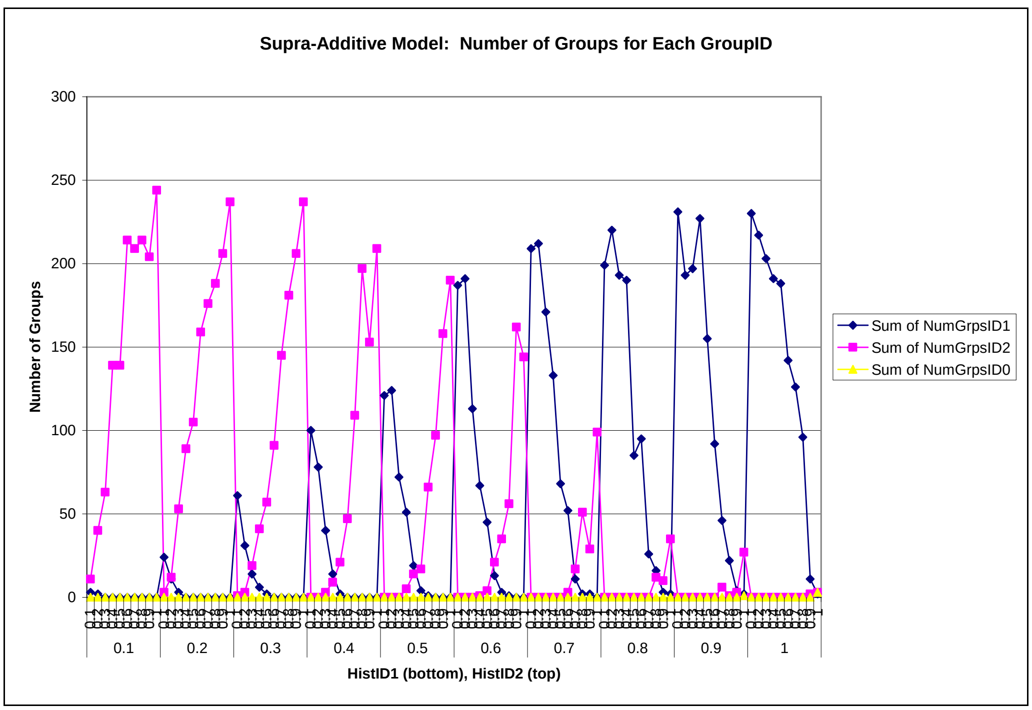
Similarly, the cases where HistID1 = 0.2// HistID2 = 0.6 and HistID1 = 0.2// HistID2 = 0.9 have the majority of agents choosing Group ID 2. The case where HistID1 = 0.6 and HistID2 = 0.9 still has the majority agents choosing GroupID2, but there is an increase of agents with GroupID1. This basic premise of "the stronger HistID wins" holds true for the Identity Salience model, too, as the decision rules dictate. The possibility of group formation is strikingly different for each HistID. The stronger HistID produces more agents with that identity, and therefore, more four-agent groups form.

Illustration 4.5 Group Formation by HistID Means, Supra-Additive Model



Next, the number of groups formed for each GroupID are calculated to see how the HistID1 and HistID2 means affect emergence. Graph 4.8 shows the number of groups as HistID1 and HistID2 vary. The overall trends are similar to the number of groups in the Identity Salience model version. The number of GroupID1 groups increase as HistID1 increases and the number of GroupID2 groups decrease as the HistID1 mean increases. Conversely, the number of GroupID2 groups increase as HistID2 increases and the number of GroupID1 groups decrease as the HistID1 mean decreases.

Graph 4.8 Number of Groups by GroupID, Supra-Additive Model



Both GroupID1 and GroupID2 flourish when the HistID means are of medium values, though the total number of groups is lower than the higher extremes for both HistIDs. That is, high HistID1 and HistID2 values generate more groups, but only

GroupID1 or GroupID2 groups respectively. When the strength of identification is located within this middle ground both GroupIDs are able to form groups. Finally, no GroupID0 groups are able to form. Under the rare circumstances that an agent has equal HistIDs, there are simply not enough agents to form a group. The majority of the time, there will always be one HistID that is stronger and in this Basic Model, agents choose that higher HistID.

Another similarity to the Identity Salience model is the balance of the population groups as the difference between HistID1 and HistID2 decreases. The population becomes split with comparable numbers for each Group ID. With respect to group emergence, the numerically close HistID strengths create similar numbers of four-agent group formations. One difference between the Identity Salience model and the Supra-Additive model again is the possibility of neutral agents. As the means of HistID1 and HistID2 become closer, the chance of having neutral agents increases.

Illustration 4.6 GroupID1 Majority

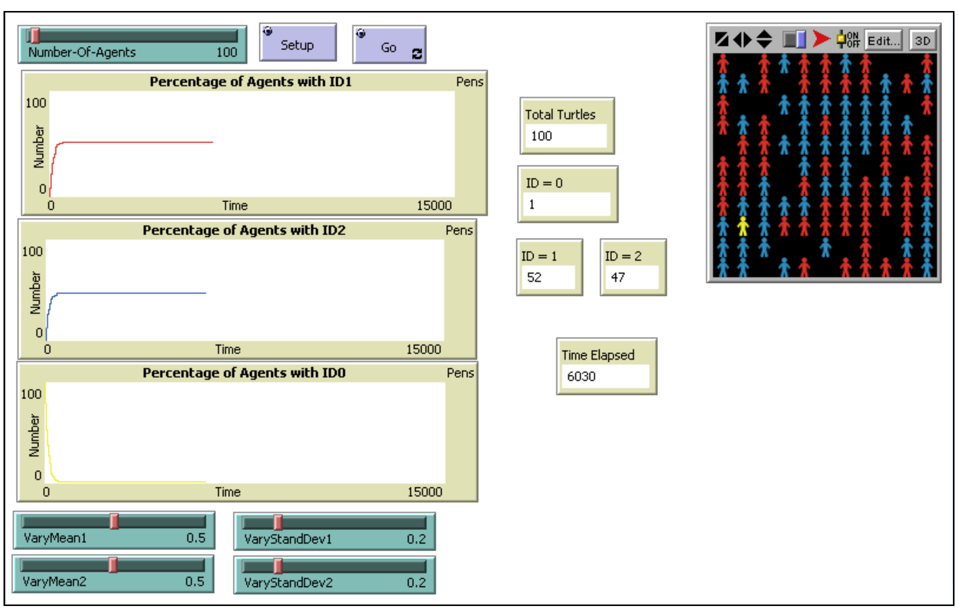
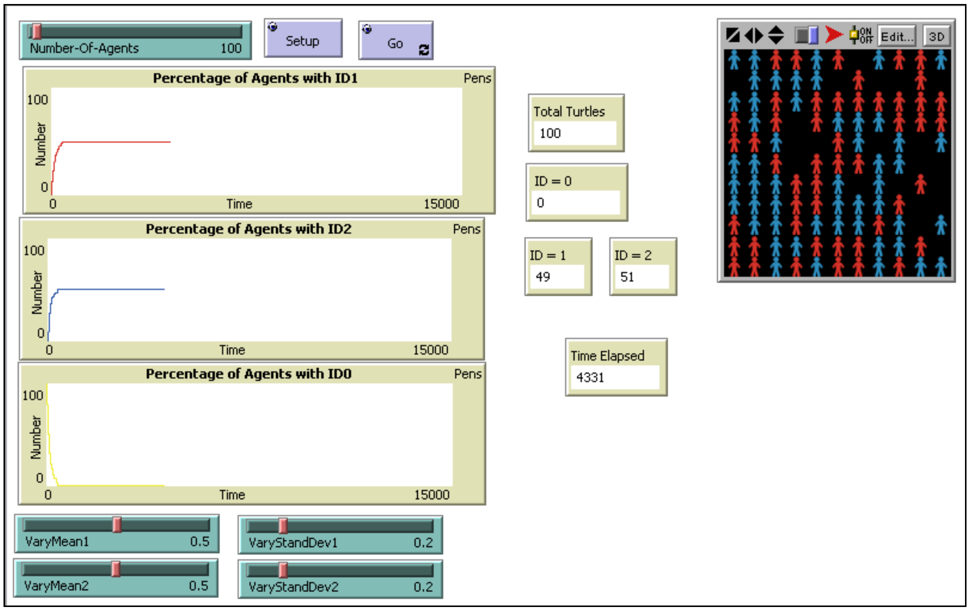


Illustration 4.7 GroupID2 Majority



Group emergence in the Supra-Additive model is also sensitive to initially assigned agent characteristics when HistID1 and HistID2 are equal. Either GroupID1 or GroupID2 could become the majority GroupID. Illustrations 4.6 and 4.7 show both possibilities. However, this phenomenon only occurs when HistID1 and HistID are equal (for any mean combination, not just 0.5). Once there is one stronger HistID, it always becomes the majority GroupID.

4.6 Group Emergence: Model Comparison

Now group emergence in the Identity Salience and Supra-Additive models will be compared to see if these identity assumptions lead to statistically different results. The hypothesis for group emergence is:

H_2: Aggregate group emergence patterns will differ across comparable HistID mean combinations between the two models.

- Group existence and patterns will be descriptively compared across HistID means for each model.
- Group totals will be counted across comparable HistID mean combinations and t-test analysis will be used to determine if the group total differences are statistically significant.

The following low/medium/high HistID1 mean combinations will be considered for each model: HistID1 = 0.2, HistID2 = 0.8; HistID1 = 0.6, HistID= 0.4; HistID1 = 0.9, HistID2 = 0.1. In the Identity Salience model, the corresponding HistID2 mean is implied because of its dependent definition on HistID1. However, in the Supra-Additive model, the HistID2 mean is independent.

Illustration 4.8 Group Emergence Patterns, Identity Salience

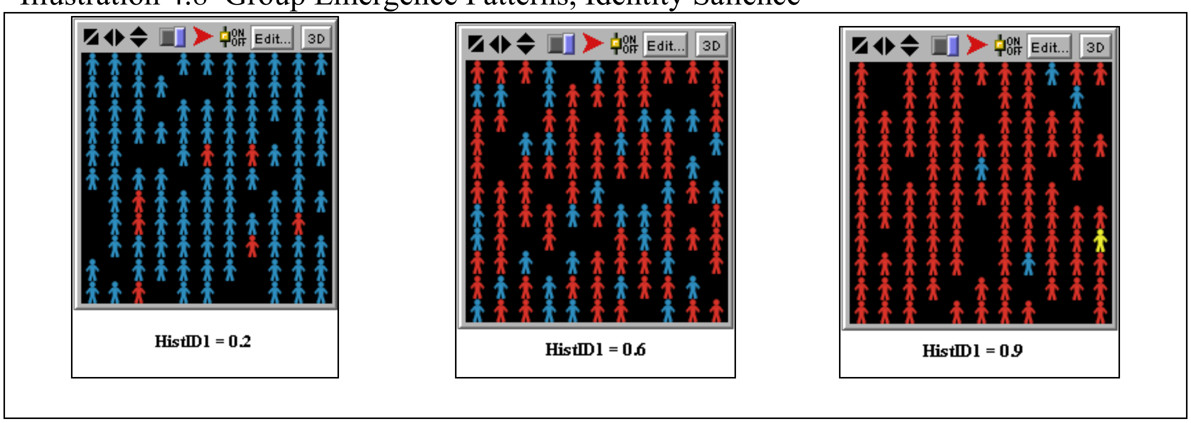
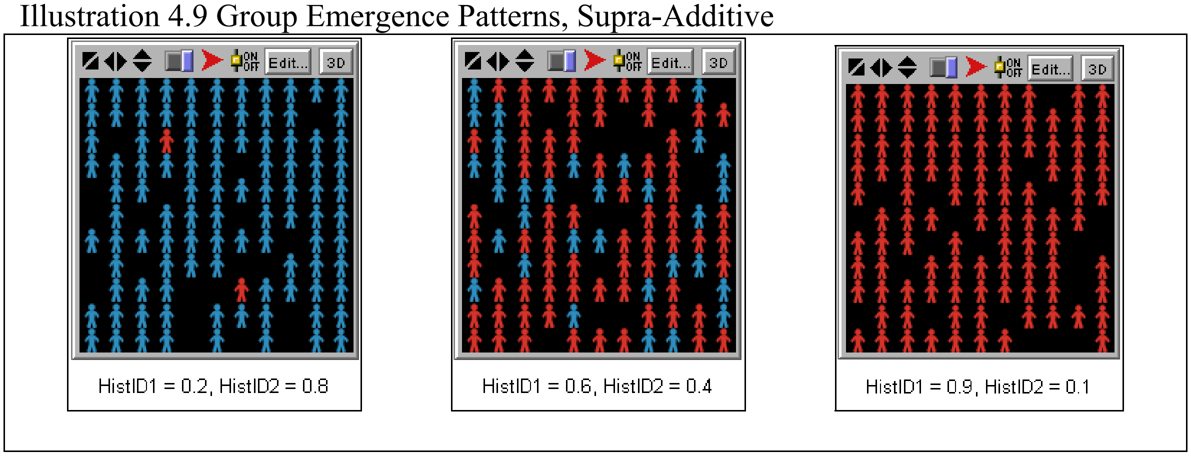


Illustration 4.9 Group Emergence Patterns, Supra-Additive



The emergence patterns shown in Illustrations 4.8 and 4.9 are descriptively very similar. When the HistID1 mean is low, the blue, GroupID2 agents dominate. The HistID2 mean is higher and agents therefore choose GroupID2. There are a few red, GroupID1 agents whose HistID1 mean is higher than their HistID2 mean, but there are not enough of these agents to form groups.

When the HistID1 mean is 0.6 and the HistID2 mean is 0.4, both GroupID1 and GroupID2 agents are able to form groups, but there are slightly more GroupID1 agents because the HistID1 mean is larger. It is important to note that where the blue, GroupID2 agents are located is randomly determined by agent movement and not by agent interaction. Groups formed in this model are not form from agent interaction.

Finally, when the HistID1 mean is high, the red, GroupID1 agents dominate. The HistID2 mean is only 0.1. If there are any GroupID2 agents (again mean values are randomly assigned), there are not enough to form groups. There is also the possibility to have agents who remain neutral (i.e. the one yellow agent in Illustration 4.x when HistID1 = 0.9). These agents' HistID1 and HistID2 have been randomly assigned as equal. There are too few to have any impact on group emergence, however. Overall, descriptively there are no differences between the two models' group emergence patterns.

Next, the number of groups generated from the Identity Salience and Supra-Additive models will be considered and compared with a t-test. Previous Graphs 4.7 and 4.8 show the number of groups for each model version as the HistID1 and HistID2 means vary. The following group numbers for each GroupID are compared for all HistID mean variations in each model:

Table 4.3 Formed Groups Totals, Supra-Additive

HistID1	HistID2	GroupID1	GroupID2	GroupID0
0.1	0.9	0	204	0
0.2	0.8	0	188	0
0.3	0.7	0	145	0
0.4	0.6	0	47	0
0.5	0.5	19	14	0
0.6	0.4	67	1	0
0.7	0.3	171	0	0
0.8	0.2	220	0	0
0.9	0.1	231	0	0

Table 4.4 Formed Groups Totals, Identity Salience

HistID1	HistID2	GroupID1	GroupID2	GroupID0
0.1	0.9	0	221	0
0.2	0.8	0	178	0
0.3	0.7	0	104	0
0.4	0.6	2	48	0
0.5	0.5	15	12	0
0.6	0.4	51	1	0
0.7	0.3	78	0	0
0.8	0.2	162	0	0
0.9	0.1	221	0	0

Using a two sample t-test with equal variances, the totals for each GroupID are compared to determine if the number of groups generated by the Identity Salience and the Supra-Additive models are statistically different. No t-test is conducted for GroupID0 because both models have no GroupID0 groups and are therefore not different. Tables 4.5 and 4.6 below provide the t-test results comparing GroupID1 and GroupID2 group numbers from the Identity Salience and Supra-Additive models. The t-statistic for both GroupID1 and GroupID2 is not significant. The Identity Salience and Supra-Additive assumptions do not generate significantly different group numbers for GroupID1, GroupID2, and GroupID0.

Table 4.5 T-Test for IdentSal v. Supra-Add, GroupID1

Two-sample t test with equal variances

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
Supra-Add GrpsID1	9	78.67	33.37	100.10	1.72	155.61
IdentSal GrpsID1	9	58.78	27.11	81.32	-3.73	121.29
combined	18	68.72	20.99	89.06	24.43	113.01
diff		19.89	42.99		-71.24	111.02

t = 0.4626 **p = 0.650**
Ho: diff = 0 **degrees of freedom = 16**

Table 4.6 T-Test for IdentSal v. Supra-Add, GroupID2

Two-sample t test with equal variances

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
Supra-Add GrpsID2	9	66.56	28.99	86.98	-0.30	133.41
IdentSal GrpsID2	9	62.67	28.49	85.47	-3.03	128.37
combined	18	64.61	19.72	83.68	23.00	106.22
diff		3.89	40.65		-82.28	90.06

t = 0.0957 **p = 0.9249**
Ho: diff = 0 **degrees of freedom = 16**

After examining the group emergence results from the Basic Model for the Identity Salience and Supra-Additive versions, it is found that the two models do not produce different results across comparable HistID mean combinations. Descriptively, the two model versions' group emergence patterns are very similar for each compared HistID1 mean. The higher HistID mean results in more agents choosing the corresponding GroupID. When the HistID1 mean is larger, there are more GroupID1 agents. When the HistID2 mean is larger, there are more GroupID2 agents. When the HistID means are similar in value, both GroupID1 and GroupID2 flourish. However, because agent interaction does not occur in the Basic Model, group emergence is dependent upon the agents being randomly located next to each other.

With respect to actual group numbers, the t-tests found that the number of GroupID1 groups and the number of GroupID2 groups are not significantly different between the Identity Salience and Supra-Additive models. Both models have no GroupID0 groups so no t-test was conducted. In conclusion, because the emergence patterns are similar and the group numbers for each GroupID are not different, H_2 is refuted.

4.7 Predicted Probabilities of Group Choice: Identity Salience Model

Next, to better examine model results based upon individual level decisions, a multinomial logistic regression can provide predicted probabilities of group choice for each HistID mean combination. Table 4.7 shows the output for the MLogit (base category is GroupID0) fitted for the following equations:[37]

Figure 4.1 MLogit Equations, Identity Salience

$$\ln\Omega_{Grp1|Grp0}(x_i) = \beta_{0,\, Grp1|Grp0} + \beta_{1,\, Grp1|Grp0}\ \text{HistID1}$$

$$\ln\Omega_{Grp2|Grp0}(x_i) = \beta_{0,\, Grp2|Grp0} + \beta_{1,\, Grp2|Grp0}\ \text{HistID1}$$

[37] The log-odds of choosing Grp1 vs. Grp0 equals the sum of the constant's effect on the log-odds of choosing Grp1 given Grp0 and the effect of HistID1 on the log-odds of choosing Grp1 vs. Grp0. The log-odds of choosing Grp2 vs. Grp0 equals the sum of the constant's effect on the log-odds of choosing Grp2 given Grp0 and the effect of HistID1 on the log-odds of choosing Grp2 vs. Grp0.

Data from all the simulation runs was used to create the dataset (each HistID1 mean from 0.1-1.0 had its own simulation).[38] GroupID0 is the base category. NewGrp is the dependent variable and the available choices are GroupID1, GroupID2, or GroupID0 (usually shown in all tables as 1, 2, or 0).

Table 4.7 MLogit Results, Identity Salience Model

```
Iteration 0:   log likelihood = -7815.5227
Iteration 1:   log likelihood = -5200.3438
Iteration 2:   log likelihood =  -4911.597
Iteration 3:   log likelihood = -4884.7341
Iteration 4:   log likelihood = -4884.3254
Iteration 5:   log likelihood = -4884.3253

Multinomial logistic regression          Number of obs   =       8994
                                         LR chi2(2)      =    5862.39
                                         Prob > chi2     =     0.0000
Log likelihood = -4884.3253              Pseudo R2       =     0.3750

------------------------------------------------------------------------
     NewGrp   |     Coef.    Std. Err.     z      P>|z|     [95% Conf. Interval]
------------------------------------------------------------------------
1             |
  HistID1Mean |     4.22      0.234     18.09    0.000       3.77        4.68
        _cons |   -0.591      0.148     -3.98    0.000     -0.882      -0.300
------------------------------------------------------------------------
2             |
  HistID1Mean |    -5.43      0.243    -22.35    0.000      -5.91       -4.96
        _cons |     4.49      0.138     32.51    0.000       4.22        4.76
------------------------------------------------------------------------
(NewGrp==0 is the base outcome)
```

These two NewGrp combinations have coefficients significantly different than zero according to their z-scores, but all GroupID combinations need to be examined to verify the entire model. Table 4.8 provides the entire list of coefficients for the remaining GroupID combinations. Again, all the combinations for this model are

[38] Other simulations generated so much data that only 25% of the data is used from each run. This 25% was randomly selected from with each run.

significantly different than zero. Moreover, the factor change in the odds of choosing each GroupID is very marked.

Table 4.8 Coefficients for all GroupID Combinations

mlogit (N=8994): Factor Change in the Odds of NewGrp

Variable: HistID1Mean (sd=0.261)

Odds comparing
Alternative 1
to Alternative 2

Alternative 1	Alternative 2	b	z	P>|z|	e^b	e^bStdX
1	-2	9.66	52.11	0.000	1.57e+04	12.42
1	-0	4.22	18.09	0.000	68.35	3.01
2	-1	-9.66	-52.11	0.000	0.0001	0.081
2	-0	-5.43	-22.35	0.000	0.004	0.242
0	-1	-4.22	-18.09	0.000	0.015	0.332
0	-2	5.43	22.35	0.000	229.19	4.13

b = raw coefficient
z = z-score for test of b=0
P>|z| = p-value for z-test
e^b = exp(b) = factor change in odds for unit increase in X
e^bStdX = exp(b*SD of X) = change in odds for SD increase in X

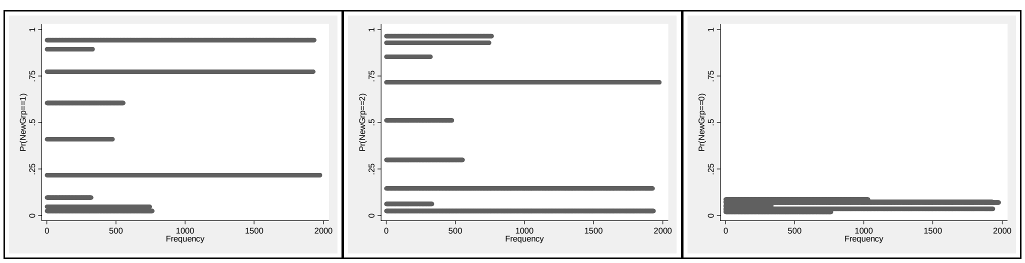
With a unit increase in the HistID1 mean, the odds of an agent choosing GroupID1 are 1.57e+04 times greater than choosing GroupID2. Similarly, with a unit increase in the HistID1 mean, the odds of choosing GroupID1 is 68.35 times greater than choosing GroupID0. The last large factor change favors GroupID0. The odds of choosing GroupID0 is 229.19 times greater than choosing GroupID2 when the HistID1 mean increase one unit. The factor change in the odds of choosing GroupID2 is very small regardless of which GroupID combination is examined. This implies that the effect of the HistID1 mean on GroupID2 is negligible (however, only when HistID1 increases). Even choosing GroupID0 has higher odds than choosing GroupID2 as the HistID1 mean increases.

Table 4.9 Predicted Probabilities Means for Each GroupID

Variable	Obs	Mean	Std. Dev.	Min	Max
p(GrpID1)	9036	0.513	0.354	0.016	0.931
p(GrpID2)	9036	0.430	0.358	0.025	0.965
p(GrpID0)	9036	0.057	0.022	0.019	0.088

Next, considering the predicted probabilities of group choice will further elucidate how the HistID1 mean shapes group formation. Table 4.9 shows the means for the predicted probabilities of each GroupID. While the impact of HistID1 is greatest on GroupID1, the mean probability of choosing GroupID1 (0.513) is only slightly higher than GroupID2 (0.430). Because the HistID1 mean is the only *x*-variable in the MLogit model, the converse relationship of varying HistID2 values is not explicit.

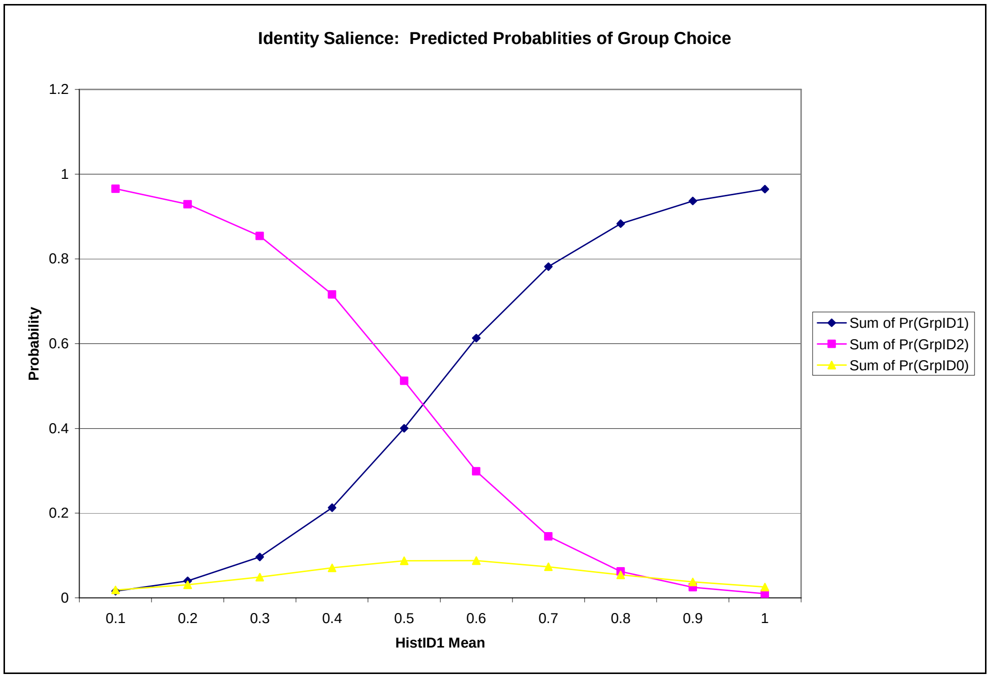
Graph 4.9 Frequencies of Predicted Probabilities



Graph 4.9 shows the frequency of probabilities for each GroupID. GroupID0 has the most predicated probabilities that are low. GroupID1 and GroupID2 have similar frequency patterns; however, GroupID1 has more high probabilities than GroupID2. Graph 4.10 of the predicted probabilities for all of HistID1 illustrates the full relationship between HistID1 and HistID2 values, and shows that agents do in fact choose GroupID2.

For low HistID1 means, GroupID2 is chosen with high probability. This probability decreases as HistID1 increases.

Graph 4.10 Predicted Probabilities of Group Choice



There is a transition point when HistID1 = 0.5 and the probabilities for both GorupID1 and GorupID2 decrease too slightly below 50%. The probabilities for GroupID0 gradually increases as the two HistID means become more equal, peak when HistID1 = 0.5, and then begin to decrease again as the difference between HistID1 and HistID2 increases. Finally, the probabilities of choosing GroupID1 increase and the HistID1 mean also increases. These probabilities provide a practical way to determine which GroupID an agent will choose given its two HistID means (when the decision is solely based upon the strength of the historical identities).

Next, calculating the discrete change in these predicted probabilities as HistID1 increases one unit helps determine the magnitude of effect of HistID1 on each GroupID. Discrete change shows the current odds of group choice as HistID1 changes. Table 4.10 below shows the marginal effects for and discrete change in for the probabilities for each GroupID. This information will then be used to create the following plots.

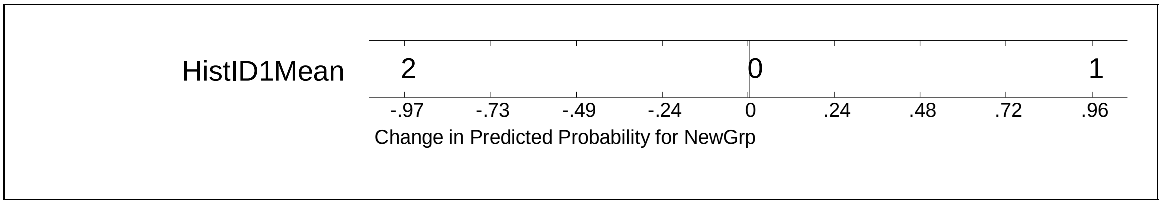
Table 4.10 Changes in Probabilities for Each GroupID

```
mlogit: Changes in Probabilities for NewGrp

HistID1Mean
                    Avg|Chg|         1        2        0
Min->Max              0.627      0.921   -0.940    0.019
   -+1/2              0.646      0.963   -0.969    0.005
  -+sd/2              0.338      0.508   -0.507   -0.001
MargEfct              1.44       2.15    -2.14    -0.011

              1        2        0
Pr(y|x)   0.524    0.386    0.090

       HistID1Mean
    x=      0.557
sd(x)=      0.261

Pr(y|x): probability of observing each y for specified x values
Avg|Chg|: average of absolute value of the change across categories
Min->Max: change in predicted probability as x changes from its minimum to
        its maximum
0->1: change in predicted probability as x changes from 0 to 1
-+1/2: change in predicted probability as x changes from 1/2 unit below
        base value to 1/2 unit above
-+sd/2: change in predicted probability as x changes from 1/2 standard
        dev below base to 1/2 standard dev above
MargEfct: the partial derivative of the predicted probability/rate with
        respect to a given independent variable
```

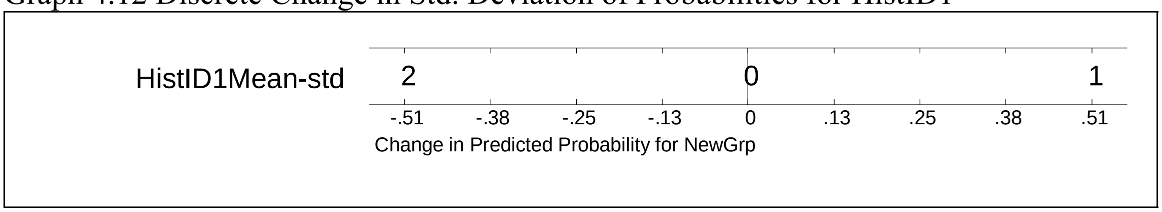
With one unit change in the HistID1 mean, the probability for GroupID1 increases almost 100% (0.963). In contrast, the probability of choosing GroupID2 decreases almost 100% (-0.940). One unit increase in the HistID1 mean has essentially no impact on the probability of choosing GroupID0 (0.019). To verify if the effect of

HistID1 on the probabilities of group choice is distinct, the discrete change in the standard deviations of the probabilities can be examined, too. Graph 4.12 verifies that the changes in probabilities are indeed as pronounced with one unit increase of HistID1.

Graph 4.11 Discrete Change in Probabilities for HistID1

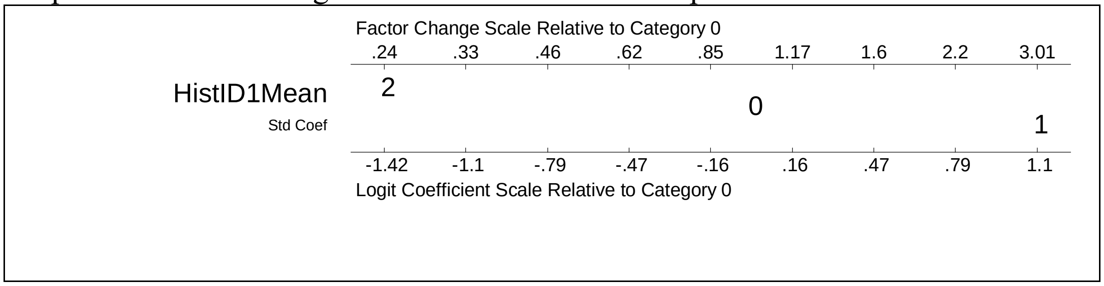


Graph 4.12 Discrete Change in Std. Deviation of Probabilities for HistID1



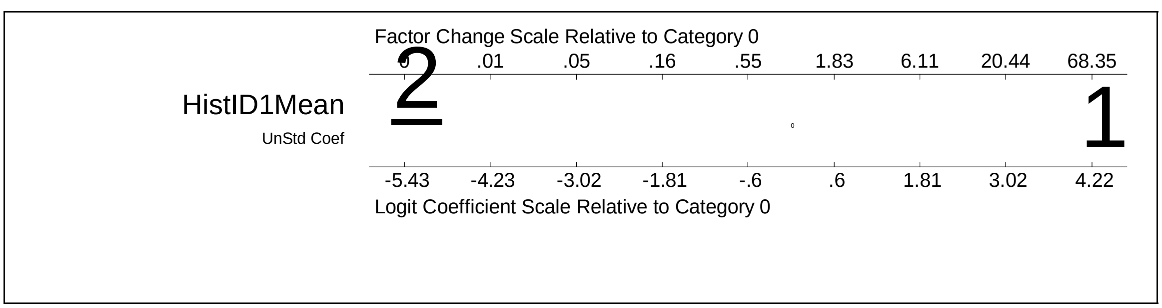
Next, plotting the factor change in the odds of group choice can illustrate the magnitude of effect HistID1 has on each GroupID. Alpha is set to 0.01 and all outcomes are significantly ordered by the HistID1 mean. As HistID1 increases one unit, the magnitude of effect of HistID1 on the odds of choosing GroupID1 and GroupID0 is twice as large as on the odds of choosing GroupID2. Relative to GroupID0, as HistID1 increases, it is more likely that agents will choose GroupID1 and less likely that they will choose GroupID2. The probability graphs support this relationship, too.

Graph 4.13 Factor Change in the Odds for Each Group Choice



Finally, combining the discrete change in probability and factor change in the odd ratios of group choice will provide a complete picture of the effect of an increase of HistID1 has on each GroupID. The factor change in the odds of group choice is constant across HistID1, but the discrete change in probability of group choice changes as HistID1 changes. There could be a large factor change in the odds of group choice, like when comparing GroupID1 vs. GroupID2 in the listed coefficient Table 4.8. However, if the current odds at a specific value of HistID1 are also large the substantive impact is small. Conversely, if the current odds are large for a specific value of HistID1, the influence the HistID1 mean has on group choice is large.

Graph 4.14 Combined Discrete Change and Odd Ratios Plot, α = 0.01



In Graph 4.14 above, the size of the GroupID number is proportional to the discrete change in the odds of group choice for that GroupID. An underlined GroupID indicates negative change. The impact from a unit increase in HistID1 on GroupID1 is the largest positive effect. This increase equally determines *not* choosing GroupID2. The effect of the HistID1 mean on GroupID0 is so little that it is difficult to see the zero!

In general, this basic model is straight forward and does not provide any analytical surprises. Agents always choose the GroupID which corresponds to the larger HistID strength. The only occurrence of both HistID1 and HistID2 being equal occurs at HistID1 = 0.5, and this is the only appearance of agents with GroupID0. The aggregate data shows that GroupID1 totals increase and the HistID1 mean increases; GroupID2 totals decrease as the HistID1 mean increases; and that by the end of the model run, almost no agents choose GroupID0.

Closely corresponding to the GroupID totals are group emergence patterns. The larger GroupID will have more agents of the same color. However, at this point of the experiments, because there is no agent interaction yet, group emergence cannot be claimed. Independent agents just happen to have the same GroupID and happen to be located next to one another. Another finding to highlight in group emergence is the varying majority GroupID when HistID1 = 0.5. The variation is dependent upon the initially (and randomly) assigned agent characteristics at the beginning of each model run. This variation in majority GroupID does not occur at any other HistID1 value.

Finally, the predicted probabilities show that as the HistID1 mean increases, so too increases the probability of choosing GroupID1. HistID1 is the main determinant of GroupID1. The probability of choosing GroupID2 decreases with the same substantive outcome. Fundamentally, the strength of an agent's historical identity does not determine GroupID0 choice at all.

4.8 Predicted Probabilities of Group Choice: Supra-Additive Model

To help assess how the identity variables for this chapter—HistID1 and HistID2—effect individual agents' decisions about group choice, the following multinomial logistic regression equations were fitted:[39]

Figure 4.2 MLogit Equations, Supra-Additive

$$\ln\Omega_{Grp1|Grp0}(x_i) = \beta_{0,\ Grp1|Grp0} + \beta_{1,\ Grp1|Grp0}\ \text{HistID1} + \beta_{2,\ Grp1|Grp0}\ \text{HistID2}$$

$$\ln\Omega_{Grp2|Grp0}(x_i) = \beta_{0,\ Grp2|Grp0} + \beta_{1,\ Grp2|Grp0}\ \text{HistID1} + \beta_{2,\ Grp2|Grp0}\ \text{HistID2}$$

For this basic model version, the identity variables are independent. GroupID0 is specified as the base category for the MLogit and yields:

Table 4.11 MLogit Results, Supra-Additive

Multinomial logistic regression — Number of obs = 11528; LR chi2(4) = 6600.09; Prob > chi2 = 0.0000; Pseudo R2 = 0.3612

Log likelihood = -5836.4129

NewGrp	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
1						
HistID1Mean	2.73	0.283	9.62	0.000	2.17	3.28
HistID2Mean	-4.59	0.317	-14.46	0.000	-5.21	-3.96
_cons	3.89	0.188	20.68	0.000	3.52	4.26
2						
HistID1Mean	-4.62	0.283	-16.33	0.000	-5.17	-4.07
HistID2Mean	3.43	0.319	10.76	0.000	2.80	4.05
_cons	3.17	0.190	16.70	0.000	2.80	3.54

(NewGrp==0 is the base outcome)

[39] The log-odds of choosing Grp1 vs. Grp0 equals the sum of the constant's effect on the log-odds of choosing Grp1 given Grp0, the effect of HistID1 on the log-odds of choosing Grp1 vs. Grp0, and the effect of HistID2 on the log-odds of choosing Grp1 vs. Grp0. The log-odds of choosing Grp2 vs. Grp0 equals the sum of the constant's effect on the log-odds of choosing Grp2 given Grp0, the effect of HistID1 on the log-odds of choosing Grp2 vs. Grp0, and the effect of HistID2 on the log-odds of choosing Grp2 vs. Grp0.

All the coefficients are significant at the 0.05 level when GroupID0 is the base category. To consider all the MLogit outcome combinations, Table 4.12 below shows which other combinations are significant. All NewGrp combinations are significant at the 0.05 level. With one unit increase in the HistID1 mean, the factor change in the odds of choosing GroupID1 over GroupID2 is the largest (e^b = 1550.07). As the HistID2 mean increases one unit, the factor change in the odds of choosing GroupID2 versus GroupID1 is the largest. To better interpret the factor change in the odds to determine how HistID1 and HistID2 affect group choice, the predicted probabilities are reviewed and then discrete change in the probability will be considered later.

Table 4.12 Coefficients for all NewGrp Combinations

mlogit (N=11528): Factor Change in the Odds of NewGrp

Variable: HistID1Mean (sd=0.31)

Odds comparing Alternative 1 to Alternative 2

Alternative 1	Alternative 2	b	z	P>|z|	e^b	e^bStdX
1	-2	7.35	51.00	0.000	1550.07	9.49
1	-0	2.73	9.62	0.000	15.27	2.30
2	-1	-7.35	-51.00	0.000	0.001	0.105
2	-0	-4.62	-16.33	0.000	0.010	0.243
0	-1	-2.73	-9.62	0.000	0.066	0.434
0	-2	4.62	16.33	0.000	101.52	4.12

Variable: HistID2Mean (sd=0.27)

Odds comparing Alternative 1 to Alternative 2

Alternative 1	Alternative 2	b	z	P>|z|	e^b	e^bStdX
1	-2	-8.01	-53.16	0.000	0.000	0.115
1	-0	-4.59	-14.46	0.000	0.010	0.291
2	-1	8.01	53.16	0.000	3019.77	8.66
2	-0	3.43	10.76	0.000	30.81	2.52
0	-1	4.59	14.46	0.000	98.03	3.44
0	-2	-3.43	-10.76	0.000	0.033	0.397

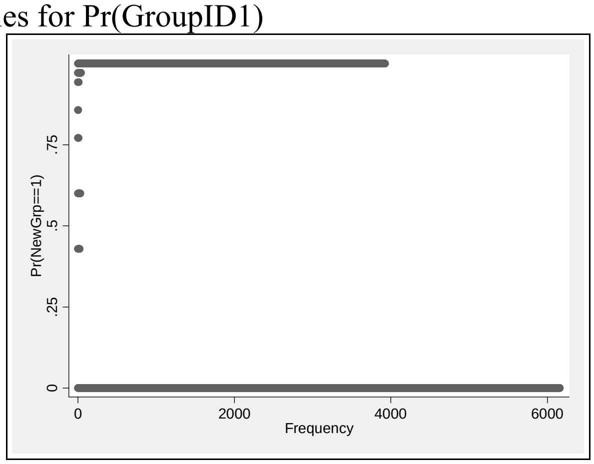
Table 4.13 shows the aggregate predicted probabilities when the identity variables HistID1 and HistID2 are defined independently. While the probability of choosing GroupID2 is higher, it is essentially equal to the predicted probability of choosing GroupID1. The probability for choosing GroupID0 is almost zero. Graphs 4.15-4.17 show the dot plots for the frequency distributions of each GroupID probability.

Table 4.13 Predicted Probabilities of Group Choice

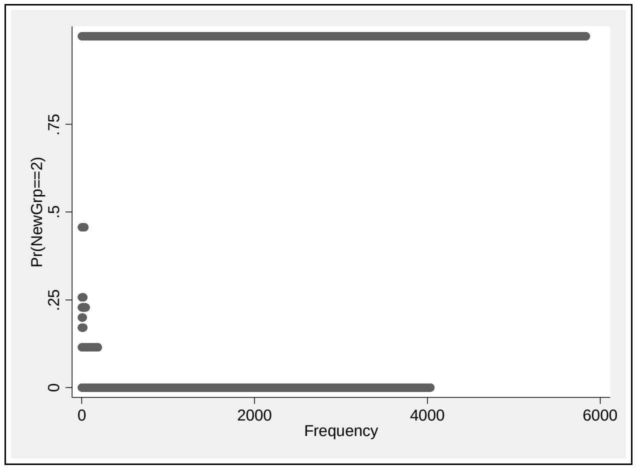
Variable	Obs	Mean	Std. Dev.	Min	Max
Pr(GroupID1)	11528	0.466	0.338	0.007	0.992
Pr(GroupID2)	11528	0.508	0.340	0.003	0.989
Pr(GroupID0)	11528	0.025	0.015	0.004	0.055

Overall, the frequency distributions for each GroupID are split, either/or; there are few, if any, probabilities other than zero or one. The frequencies for the predicted probability of GroupID0 are mostly zero probabilities. GroupID1 has more zero probabilities than one probabilities, and GroupID2 has more one probabilities than zero probabilities. This GroupID2 advantage is reflected in the average probabilities in Table 4.13.

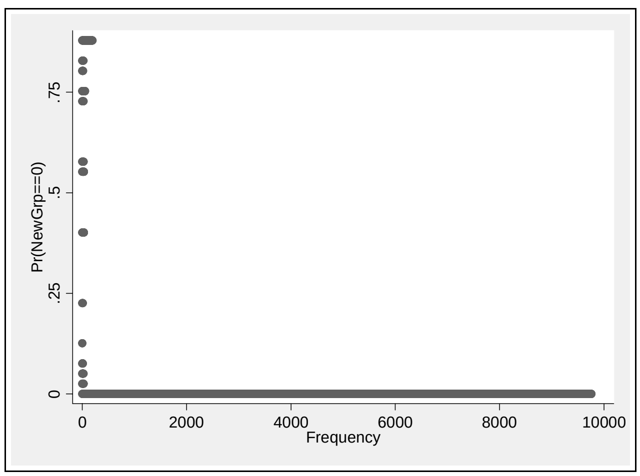
Graph 4.15 Frequencies for Pr(GroupID1)



Graph 4.16 Frequencies for Pr(GroupID2)



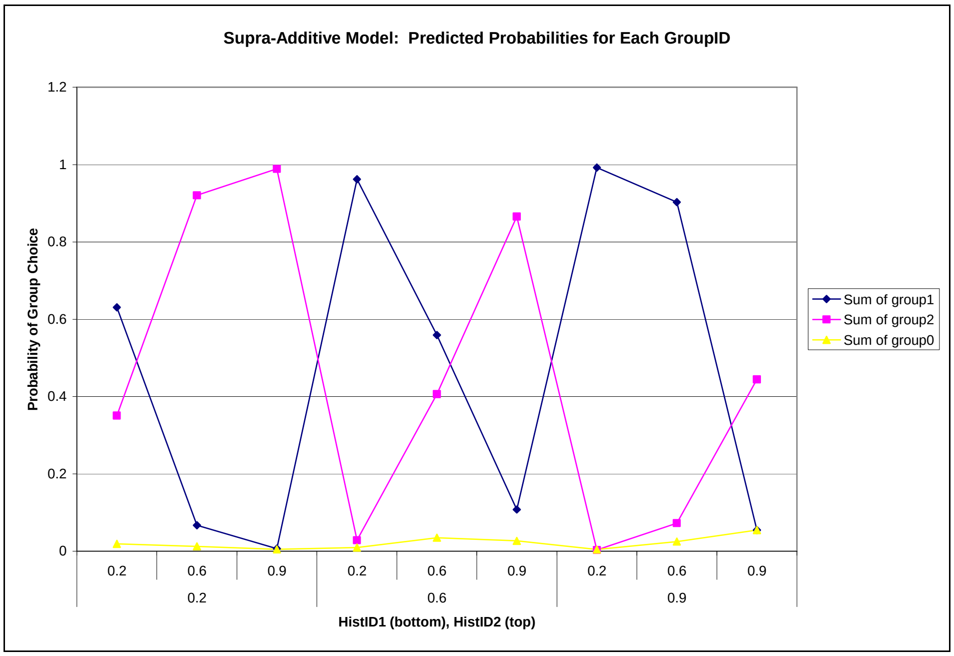
Graph 4.17 Frequencies for Pr(GroupID0)



Next, utilizing the *prvalue* command, specific probabilities can be calculated for each HistID1 and HistID2 mean combination. Graph 4.18 shows the probabilities for each GroupID as HistID1 and HistID2 increase from low to high values. The probabilities for GroupID0 remain low or zero for across all HistID values. The general trend for the relationship between HistID1 and HistID2 is straightforward: the higher HistID mean has the higher probability for its corresponding GroupID. That is, when

HistID1 is higher, the probability of GroupID1 will be higher. Conversely, when HistID2 is higher, the probability of GroupID2 will be higher.

Graph 4.18 Predicted Probabilities for Each GroupID



However, when the two HistID means are the same, either GroupID1 or GroupID2 could have the higher probability. This variability in which majority GroupID prevails is seen in the group emergence, too. Because HistID1 and HistID2 are equal, the probability of group choice depends on other factors, like the induced variation from the standard deviation for each HistID mean.[40] Either GroupID1 or GroupID2 could become the majority group. For this model version where group choice only depends on the pre-existing HistID1 and HistID2 means, even though the means are equal, the actual assigned mean to each agent has a +/- 0.2 variation. The decision rule of choosing a

[40] For this project, the standard deviations for all variables are held constant at 0.2.

GroupID based upon the highest HistID then still prevails. There will always be a higher HistID, except in the cases when they are truly equal (like in the extremes of each distribution when more GroupID0 agents appear because of the neutrality definitions).

Table 4.14 Discrete Change in Probabilities for Each GroupID

mlogit: Changes in Probabilities for NewGrp

HistID1Mean

	Avg|Chg|	1	2	0
Min->Max	0.565	0.832	-0.847	0.015
-+1/2	0.630	0.932	-0.944	0.012
-+sd/2	0.332	0.488	-0.499	0.010
MargEfct	1.19	1.75	-1.79	0.038

HistID2Mean

	Avg|Chg|	1	2	0
Min->Max	0.579	-0.869	0.856	0.012
-+1/2	0.638	-0.957	0.953	0.004
-+sd/2	0.319	-0.478	0.475	0.003
MargEfct	1.29	-1.93	1.92	0.012

	1	2	0
Pr(y|x)	0.455	0.510	0.034

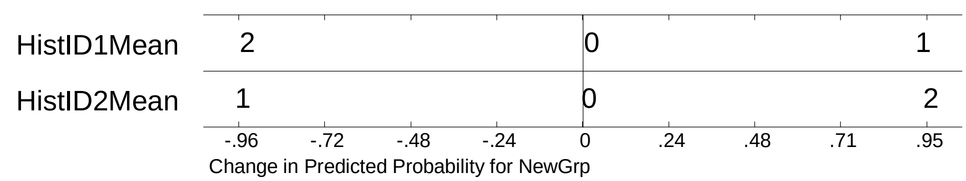
	HistID1Mean	HistID2Mean
x=	0.561	0.618
sd(x)=	0.306	0.269

Pr(y|x): probability of observing each y for specified x values
Avg|Chg|: average of absolute value of the change across categories
Min->Max: change in predicted probability as x changes from its minimum to its maximum
0->1: change in predicted probability as x changes from 0 to 1
-+1/2: change in predicted probability as x changes from 1/2 unit below base value to 1/2 unit above
-+sd/2: change in predicted probability as x changes from 1/2 standard

Next, discrete change in the probability of each GroupID (the current odds) is reviewed to help better determine the relationship between each pre-existing HistID and group choice. Table 4.14 provides the values used in the following plots. Graph 4.19

shows the change in predicted probability for GroupID1, GroupID2, and GroupID0 with one unit increase of each HistID. GroupID0 is the base category.

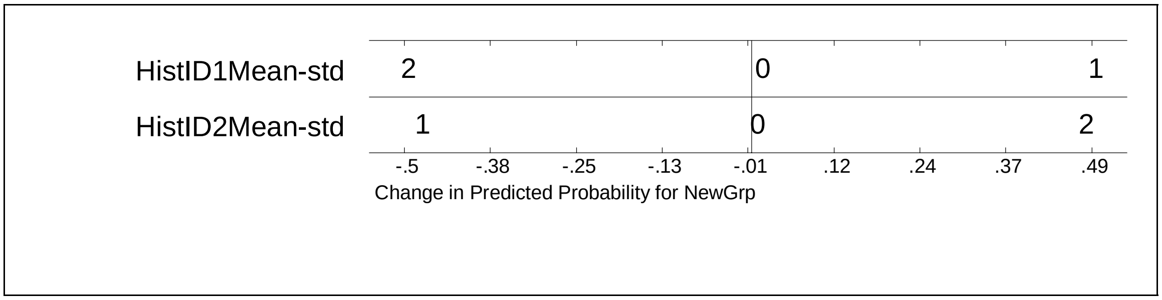
Graph 4.19 Discrete Change in Predicted Probability for Each GroupID



With one unit increase in the HistID1 mean, the probability of choosing GroupID0 barely increases by 0.012. However, the effect on the GroupID1 and GroupID2 are great. With one unit increase in HistID1, the probability of choosing GroupID1 increases by 0.932 and the probability of choosing GroupID2 decreases by 0.944. This change is almost a 100% difference in each direction.

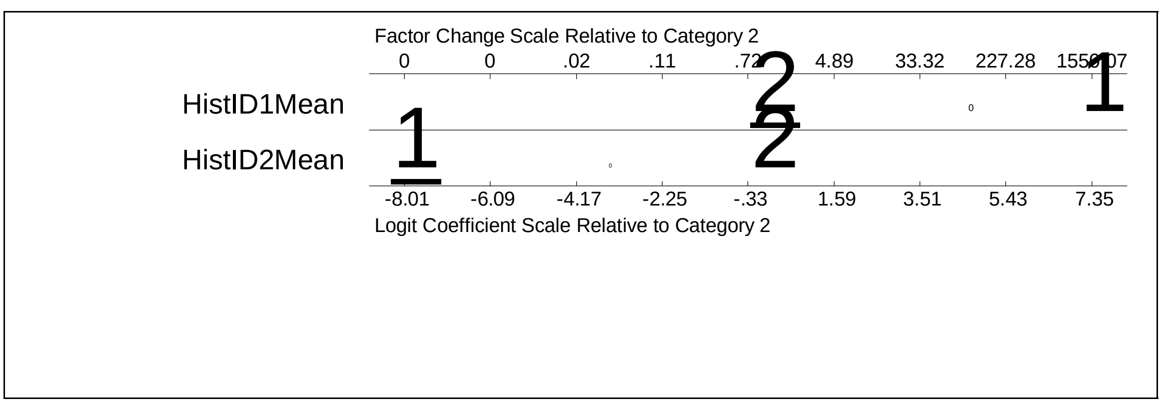
The converse is true for one unit increase in HistID2. The probability of choosing GroupID2 increases by 0.953 and the probability of choosing GroupID1 decreases by 0.957. The probability of choosing GroupID0 remains almost unchanged and increases negligibly by 0.004. These cut-and-dry changes reflect the basic decision parameter for this model version—the higher HistID always wins.

Graph 4.20 Discrete Change in Group Choice for One Std. Deviation



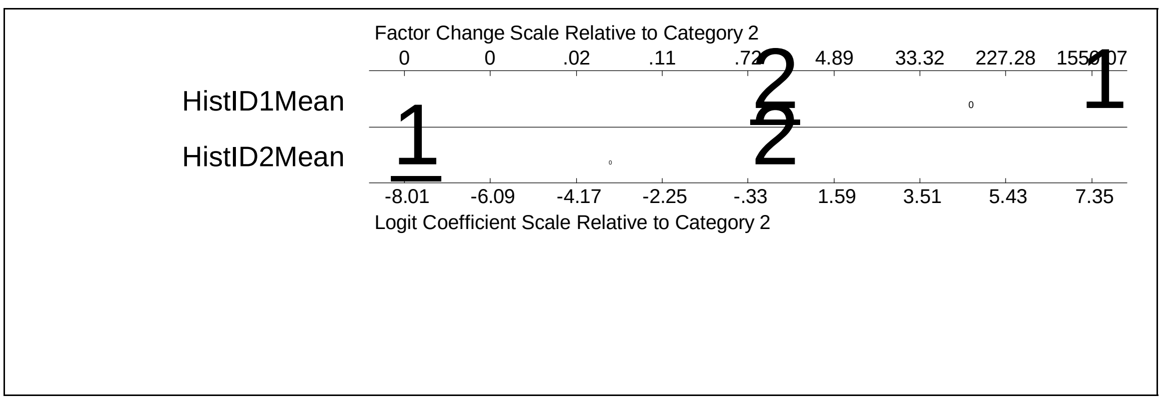
To further verify if the differences in the discrete change is as extreme as Graph 4.19 shows, Graph 4.20 depicts the discrete change with an increase of one standard deviation for HistID1 and HistID2. It confirms that the change in probability for each GroupID is almost 100% (except GroupID0, which remains unaffected). With an increase of one standard deviation in HistID1, the probability of choosing GroupID1 increases by 0.49. The probability of choosing GroupID2 decreases 0.50. With a standard deviation increase in HistID2, the probability of choosing GroupID2 increases by 0.46 and the probability of choosing GroupID1 decreases by 0.48. Again, each HistID's affect on the probability of choosing GroupID0 is essentially non-existent.

Graph 4.21 Factor and Discrete Change for Each GroupID, α=0.01



Now, the factor change in the odds and the discrete change in the probability of choosing each GroupID is plotted to consider the effect of the identity variables on group choice. The factor change in the odds of group choice provides a measure for the constant change in the odds across GroupID1, GroupID2, and GroupID0. However, when combined with the discrete change in the probability of group choice—the current odds for each GroupID as the identity variables change—a more complete picture is given of the impact the identity variables have on group choice. Long and Freese (2006) explain that "information on the discrete change in probability can be incorporated in the odds-ratio graph by making the size of the letter proportional to the discrete change in the odds (specifically, the area of the letter is proportional to the size of the discrete change)" (266).

Graph 4.22 Discrete Change and Odd Ratios Plot, α = 0.01.



Graph 4.22 shows the straight forward results of the discrete change and odd ratios combination plot. All HistID effects are significant at the 0.01 level (otherwise, a diagonal line would connect different GroupID combinations). This means that HistID1 and HistID2 significantly order the outcomes for GroupID1, GroupID2, and GroupID0.

Moreover, the influence from each HistID on the current odds on GroupID1 and GroupID2 are very large. With one unit increase in the HistID1 mean, the current odds and the overall odds significantly increase for choosing GroupID1. The current odds and the overall odds significantly decrease for choosing GroupID2 (negative change is noted by an underlined GroupID). HistID1 has almost no effect on the odds for choosing GroupID0, though HistID1 is the only identity variable that determines GroupID0. HistID2 does not influence the odds for choosing GroupID0 at all.

The opposite trend is true for the HistID2 mean. With one unit increase in HistID2, the current odds and overall odds significantly increase for choosing GroupID2. The current odds and the overall odds significantly decrease for choosing GroupID1. For this model version, in sum, the magnitude of effect of HistID1 and HistID2 on determining GroupID1 and GroupID2 outcomes (respectively) are absolute. This outcome is no surprise. Logically, these results are in line with agent decisions given that the identity variables thus far are the only variables determining group choice.

4.9 Predicted Probabilities of Group Choice: Model Comparison

In order to compare the two Basic Model versions, any differences between the predicted probabilities for each GroupID are examined using a two-proportion z-test. The final hypothesis for the Basic Model is:

> **H_3: Predicted probabilities of group choice will be different across comparable HistID mean combinations between the two models.**

Tables 4.15 – 4.17 show the z-values and p-values for the predicted probabilities of choosing GroupID1, GroupID2, and GroupID0 within the Identity Salience and Supra-Additive versions. The probabilities chosen for comparison are based upon the designated HistID1 and HistID2 means at the left of the tables. The significance level is 95%.

Table 4.15 Z-test Results for GroupID1 Probabilities

		Identity Salience (N = 8994)	**Supra-Additive (N=11528)**			
HistID1	**HistID2**	**Pr(GrpID1) (sd)**	**Pr(GrpID1) (sd)**	**Diff (sd)**	**z**	**p>|z|**
0	1	0.006 (0.001)	0.001 (0.000)	0.005 (0.001)	6.30	0.000
0.1	0.9	0.016 (0.001)	0.003 (0.001)	0.013 (0.001)	9.95	0.000
0.2	0.8	0.04 (0.002)	0.014 (0.001)	0.026 (0.002)	11.52	0.000
0.3	0.7	0.097 (0.003)	0.063 (0.002)	0.033 (0.004)	8.97	0.000
0.4	0.6	0.213 (0.004)	0.235 (0.004)	-0.022 (0.006)	-3.68	0.000
0.5	0.5	0.400 (0.005)	0.578 (0.005)	-0.177 (0.007)	-25.22	0.000
0.6	0.4	0.613 (0.005)	0.854 (0.003)	-0.241 (0.006)	-39.39	0.000
0.7	0.3	0.782(0.004)	0.958 (0.002)	-0.177 (0.005)	-38.75	0.000
0.8	0.2	0.883 (0.003)	0.988 (0.001)	-0.105 (0.004)	-31.75	0.000
0.9	0.1	0.937 (0.003)	0.996 (0.001)	-0.059 (0.003)	-24.51	0.000
1	0	0.965 (0.002)	0.998 (0.000)	-0.034 (0.002)	-18.91	0.000

Table 4.16 Z-test Results for GroupID2 Probabilities

		Identity Salience (N = 8994)	**Supra-Additive (N=11528)**			
HistID1	**HistID2**	**Pr(GrpID2) (sd)**	**Pr(GrpID2) (sd)**	**Diff (sd)**	**z**	**p>|z|**
0	1	0.983 (0.001)	0.998 (0.001)	-0.015 (0.001)	-11.66	0.000
0.1	0.9	0.965 (0.002)	0.994 (0.001)	-0.028 (0.002)	-14.92	0.000
0.2	0.8	0.929 (0.003)	0.979 (0.001)	-0.050 (0.003)	-17.56	0.000
0.3	0.7	0.854 (0.004)	0.923 (0.002)	-0.069 (0.004)	-15.81	0.000
0.4	0.6	0.716 (0.005)	0.740 (0.004)	-0.024 (0.006)	-3.87	0.000
0.5	0.5	0.512 (0.005)	0.393 (0.005)	0.120 (0.007)	17.15	0.000
0.6	0.4	0.299 (0.005)	0.125 (0.003)	0.174 (0.006)	30.85	0.000
0.7	0.3	0.145 (0.004)	0.030 (0.002)	0.115 (0.004)	29.99	0.000
0.8	0.2	0.062 (0.003)	0.007 (0.001)	0.056 (0.003)	22.80	0.000
0.9	0.1	0.025 (0.002)	0.002 (0.000)	0.024 (0.002)	15.54	0.000
1	0	0.010 (0.001)	0.0003 (0.000)	0.010 (0.001)	10.19	0.000

Table 4.15 shows that as the HistID1 mean increases, the predicted probabilities for choosing GroupID1 increase for both the Identity Salience and Supra-Additive model versions, but that the difference between these probabilities is statistically different. Similarly, Table 4.16 shows that as the HistID1 mean increases, the predicted probabilities for choosing GroupID2 decrease for both the Identity Salience and Supra-Additive models, but again, the difference between these probabilities are significantly different.

Table 4.17 Z-test Results for GroupID0 Probabilities

		Identity Salience (N = 8994)	Supra-Additive (N=11528)			
HistID1	**HistID2**	**Pr(GrpID0) (sd)**	**Pr(GrpID0) (sd)**	**Diff (sd)**	**z**	**p>|z|**
0	1	0.011 (0.001)	0.001 (0.000)	0.010 (0.001)	9.71	0.000
0.1	0.9	0.0187 (0.001)	0.003 (0.001)	0.0157 (0.002)	11.28	0.000
0.2	0.8	0.031 (0.002)	0.0067 (0.001)	0.0243 (0.002)	13.23	0.000
0.3	0.7	0.0492 (0.002)	0.0141 (0.001)	0.0351 (0.003)	14.75	0.000
0.4	0.6	0.071 (0.003)	0.0252 (0.001)	-0.046 (0.003)	15.66	0.000
0.5	0.5	0.087 (0.003)	0.0299 (0.002)	0.0571 (0.003)	17.81	0.000
0.6	0.4	0.088 (0.003)	0.0213 (0.001)	0.0667 (0.003)	21.64	0.000
0.7	0.3	0.073 (0.003)	0.0115 (0.001)	0.0615 (0.003)	22.73	0.000
0.8	0.2	0.0543 (0.002)	0.0057 (0.001)	0.0486 (0.002)	21.31	0.000
0.9	0.1	0.0378 (0.002)	0.0028 (0.000)	0.035 (0.002)	16.64	0.000
1	0	0.0255 (0.002)	0.0013 (0.000)	0.024 (0.002)	15.86	0.000

Finally, Table 4.17 shows the z-test results from comparing the predicted probabilities of choosing GroupID0. As the HistID1 mean increases from zero to one, the probabilities of choosing GroupID0 remain low for both the Identity Salience and Supra-Additive models. However, the difference between the two models' probabilities is significantly different.

When the combined odd ratio-discrete change plots are compared between the Identity Salience and Supra-Additive versions (Graphs 4.14 and 4.22), another difference becomes evident. The magnitude of effect of HistID1 and HistID2 are group choice is consistently higher in the Supra-Additive model than in the Identity Salience model. That is, as each identity variable changes, the odd ratios and impact on group choice are stronger in the Supra-Additive model than in the Identity Salience model. Overall, the null hypothesis that the models would generate the same predicted probabilities of group choice is rejected.

4.10 Conclusion

Both basic versions of the Identity Salience and Supra-Additive models have similar results when the aggregate data of agent group totals, group emergence patterns, and total groups formed are considered. The general trend for agent totals for each GroupID is that the larger HistID generates the larger group totals. As HistID1 increases, GroupID1 totals increase; as HistID2 increases, GroupID2 totals increase. The converse is also true: as HistID1 decreases, GroupID1 totals decrease; as HistID2 decreases, GroupID2 totals decrease. For the most part, GroupID0 does not form. The Supra-Additive model does have more GroupID0 agents at the tails of the HistID1 mean, but these totals result from the neutrality definitions preventing agents from having means lower than zero or higher than one.

One major difference is that the Supra-Additive model shows signs of diminishing returns from high or low HistID means. High HistID1 means result in the same amount of GroupID1 agents for HistID2 means from 0.1 to essentially 0.5. That is, when the HistID2 mean is low (0.1 to 0.4), the same amount of agents choose GroupID1 when their HistID1 mean is 0.6 as when their HistID1 mean is 1.0. Having a stronger allegiance to HistID1 does not equate into more GroupID1 agents. The converse is true for HistID2 means and low HistID1 means. Overall, however, H_1 (agent totals for all GroupID choices are not equal) *is* rejected because the agent totals were not significantly different. Examining aggregate totals shows no difference between the assumptions in the Identity Salience and Supra-Additive models.

Group emergence patterns are also similar between the basic versions of the Identity Salience and the Supra-Additive models. The larger HistID mean generates larger groups and most of the time completely “takes over.” When the HistID means are similar in value, both groups form. At this point, however, agents do not communicate with one another so it is difficult to claim they are cohesive groups, but rather just individuals with the same GroupID who are located next to one another. Moreover, because there is still no social influence, lone agents or “political ideologues” cannot influence neighbors (nor be influenced by other agents). These individual agents remain surrounded by agents with the majority GroupID.

In both models, when the two HistIDs are equal, the majority GroupID varies depending upon the initially assigned agent characteristics and random agent locations on the grid. This variation, in turn, changes the group formation patterns. In both the Identity Salience and Supra-Additive models, majority GroupID variation only occurs when the HistID1 and HistID2 means equal 0.5.

The number of groups formed in each model version was also compared. The t-tests comparing the number of GroupID1 and GroupID2 groups found that the models' results were not significantly different. H_2, that group emergence patterns and number of groups formed for comparable HistID1 and HistID2 means would be different between the two model versions, is refuted. Group emergence patterns and the number of groups formed with the different Identity Salience and Supra-Additive assumptions are the statistically the same.

Finally, both models have very similar predicted probabilities and each HistID mean affects group choice with the same general trend. However, the predicted probabilities of group choice *are* significantly different between the two models. Even though the magnitude of effect from each HistID mean affects group choice similarly, the differences in the assumptions between the Identity Salience and Supra-Additive models do in fact change the probabilities of group choice.

In the Identity Salience model, one unit increase in the HistID1 mean increases both the discrete change in probability and the factor change in the odds of choosing GroupID1 and decreases both the probability and the odds of choosing GroupID2. The HistID1 mean has a large magnitude of effect on choosing GroupID1 and in not choosing GroupID2. This is not shocking given it is the only variable in this basic model version. In both models, the HistID means have almost no influence on GroupID0 formation.

Similarly, in the Supra-Additive model, the HistID1 mean is the main determinant for GroupID1 and the HistID2 mean is the main determinant for GroupID2. This can be considered another difference between the two models: in the Identity Salience model because HistID2 is dependently defined by HistID1, the HistID1 mean effects both GroupID1 and GroupID2 choice; in the Supra-Additive model, the HistID2 mean solely determines GroupID2 choice.

The lack of difference between the Identity Salience and Supra-Additive models' aggregate results—agent totals, group emergence patterns, total groups formed—in comparison to the statistical differences in predicted probabilities of group choice highlight classic complex system behavior. The dynamics of individual agent decisions and probabilities of choosing GroupID1, GroupID2, and GroupID0 are different between the Identity Salience and Supra-Additive models. However, these differences give rise to group formations and group totals that operate with other dynamics at the aggregate level. The whole system of group formation is not exactly the sum of its parts. The local level agent decisions behave differently between the two model versions, but the aggregate level formations are similar regardless of identity assumptions. The HistID, SPTol and Buckle variables interact differently in each model, even though for these environmental assumptions (low standard deviation, i.e. homogenous population) agent choices lead to similar group emergence patterns.

Chapter Five

Social Pressure and Tolerance

Social pressure has always been an important variable in collective action studies and social movement research. However, most of the research focuses upon the effects from social pressure during the social movement or after a group has formed. For Olson (1971), social pressure was central to overcoming the free rider problem in small group collective action. For Chong (1991), social pressure was part of the equation of social and psychology incentives that made collective action in the Civil Rights movement possible. The fundamental assumption, however, is that social pressure made people *participate* after they had chosen a group to support within the social movement. What role does social pressure play in group formation? What would its relationship be to other interacting variables like multiple identities during group emergence?

As was detailed in Chapter Two, fieldwork in Tepoztlán showed that social pressure was important to formation of the pro- and anti-golf club groups. It also influenced people who claimed to be neutral about the advantages and disadvantages of the club's construction. The main component of social pressure in this context was social interaction. People attended *asembleas*, or town meetings, where they heard information about the club from the local government and community leaders. These town meetings were the main source of information about the club for Tepoztlán and provided a forum for the people to debate and define the issues. During this period of time when the series of *asembleas* occurred, the main question that developed was, “Are you for or against the club?” This question then allowed friends, family, neighbors, and eventual associations to size each other up and organize into respective groups. After the town decided to be overwhelmingly against the golf club, the *asembleas* were then the main source of anti-club information.

Social pressure was predominantly against the club. The pressure to maintain family and friendship ties was great. To admit that one saw benefits from the club’s construction risked breaking up the family, being ostracized within the community, or even worse—driven out of Tepoztlán for safety reasons. The local politicians were thrown out of office and town; images of them were burned in effigy during protest. Many people who supported the club felt threatened enough to leave town—for personal safety reasons or because of threats to their economic well-being (i.e. market stalls being vandalized)—and few have been able to return and rejoin the community without controversy. The risks to support the club were high increasing the social pressure to be against the golf club.

Therefore, social pressure in the context of group emergence influenced the environment in which the groups formed and also inclined information to be anti-club. Yet many respondents maintain that they independently made their decisions to be against the club, that family and neighbors did not influence their decision. If social pressure exists and people still make their decisions independently, how can the two be reconciled? One way to view this discrepancy is to understand that social pressure helps to create the environment in which people make their decisions. It was difficult to find pro-club information. Moreover, if the majority of the town is against the club, it is easy to not "feel" the social pressure if you are in agreement with your neighbors.

However, the effects from social pressure are highlighted in the interviews with people who were for the club's construction. Some felt their person threatened, some chose to leave, some lost jobs or were threatened to be fired, some felt pressure to participate in protests to protect their market stalls, etc. Of those who fled Tepoztlán, few have been able to return and most would claim that the past ten years of reincorporating themselves into the community has been difficult. The Tepoztecos who supported the golf club felt enormous social pressure to be anti-club.

Constructing the Identity Salience and Supra-Additive models for this Chapter includes four additions to the Basic Model that capture how social pressure operated in the *No al Club de Golf* movement. One, agents can move around the grid. Two, agents have limited interaction with their neighbors by being able to see their neighbors' GroupID. Three, agents then compare the percentage of each GroupID within their sight and determine if the percentage of the majority GroupID is within their social pressure tolerance level. Four, if their tolerance level is higher, agents choose their own GroupID; if their tolerance level is lower than the majority GroupID's percentage, then the agents must choose the majority GroupID.

The following table sums up the potential decision outcomes for the more complicated model versions with social pressure and social interaction:

Table 5.1 GroupID Outcomes

	HistID1	HistID2	SPTol	Group ID
Case 1	**Higher**	**Lower**	**Tolerance**	**1**
Case 2	**Lower**	**Higher**	**Tolerance**	**2**
Case 3	**Equal**	**Equal**	**Tolerance**	**0**
Case 4	**Higher**	**Lower**	**No Tolerance**	**Neighbors' ID**
Case 5	**Lower**	**Higher**	**No Tolerance**	**Neighbors' ID**
Case 6	**Equal**	**Equal**	**No Tolerance**	**Neighbors' ID**

Case One and Two demonstrate when the social pressure for a particular GroupID can be tolerated by the agent. In Case One, the agent's historical identity preference is for group one, HistID1 > HistID2. The agent's social pressure tolerance is also higher than the highest percentage of neighbors with the same GroupID. Case Two is the same decision logic, but is for when the agent's HistID2 > HistID1. The agent can withstand the social pressure from its neighbors and chooses group two. Case Three is when the two HistIDs are equal and the agent can tolerate the social pressure from its neighbors. This agent would choose GroupID0.

Cases Four through Six demonstrate agent decisions when they cannot tolerate the social pressure from their neighbors' group choices—the agent's social pressure tolerance is lower than the highest percentage of the neighbors' same GroupID. Case Four has the agent's HistID1 > HistID2, but because the agent cannot withstand its neighbors' pressure, it will choose the neighbors' majority GroupID. In Case Five, the historical identity preference is for GroupID2, but the agent must give in to social pressure and choose the neighbors' majority GroupID. Case Six demonstrates the outcome when the

HistIDs are equal, but the agent's tolerance level is too low to withstand social pressure from neighbors' majority GroupID.

It is possible for the agent to agree with the majority of its neighbors. In these cases (not shown in the chart), the agent just keeps its group choice based on its historical identity preference. Therefore, even if an agent cannot withstand the neighbors' social pressure, if the social pressure is for the group choice that already matches the agent's historical identity preference, no change is needed. The agent luckily agrees with the surrounding majority.

Finally, this chapter will be organized by the same hypotheses as in Chapter Four:

H_1: Agent totals for GroupID1, GroupID2, and GroupID0 will not be equal between the two models.

- GroupID totals at the end of each model run will be compared across HistID means for each model.
- Chi-square analysis is used to determine if the totals are statistically different.

H_2: Aggregate group emergence patterns will differ across comparable HistID mean combinations between the two models.

- Group existence and patterns will be descriptively compared across HistID means for each model.
- Group totals will be counted across comparable HistID mean combinations and a t-test will be used to determine if the group total differences are statistically significant.

H_3: Predicted probabilities of group choice will be different across comparable HistID mean combinations between the two models.

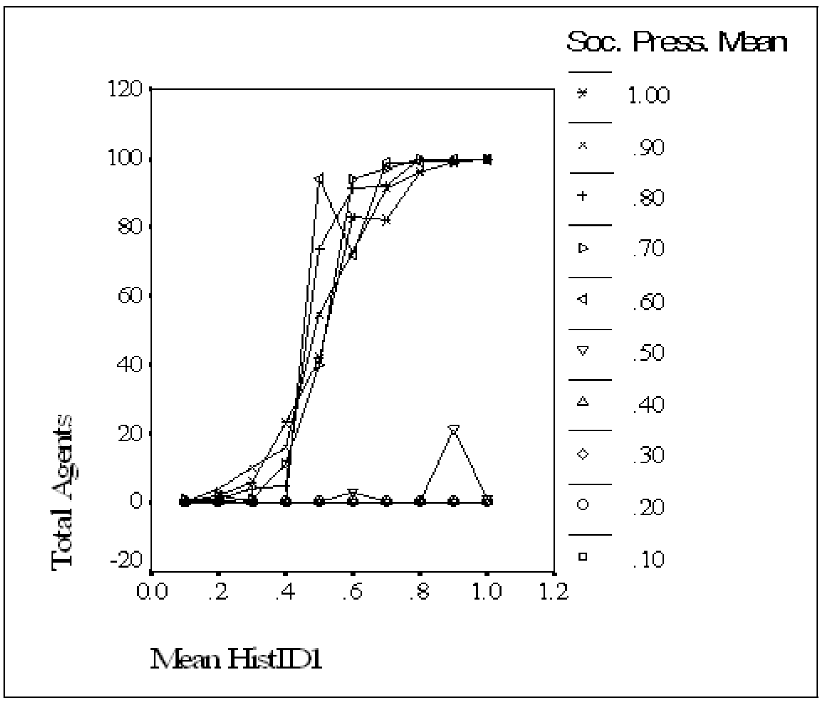
- Predicted probability means for each GroupID will be compared using a two-proportion z-test

In conjunction to the comparison between the Identity Salience and Supra-Additive models, this chapter will examine how social pressure and tolerance levels interact with multiple identities with respect to group choice and group emergence.

5.1 Agent Totals by GroupID: Identity Salience Model

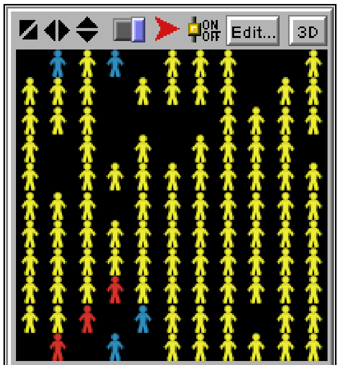
This section examines agent totals for GroupID1, GroupID2, and GroupID0 for the Identity Salience model given the addition of social pressure tolerance levels. Graph 5.1 depicts the agent totals for Group ID1 as the means of HistID1 and Social Pressure Tolerance interact.

Graph 5.1 Total Agents with GroupID1, Identity Salience Model



The most noticeable feature of this graph is that the social pressure inhibits group choice for all HistID1 means until agents' tolerance is at least 0.6. This means that agents cannot choose GroupID1 until their ability to withstand the social, SPTol, reaches a mean of 0.6. Some agents choose GroupID1 with a social pressure mean of 0.5 when the HistID1 = 0.6 and 0.9. For these cases, there are too few agents (three agents) that random attribute assignment nor can location be ruled out. The illustration below shows where the red agents with GroupID1 are located when HistID1 = 0.6 and SPTol = 0.5.

Illustration 5.1 Ideologues, Identity Salience Model



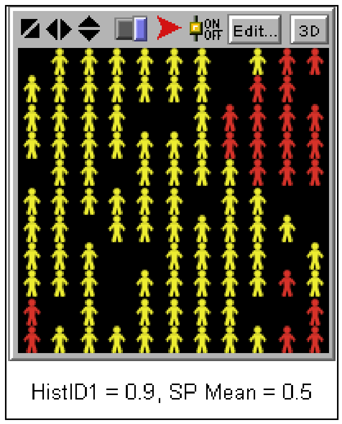
HistID1 = 0.6, SP Mean = 0.5

These agents' social pressure tolerances are higher than the MaxNeighID. Essentially, there were so few neighbors within the agents' vision that the MaxNeighID percentage was within their tolerance levels and the agents chose GroupID1. Group choice is affected by where the agents are located within the grid. This is an example of when the environment is important in agent decision making. Substantively, people who are not surrounded by social pressure—whether from neighbors or biased information—will be more inclined to make an untainted and independent decision.

However, when HistID1 = 0.9 there are 21 agents. This indicates that there may be social pressure influence. Illustration 5.2 depicts this case. While there are only 21 agents with GroupID1 (red agents), they are definitely clustered in a group formation. This clustering of four-agent groups indicates that a few initial agents influence the decisions of their neighbors and influenced them to choose GroupID1. While the initial

GroupID1 agents may have been able to choose GroupID1 because of chance environmental circumstances (few neighbors with GroupID0), the fact that more neighbors are able to then chose GroupID1 than when SPTol = 0.5 demonstrates possible effects from social pressure on group choice.

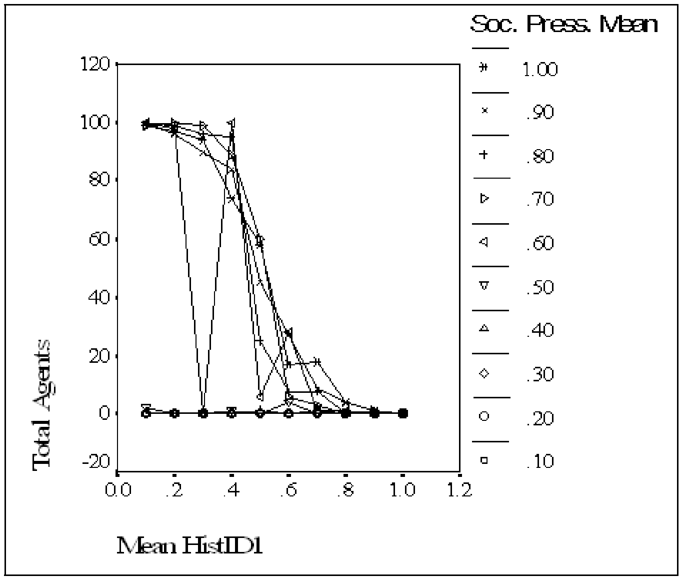
Illustration 5.2 Growing Minority Population



Moreover, it is not until the combination of HistID1 = 0.5 and Social Pressure Tolerance = 0.6 that the ID strength is strong enough and the tolerance high enough to withstand the neighbors' social pressure without dependence on being fortunately located on the grid. Once the social pressure tolerance surpasses 0.6, agents have enough ability to withstand GroupID0 social pressure for all strengths of HistID 1 means. At this point, HistID1 decides GroupID choice and not the influence from the neighbors' GroupIDs. When Social Pressure Tolerance = 0.1 to 0.5, not even high HistID1 strengths are enough to help generate agent totals.

As the social pressure tolerance increases, lower HistID1 means are able to gain agents. That is, increasing tolerance *compensates* for weak HistID1 identification. However, for mid-range HistID1 means (approximately 0.5-0.8), totals *decrease* for the same social pressure tolerance ranges (as they increase past 0.6 but with the exception of when the social pressure mean equal 0.9 and 1). This indicates a diminishing return from high social pressure tolerance when the HistID is also high.

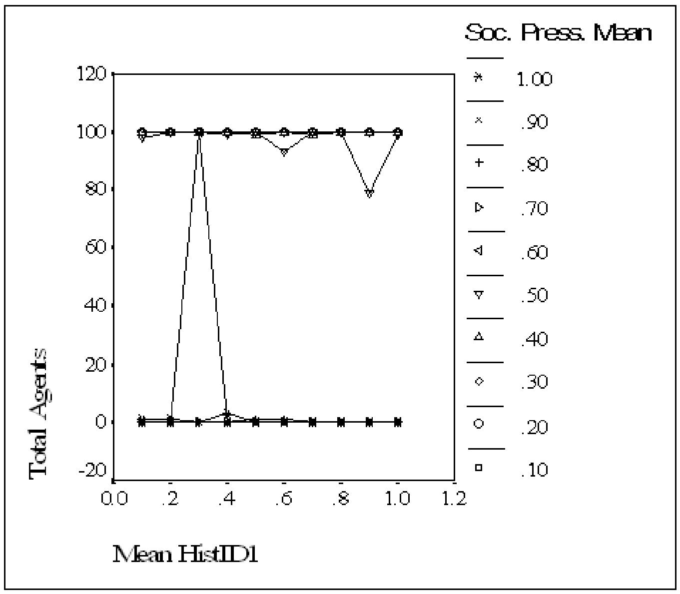
Graph 5.2 Total Agents with Group ID2, Identity Salience Model



GroupID2 Totals are shown in Graph 5.2 above. As expected, results are opposite to the GroupID1 Totals because of the dependence of HistID2 on HistID1. For all Social Pressure Tolerance levels as the Mean of HistID1 increases to 0.5, there are no agents with GroupID2. There is a transition when the Social Pressure Tolerance level hits 0.6 and agents begin to choose GroupID2.

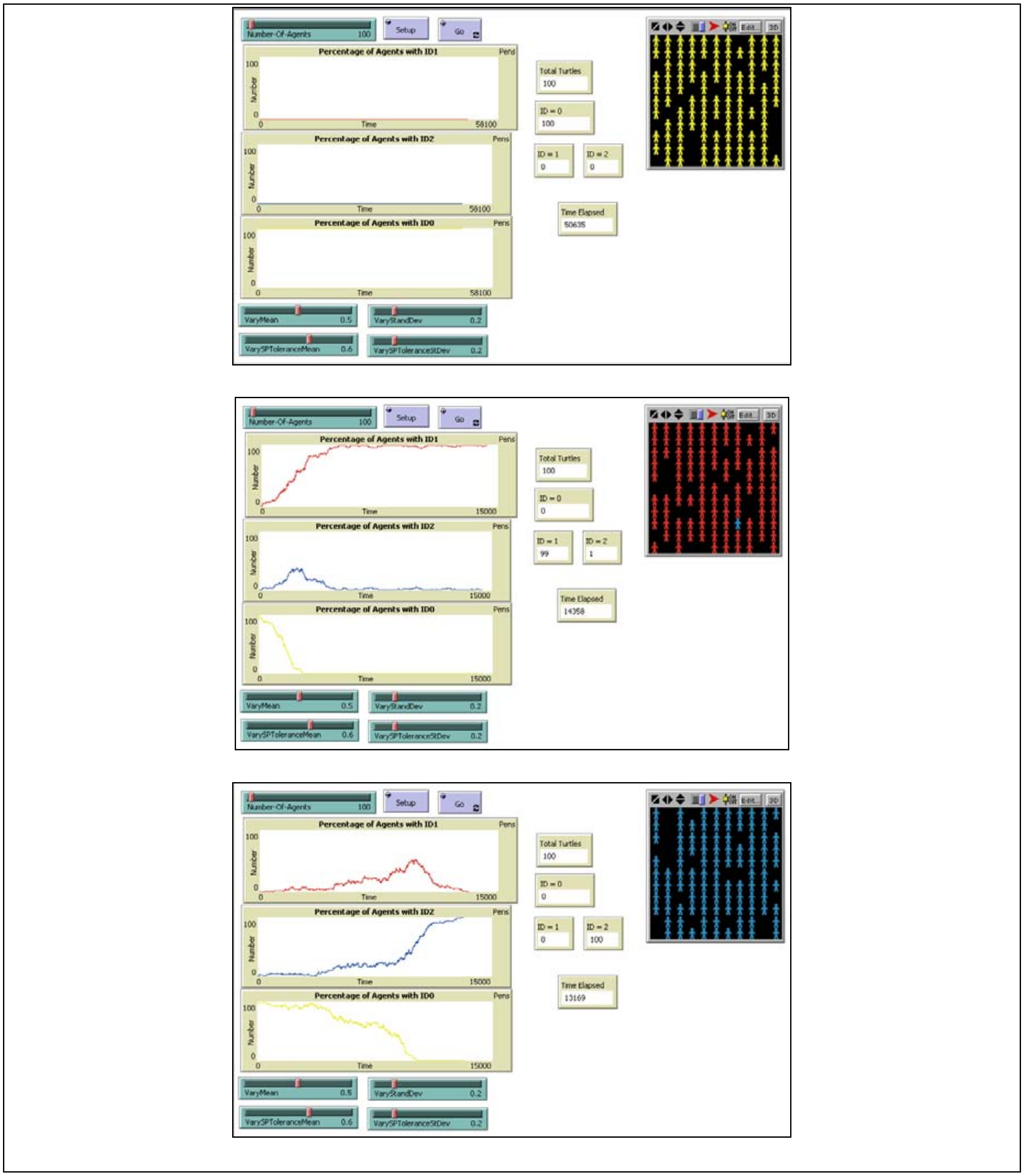
The most marked difference in the Identity Salience model when social pressure is added are the agent totals for GroupID0. As the mean for Social Pressure Tolerance increases (for all HistID1 means), agent totals go from *all* GroupID0 to *no* GroupID0. Therefore, the strength of HistID1 does not significantly influence GroupID0 totals. There is a transition between HistID1 = 0.5 and 0.6 where the totals do fluctuate according to HistID1 means. However, once the Social Pressure Tolerance mean becomes 0.7, agents are able to withstand all social pressure from their neighbors and change their GroupID from the initial start of the model run. Agents need to have medium-to-high SPTol in order to resist the GroupID0 majority.

Graph 5.3 Total Agents with GroupID0, Identity Salience Model



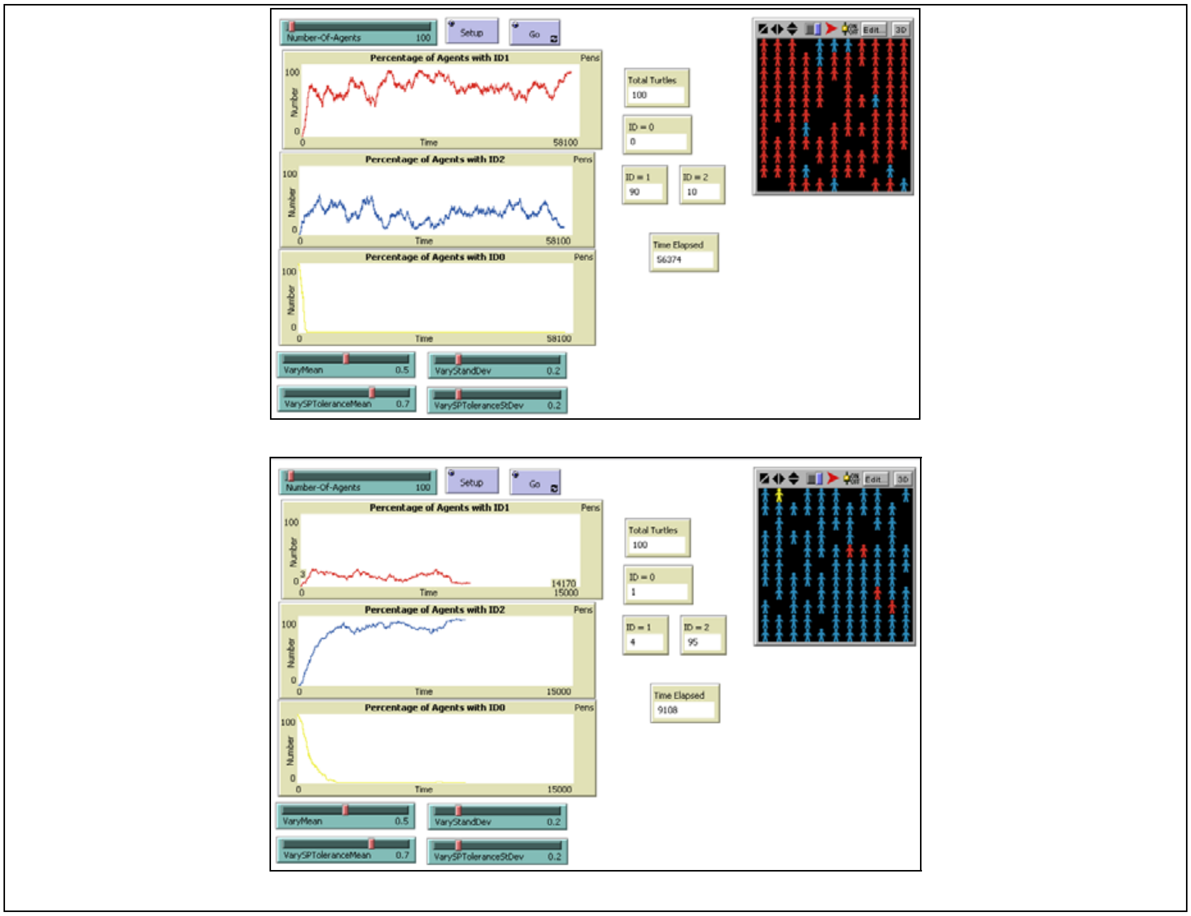
Further investigation into the fluctuation that occurs when HistID1 = 0.5 shows that the GroupID majorities change depending upon SPTol level and initially assigned agent characteristics. Illustration 5.3 shows the different majorities when HistID1 = 0.5 and SPTol = 0.6. All three GroupIDs can potentially become (or remain) the majority GroupID. This depends upon how many agents are pre-assigned SPTol levels that are high enough to withstand the GroupID0 majority at start-up.

Illustration 5.3 Varying GroupID Majorities, HistID1 = 0.5



Agent location also plays a role in which GroupID will become a majority. An agent that has high SPTol levels and that is located next to open spaces on the grid is able to have lower neighbor GroupID percentages. These two conditions provide an opportunity for the agent to choose its own GroupID.

Illustration 5.4 Varying GroupID Majorities, HistID1 = 0.5 and SPTol > 0.6



Next, this political ideologue or ideologue—a lone agent who has been able to choose its own GroupID against the social pressure from the majority GroupID—needs to influence other agents to change their GroupID. This depends again upon location and initially assigned agent characteristics. If enough agents are able to change their GroupID away from the majority GroupID a cascade can occur, increasing numbers of the minority GroupID. The increasing numbers change the neighborhood make-up and GroupID percentages in favor of the once minority GroupID.

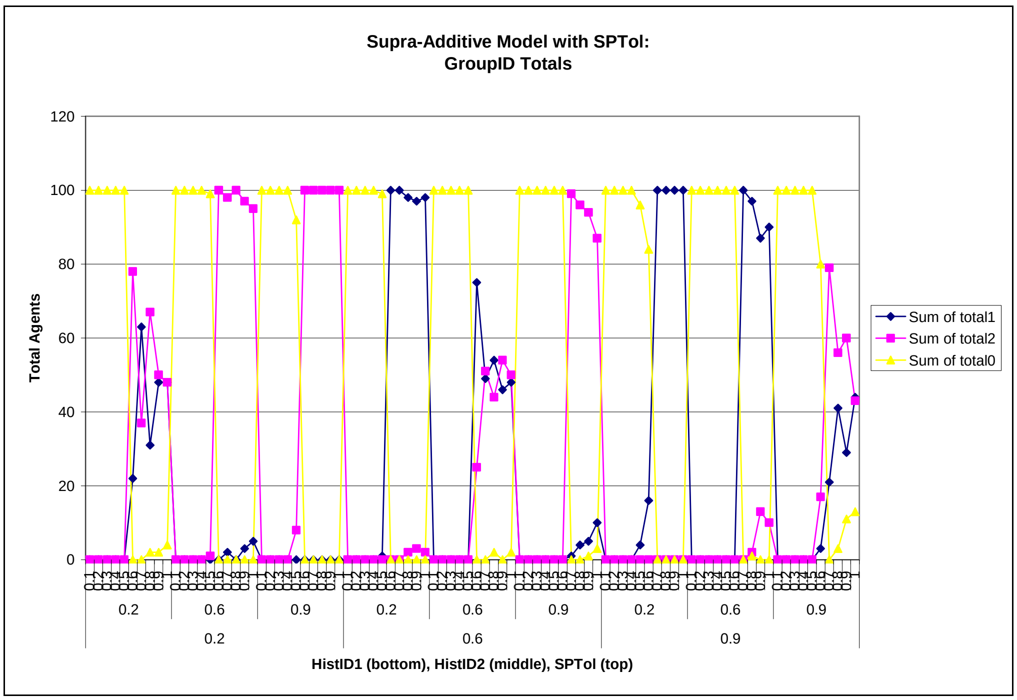
SPTol is another factor determining which GroupID can form. When SPTol < 0.6 agents cannot break away from the GroupID0 majority when the model starts. When SPTol = 0.6, GroupID0 can still form if agent characteristics and location allow. However, when SPTol > 0.6, GroupID0 does not form at all. Agents are able to withstand social pressure easily and the majority GroupID fluctuates between GroupID1 and GroupID2. This majority GroupID fluctuation occurs only when HistID1 = 0.5 (and HistID2 = 0.5; any other mean value puts one HistID greater than the other making it dominate.

5.2 Agent Totals by GroupID: Supra-Additive Model

When multiple identities are defined as supra-additive, the introduction of social pressure makes it more difficult for agents to break out of their initial assignment to GroupID0. Graph 5.4 shows the necessity of having medium to high Social Pressure Tolerance in order for agents to choose either GroupID1 or GroupID2. Most of the trend for HistID1 and HistID2 means follow the decision parameters logic. As either HistID increases, agents need medium to high Social Pressure Tolerance to gain any agents in their respective group. However, Social Pressure Tolerance levels have made the dynamics of the totals more sensitive to any changes.

For example, when HistID1 mean and HistID2 mean are both low, agents need a Tolerance level of 0.6 and 0.9 to choose either GroupID1 or GroupID2. As the HistID1 mean is held constant and the HistID2 mean increases, this increase pre-dominates agents' choices for GroupID2 even as their Social Pressure Tolerance levels are increasing. For agents to choose GroupID1 when their identification to HistID1 is low, their identification to HistID2 must also be low. They need to have medium to high Social Pressure Tolerance to withstand neighbors' pressure to either maintain their originally assigned GroupID0 or to choose GroupID2.

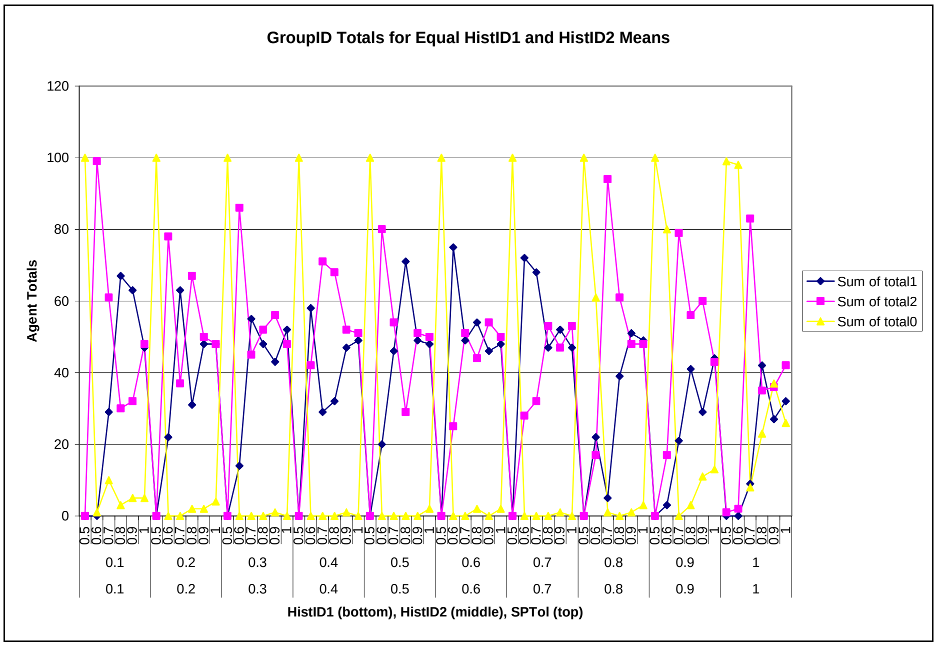
Graph 5.4 GroupID Totals, Supra-Additive Model



When the HistID1 mean equals 0.6, GroupID1 choices significantly increase. That is, this medium level of identification to HistID1 is strong enough to withstand increasing HistID2 means, but *only* for medium to high Social Pressure Tolerance levels. At this middle point, Graph 5.4 clearly depicts a cross-over in totals as HistID2 increases—GroupID1 choices begin to decrease and GroupID2 choice begin to increase. Also, at this point in the graph, it becomes noticeable that when HistID1 equal 0.6 and

HistID2 equals 0.9, low and medium Social Pressure Tolerance levels are not enough to have agents break away from their initial state of GroupID0.

Graph 5.5 GroupID Totals for Equal HistIDs



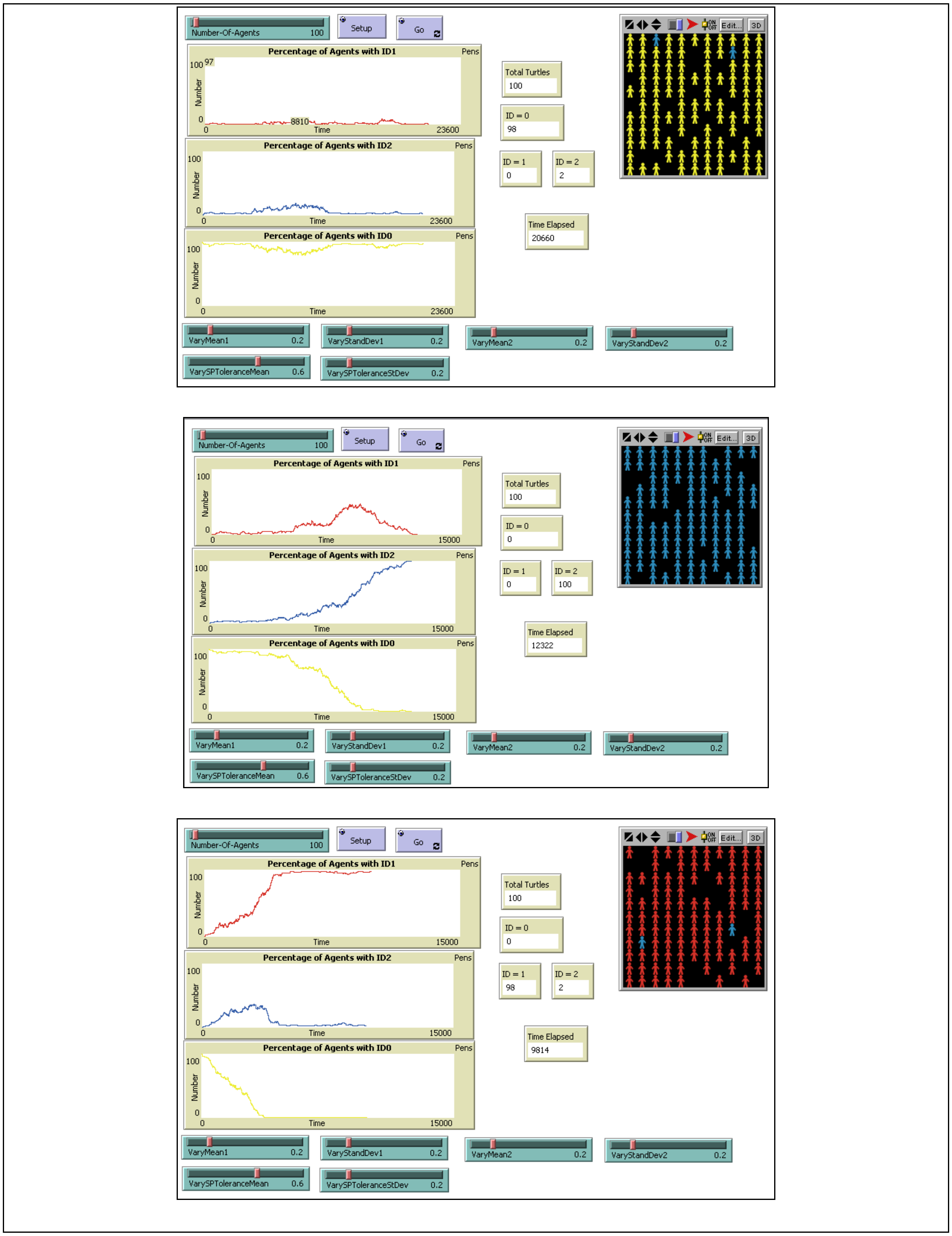
This difficulty for agents to change their initial assignment of GroupID0 is more prevalent as the HistID1 mean increases to 0.9 and the HistID2 mean increases from low to high levels of identification. It is logical that at this point when HistID2 is low, there will be more agents with GroupID1, especially as agents' Social Pressure Tolerance levels increase. What is not expected is that even at this high level of HistID1 and as HistID2 increases, agents' still keep their original GroupID0 state when Social Pressure Tolerance levels are low and medium. It is a little counterintuitive since both HistID means are high. One would expect more consistent GroupID1 choices even as GroupID2 increases. In fact, when agents' Social Pressure Tolerance is low (0.2), no agents choose

GroupID1 or GroupID2—even as both HistID1 and HistID2 means are *increasing*. Overall, the effect from introducing agent interaction and social pressure is most evident in GroupID0 totals.

A final characteristic of GroupID totals for this version of the Supra-Additive model occurs when HistID1 and HistID2 have the same means. The majority GroupID varies depending upon initially assigned agent characteristics and subsequent agent interaction. Graph 5.5 shows the GroupID totals when the two HistIDs are equal. Agent totals have high variation around the 50-agent mark after social pressure tolerance reaches 0.6. SPTol must be strong enough to withstand the GroupID0 majority. Further investigation yields that the majority GroupID can actually change completely. Illustration 5.5 shows the NetLogo screen output for when the majority GroupID is GroupID0, GroupID1, and GroupID2.

Variation in the majority GroupID depends upon several events, all to which resulting GroupID totals are sensitive. There must be enough agents assigned medium-high SPTol levels that can withstand the majority GroupID0 at t = 1. Or these agents must randomly move to a position on the grid that has open surrounding spaces; this lowers the need for a high tolerance level because the overall neighbor percentage is lower. These above factors provide the opportunity for an agent to choose either GroupID1 or GroupID2.

Illustration 5.5 Variation in Majority GroupID when HistIDs are Equal



Once an agent chooses another GroupID, this agent must be able to influence other agents' decisions. This also depends upon agent location and its surrounding environment. This ideologue must be located near open grid spaces to again lower the neighbor percentages for the other agents that can potentially be influenced by this lone agent. The neighbors must have lower SPTol levels to succumb to social pressure.

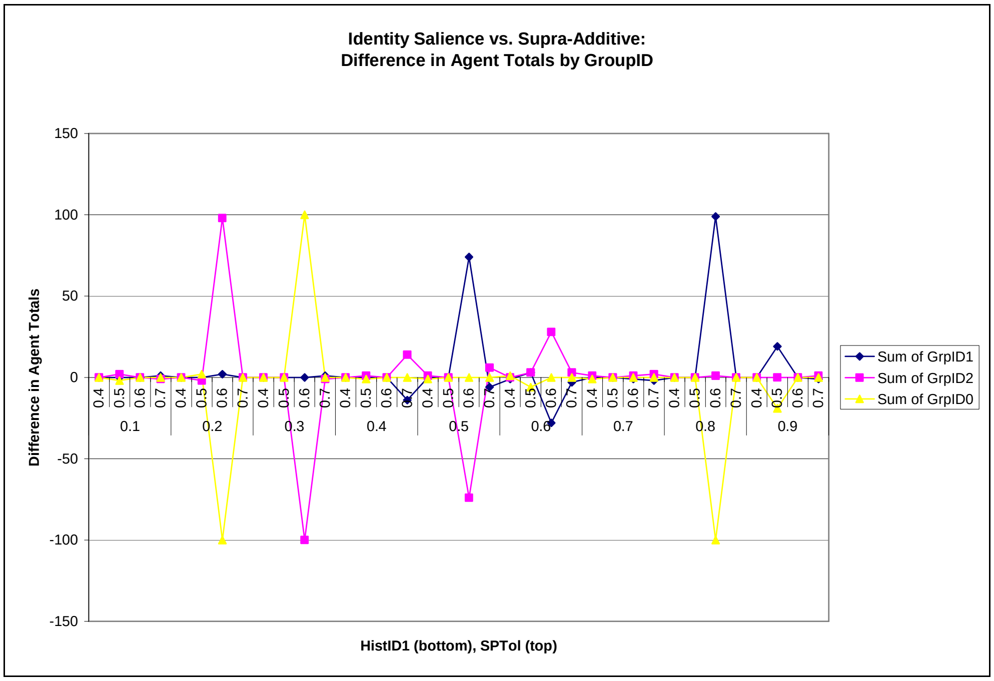
As more agents choose either GroupID1 or GroupID2, the need to be near open spaces decreases because the social pressure then comes from the amount of surrounding agents with these GroupIDs. However, in order to pressure the remaining agents into choosing GroupID1 or GroupID2, the remaining agents must have lower SPTol levels than the percentage of the surrounding majority GroupID. Essentially, when the two HistID means are equal, agent decisions are then based upon other factors sensitive to the initial conditions of agent characteristic assignment and agent location on the grid.

5.3 Agent Totals by GroupID: Model Comparison

Next, this section compare agent totals for each GroupID and determines if there is a statistical difference between the values for the Identity Salience and Supra-Additive model versions. H_1 is that the models' agent totals are indeed different because of their different identity assumptions. The following HistID1, HistID2, and SPTol means are compared: for HistID1 and HistID2 (0.2, 0.6, and 0.9) and for SPTol (0.2, 0.5, 0.6, and 0.9). These means were chosen because they best illustrate agent totals for low, medium, and high means. Because of the increased variation when the SPTol mean is 0.5 and 0.6

(i.e. the fluctuation points seen in Graph 5.4), these two means were included, too. Graph 5.6 shows the difference in agent totals between the two model versions.

Graph 5.6 Difference in Agent Totals for Each GroupID



While most of the chosen mean combinations have the same GroupID totals, there are some combinations that yield considerable differences. It is not surprising that these differences occur when the SPTol mean is 0.6, but further investigation is warranted. Table 5.2 shows the χ^2 test results to determine if the agent totals are significantly different and if H_1 should be rejected (significance level of 0.05). The mean combinations that are statistically different are in bold.

Table 5.2 χ^2 Test, Identity Salience (IS) v. Supra-Additive (SA)

HistID1	HistID2	SPTol	IS- ID1	SA-ID1	IS- ID2	SA- ID2	IS-ID0	SA- ID0	Chi2	df	p
0.2	0.8	0.2	0	0	0	0	100	100	0.00	0	1.000
0.2	0.8	0.5	0	0	0	2	100	98	2.02	1	0.155
0.2	**0.8**	**0.6**	**2**	**0**	**98**	**0**	**0**	**100**	**200.00**	**2**	**0.000**
0.2	**0.8**	**0.9**	**4**	**0**	**96**	**100**	**0**	**0**	**4.08**	**1**	**0.043**
0.6	0.4	0.2	0	0	0	0	100	100	0.00	0	1.000
0.6	0.4	0.5	3	0	4	1	93	99	4.99	2	0.083
0.6	**0.4**	**0.6**	**72**	**100**	**28**	**0**	**0**	**0**	**32.56**	**1**	**0.000**
0.6	0.4	0.9	73	78	27	21	0	1	1.92	2	0.384
0.9	0.1	0.2	0	0	0	0	100	100	0.00	0	1.000
0.9	**0.1**	**0.5**	**100**	**2**	**0**	**0**	**0**	**98**	**17.74**	**1**	**0.000**
0.9	0.1	0.6	100	100	0	0	0	0	0.00		1.000
0.9	0.1	0.9	99	100	1	0	0	0	1.01	1	0.316
0.8	0.2	0.2	0	0	0	0	100	100	0.00	0	1.000
0.8	0.2	0.5	0	0	0	0	100	100	0.00	0	1.000
0.8	**0.2**	**0.6**	**99**	**0**	**1**	**0**	**0**	**100**	**200.00**	**2**	**0.000**
0.8	**0.2**	**0.9**	**96**	**100**	**4**	**0**	**0**	**0**	**4.08**	**1**	**0.043**
0.4	0.6	0.2	0	0	0	0	100	100	0.00	0	1.000
0.4	0.6	0.5	0	0	1	0	99	100	1.01	1	0.316
0.4	0.6	0.6	0	0	100	100	0	0	0.00	0	1.000
0.4	0.6	0.9	16	16	84	84	0	0	0.00	1	1.000
0.1	0.9	0.2	0	0	0	0	100	100	0.00	0	1.000
0.1	0.9	0.5	0	0	2	0	98	100	2.02	1	0.155
0.1	0.9	0.6	0	0	100	100	0	0	0.00	0	1.000
0.1	0.9	0.9	0	0	100	100	0	0	0	0	1.000

The majority of agent totals for these mean combinations can be considered the same. However, there are two circumstances that can lead to the models producing different agent totals. The first is when the SPTol mean is 0.6. At these tolerance levels, GroupID totals are dependent upon the initially assigned agent characteristics and random movement. It is possible for the Identity Salience and Supra-Additive models to produce the same agent totals, but in these runs, they did not. Illustrations 5.6 – 5.7 show the outcome possibilities for each model that are in Table 5.x when HistID1 = 0.9, HistID2 = 0.1, and SPTol = 0.5.

Illustration 5.6 Outcome One: Identity Salience Model

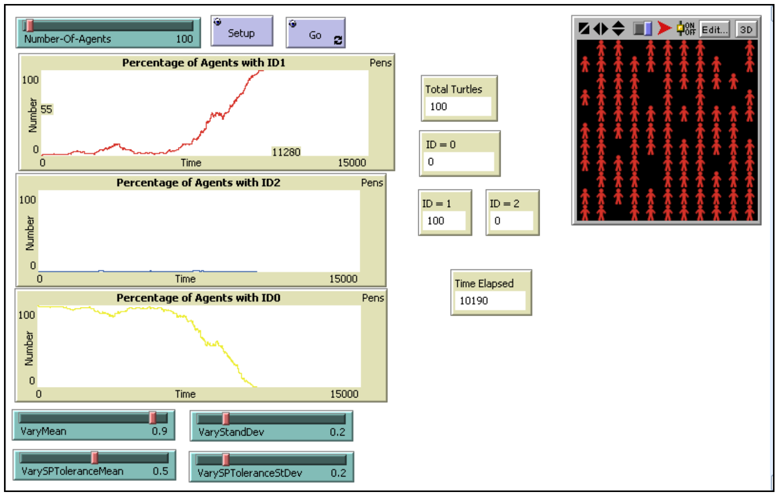
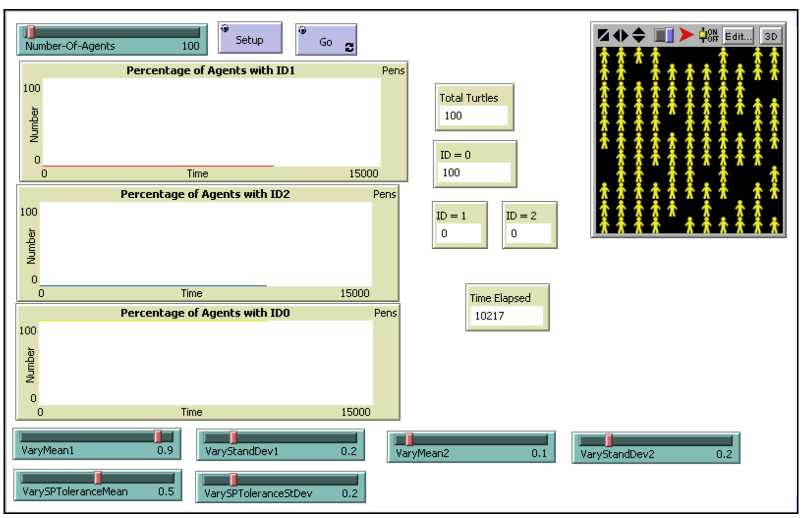


Illustration 5.7 Outcome One: Supra-Additive Model



It would be expected that given the very high HistID1 mean, all agents would immediately choose GroupID1. What occurred in these runs shows the importance of understanding the sensitivity of initial conditions that can generate very different outcomes. In the Identity Salience model (Illustration 5.6), there was at least one ideologue agent that withstood agent social pressure to choose GroupID1; this agent also had the opportunity given its movement around the grid to influence and change other agents' group choice leading to a GroupID1 cascade.

In the Supra-Additive model outcome (Illustration 5.7), there were no ideologues and agents could not break out of the GroupID0 choice. Another situation is that there are not enough ideologues to influence a GroupID1 cascade and the GroupID0 agents maintain their domination. However, Illustrations 5.8 – 5.9 show how the same mean combinations can lead to the opposite results for each model.

Illustration 5.8 Outcome Two: Identity Salience Model

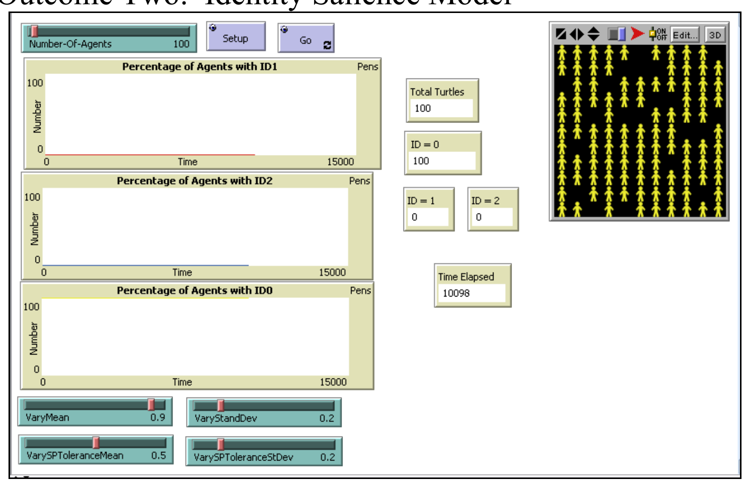


Illustration 5.9 Outcome Two: Supra-Additive Model

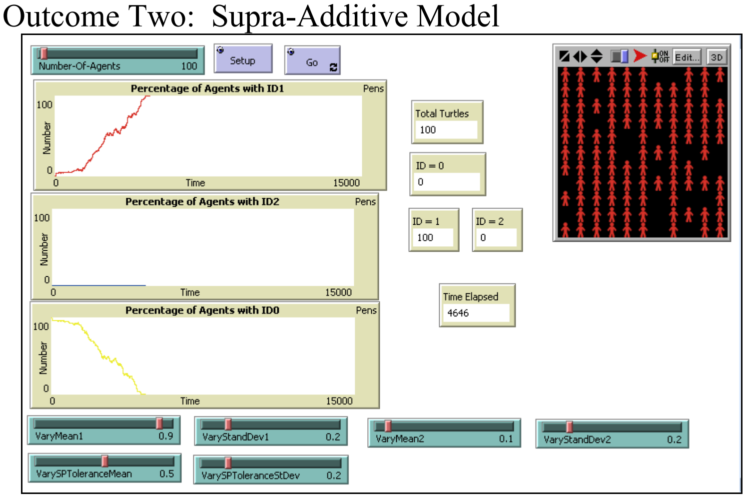


Illustration 5.8 shows that it is possible for the Identity Salience model to generate the same results (for these mean combinations) as the Supra-Additive model in Illustration 5.7. Similarly, Illustration 5.9 shows that is possible for the Supra-Additive model to produce the same results as the Identity Salience model in Illustration 5.6. What determines the different outcomes are the agents' characteristics (which then determines if there are any ideologues) and agent movement (which influences the ideologues' ability to change other agents' group choice). In effect, these mean combinations (around the fluctuation point) have the opportunity to generate different agent totals, but the mechanism which allows the models to have different results is the same.

The second circumstance that Table 5.2 shows generates statistically different agent totals between the Identity Salience and Supra-Additive models essentially results from the randomness put into the models. These combinations (when SPTol = 0.5 and 0.9) produce similar results between the models though some combinations are considered statistically the same, while others with just slightly more variation (one or two agents more) are barely significantly different. There is no larger variation between the mean combinations to indicate that there is as great sensitivity to initial conditions as in the previous example.

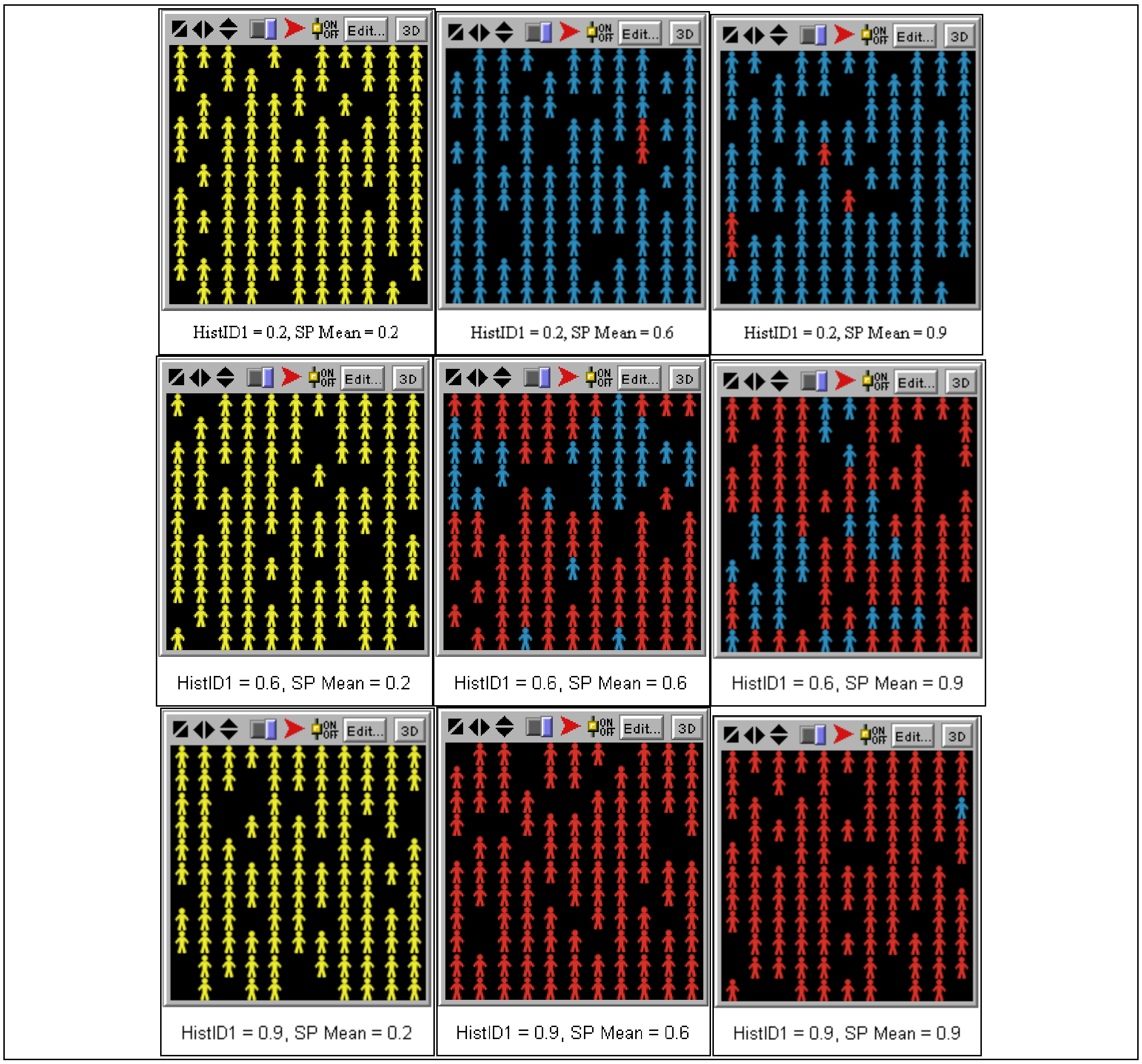
Overall, given most of the HistID1, HistID2, and SPTol mean combinations are the same between the Identity Salience and Supra-Additive models, it is difficult to accept H_1. The two circumstances that were shown to produce statistically different GroupID totals can be explained. When SPTol = 0.6, the two models generally produce the same results. However, there is the opportunity for the models to have opposite agent totals, but this occurs in the same way for each model. Similarly, when SPTol = 0.5 and 0.9, agent totals differ slightly between the Identity Salience and Supra-Additive models, but sometimes this variation is significantly different and other times it is not. When these mean combinations are statistically different with p-values just under 0.05, they vary by only one or two agents (and no more). As in the Basic Model, the agent totals for each GroupID can be considered the same between the Identity Salience and Supra-Additive models.

5.4 Group Emergence: Identity Salience Model

Agent interaction and Social Pressure Tolerance do affect the process of group emergence. Group clustering is now evident because of the impact one agent can have on its neighbors' GroupID choices. Illustration 5.10 shows group emergence as both HistID and SPTol increase. Whereas agents in the basic Identity Salience model version choose different GroupIDs, they are scattered throughout the grid. Group emergence is dependent on the random assignment of agent locations. However, when agent interaction and social pressure are added to agents' decision making, groups form in a domino effect of 4-agent neighborhoods.

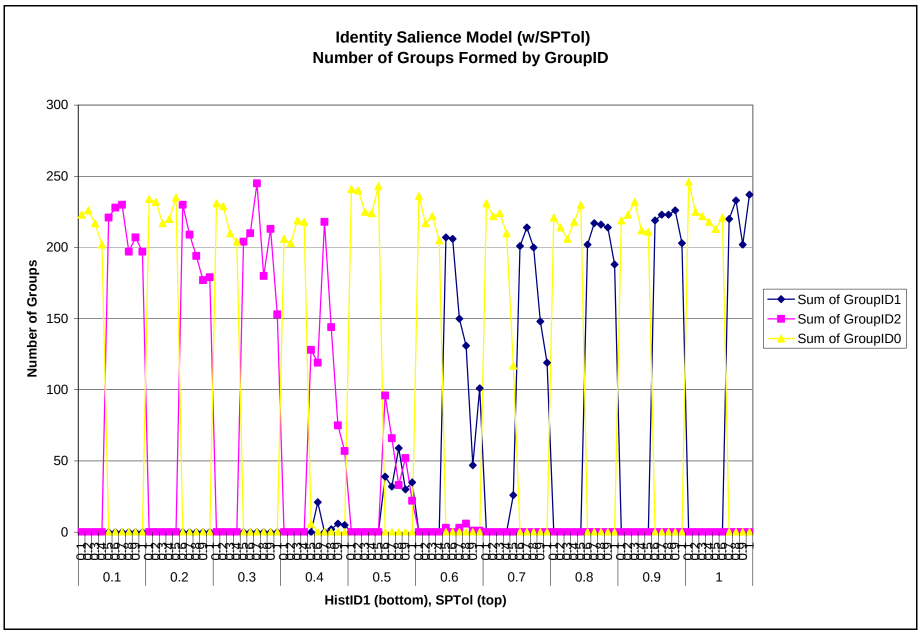
Social pressure makes it more difficult for groups to form, though. Once agents do begin to choose GroupIDs, they can influence their neighbors' decisions. There is a very strict delineation between group emergence when Social Pressure Tolerance = 0.5 and 0.6. Groups do not start to form until the Social Pressure Tolerance = 0.6. Until then, all agents maintain their initial GroupID0. Illustration 5.10 shows that the high HistID1 mean 0.9 is still not strong enough for even the low Social Pressure Tolerance level of 0.2 to change agents' GroupIDs. After 0.6, group formation is dependent upon the strength of an agent's HistID. In the middle HistIDs and Social Pressure Tolerance levels, both group flourish and the majority GroupID can fluctuate as shown in the totals section. At the high ends of both HistID means and Social Pressure Tolerance means, only one GroupID1 (red) or GroupID2 (blue) dominate group formation completely.

Illustration 5.10 Group Emergence, HistID1 and SPTol Mean



Next, calculating the total groups formed in this Identity Salience model version will help to indicate how social pressure and tolerance levels affect group emergence. Graph 5.7 shows the number of four-agent groups formed for each GroupID. It is clear that group emergence is definitely influenced by social pressure tolerance levels.

Graph 5.7 Number of Formed Groups, Identity Salience Model



Groups cannot form until agents have a social pressure tolerance level of at least 0.5; at this level, agents are able to withstand the pressure to maintain GroupID0. When the HistID1 mean is low (0.1-0.3), only GroupID0 groups are able to form (or rather, agents maintain their GroupID0 groups). When HistID1 is 0.4-0.6, agents need a SPTol level of 0.5, too, except when the HistID1 mean is 0.5. When the HistID1 mean is 0.5, agents need a higher SPTol level of 0.6 to form groups. This makes sense because when the agents are essentially equal, the higher SPTol level is needed to differentiate agents enough for agents to choose a different GroupID. The number of groups are lower than the other HistID-SPTol combinations because both GroupID1 and GroupID2 are able to emerge when HistID1 = 0.5.

When agents have a high HistID1 mean (0.7-1.0), the SPTol level that is necessary to allow group formation also varies between 0.5-0.7. However, the number of formed groups begins to decrease as tolerance levels increase. For example, when HistID1 = 0.7 and HistID2 = 0.3, there will be more agents choosing GroupID1. The HistID1 mean is high enough for agents to benefit from a SPTol mean of 0.5; the HistID1 mean is too low to gain benefit from this medium SPTol mean. However, as the SPTol increases, there are more agents that are able to choose GroupID2 because of the higher tolerance level. While there are more GroupID2 agents, there are still not enough to form groups, but this increase in GroupID2 agent totals decreases the number of GroupID1 agents and decreases the overall number of possible GroupID1 groups. This relationship between the HistID1, HistID2, and SPTol means explains why increasing tolerance levels do not always generate more groups and why there appears to be diminishing returns from both strong levels of identification with a HistID and high social pressure tolerance.

When the group totals are compared to the previous chapters' results, it is clear that medium to high (0.5-1.0) social pressure tolerance levels increase group emergence. While it takes a tolerance level of at least 0.5 to form any groups, when there are enough agents to form groups the total groups formed is significantly higher than in the Identity Salience Basic Model version (Graph 4.7). SPTol allows groups to form at lower HistID levels (when HistID = 0.4 instead of 0.5) and when groups do form, there are more. However, it takes higher SPTol means to generate the same amount groups as the HistID1 mean increases. This is because higher SPTol levels also help agents with lower

HistID2 means choose GroupID2, lowering the overall possible number of GroupID1 agents.

5.5 Group Emergence: Supra-Additive Model

To assess how social pressure and agent interaction affect group emergence for this second version of the Supra-Additive model, all of the possible low (mean = 0.2), medium (mean = 0.6), and high (mean = 0.9) HistID1, HistID2, and Social Pressure Tolerance mean combinations are analyzed. Illustration 5.11 provides the mean combinations while holding the HistID1 mean low. In general, as agents' Social Pressure Tolerance increases, they are able to choose either GroupID1 or GroupID2. When Social Pressure Tolerance = 0.2, it is too low for the agents to change their initial GroupID = 0. Moreover, the low HistID1 is too low to counter the increasing HistID2 mean, except when the HistID2 mean is also low *and* agents' Social Pressure Tolerance is 0.6 or 0.9. Only then is there clustering of both GroupIDs. Otherwise, agents choose GroupID2.

As the HistID1 mean increases to 0.6 in Illustration 5.12, low Social Pressure Tolerance negatively affects agents ability to withstand social pressure; agents remain with their GroupID = 0. However, the medium and high Social Pressure Tolerance levels provide enough forbearance for the majority of agents to choose GroupID1. There are a few GroupID2 "political ideologues" only when their Tolerance levels are high. These agents are able to withstand social pressure from their GroupID1 neighbors and choose GroupID2. Note that there are too few to influence any other agents' decisions.

Illustration 5.11 Group Emergence, Low HistID1 Means

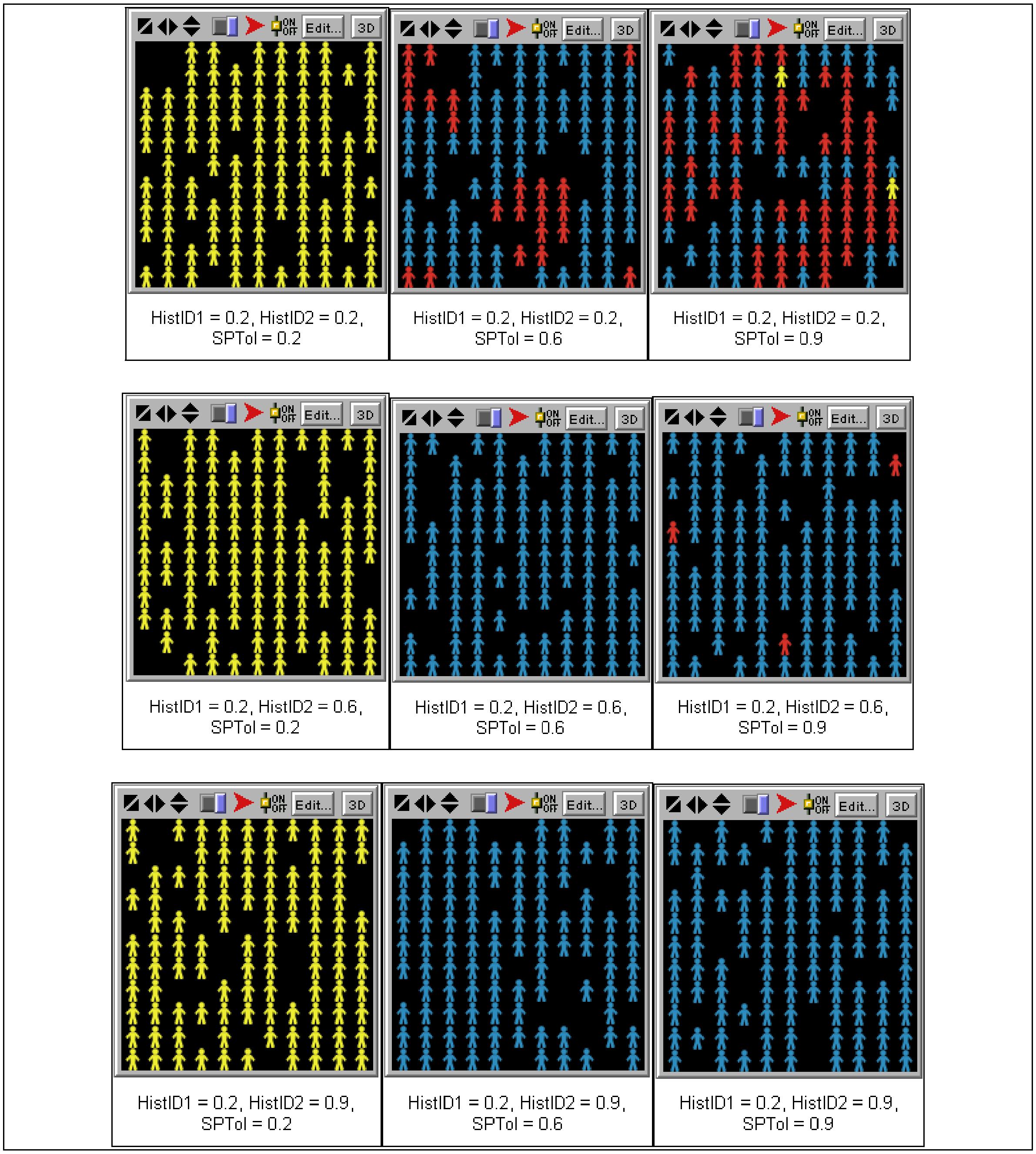
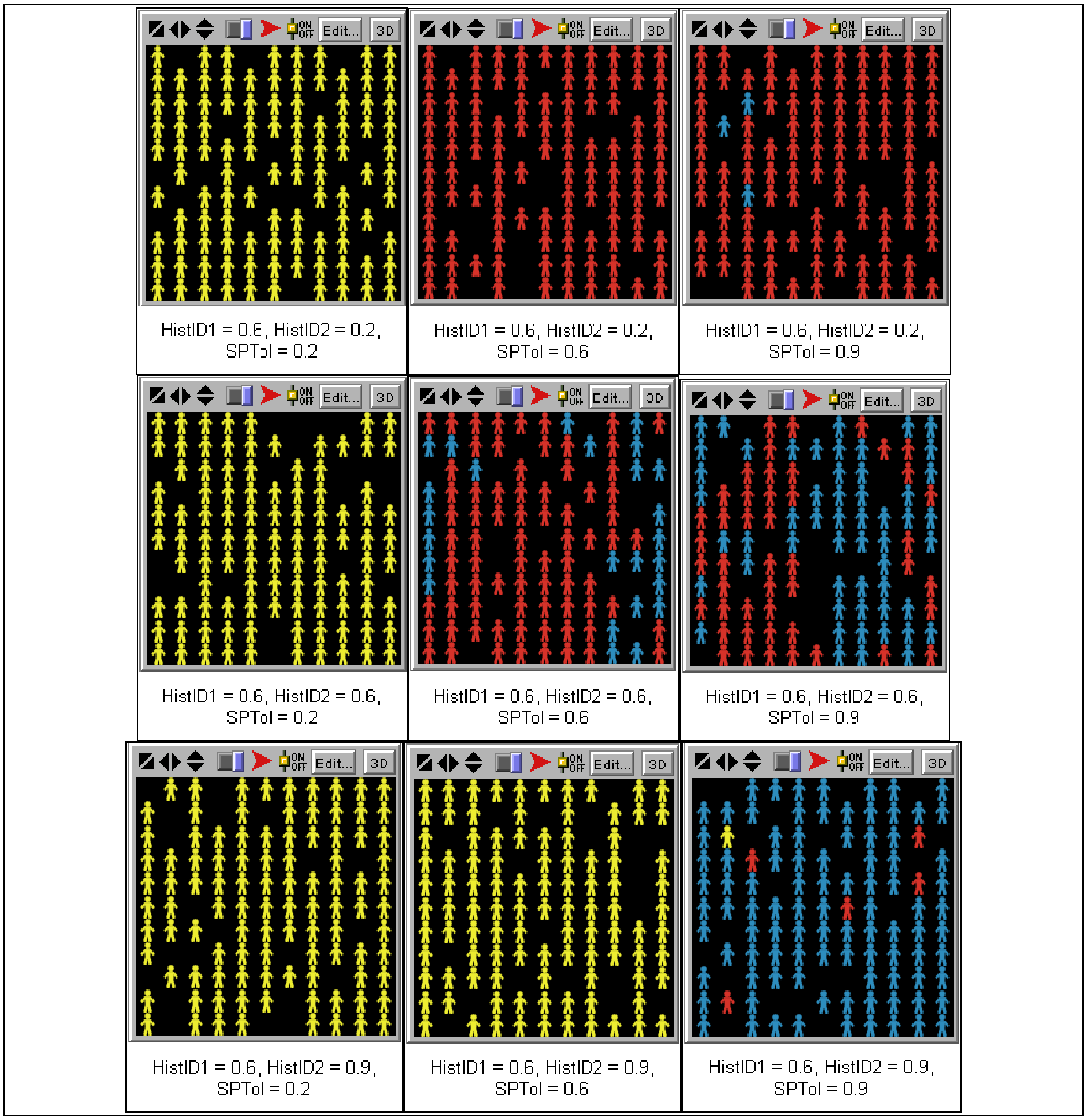


Illustration 5.12 Group Emergence, Medium HistID1 Means



Clustering of agents is found only when both HistIDs are medium. As agents' Social Pressure Tolerance levels increase from medium to high, more agents are able to choose GroupID2. Therefore, while the HistIDs are equal, there is not an equal probability that agents will choose either corresponding GroupID because of Social

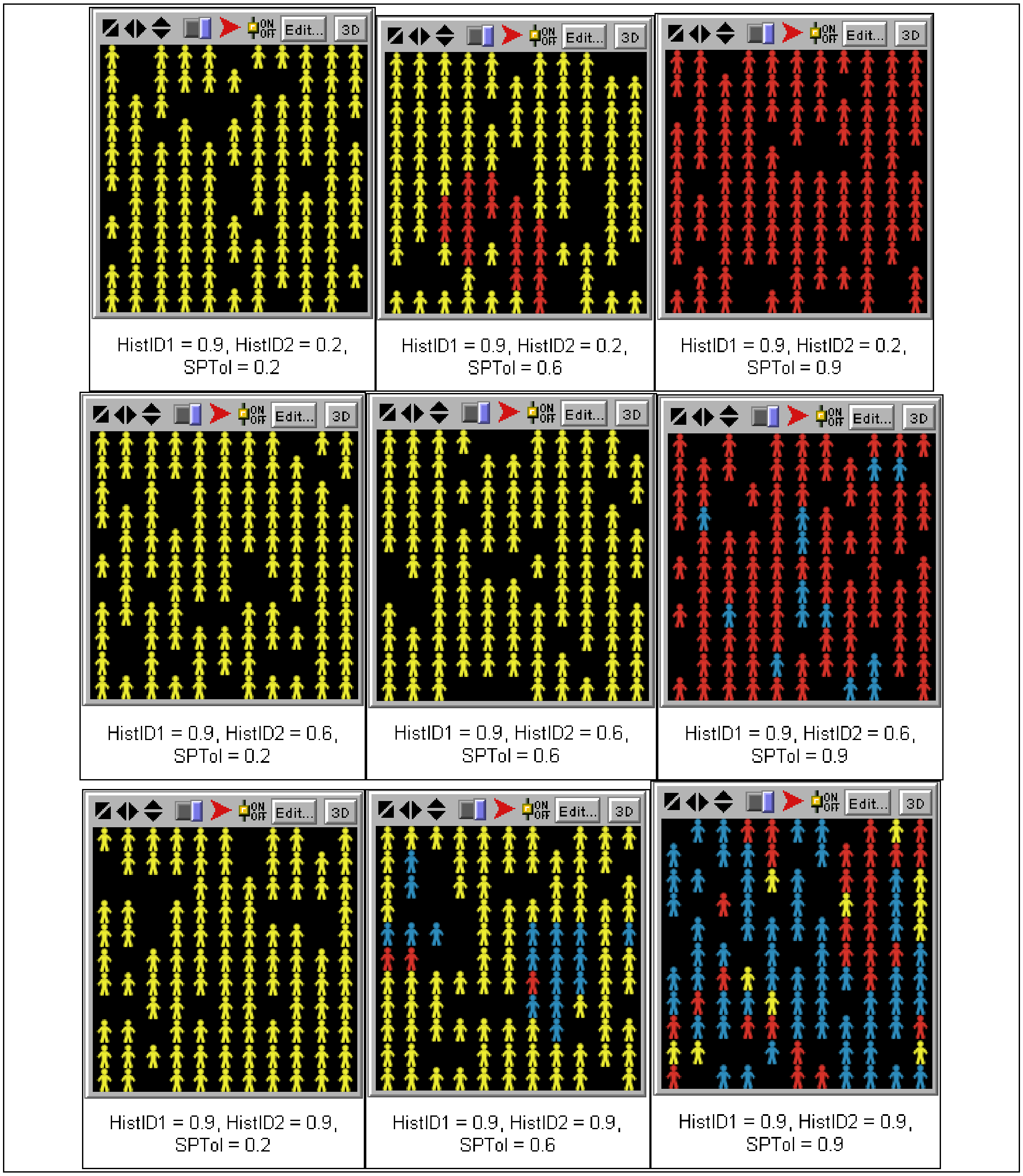
Pressure Tolerance levels. The high Tolerance level creates many more GroupID2 groups than with the medium Tolerance level.

When the HistID1 mean = 0.6 and the HistID2 mean = 0.9, the medium level Social Pressure Tolerance mean is still not enough tolerance to break agents away from their initially assigned GroupID0. The medium level Tolerance level is more than enough strength to have agents with the higher HistID to influence their neighbors' decisions. However, this particular HistID mean combination is neither too close (both GroupIDs flourish when both HistID means are equal) nor too far that the stronger identification with a HistID dominates agents' decisions. However, when the Social Pressure Tolerance level = 0.9, this level is strong enough to have the majority of agents go with their stronger HistID and choose GroupID2. This high Social Pressure Tolerance mean also provides protection for a few lone "political ideologues."

The importance of the higher Social Pressure Tolerance levels becomes more evident when the HistID1 mean is also high. Fewer groups are able to form when both HistIDs are medium to high. When the HistID equals 0.6 and 0.9, agents need a high Social Pressure Tolerance mean to have any group formation. Alternatively, group emergence can occur when both HistID1 and HistID2 can be equally high.

When HistID1 = 0.9 and HistID2 =0.2, it is logical to think that this distance between the strengths would be enough to have the majority of agents choosing GroupID1. However, the low Social Pressure Tolerance is not enough for the agents to choose either GroupID. Not until the Tolerance level increases, do agents choose the higher GroupID1. The total number of clustered agents, though, is still smaller compare to when the Tolerance level is high.

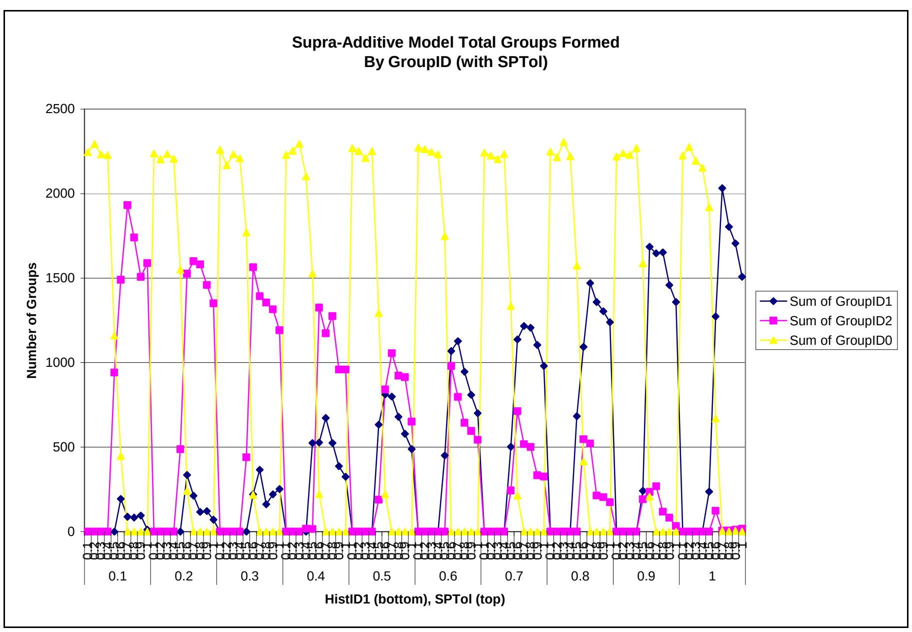
Illustration 5.13 Group Emergence, High HistID1 Means



When the HistID2 mean increases to 0.6, the high HistID1 does not affect agents' decisions until their mean Social Pressure Tolerance is also high. Similarly, when both HistIDs are high, Tolerance levels control GroupID2 formation. However, because the high identification with both HistIDs, political ideologues are able to surface with only a medium level Social Pressure Tolerance level. Moreover, there are several agents who do not choose either GroupID1 or GroupID2 and maintain their original GroupID0 when the Tolerance level is high.

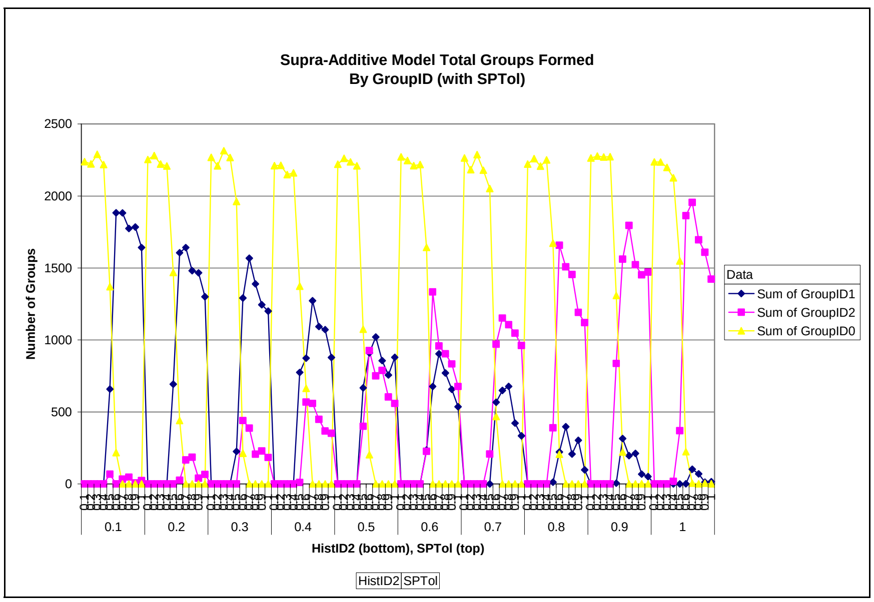
Overall, agents must have a SPTol higher than 0.2 in order to withstand the GroupID0 majority at start-up. GroupID1 and GroupID2 are than able to emerge. The majority GroupID is determined by the higher HistID. When HistID1 = HistID2, both GroupID1 and GroupID2 can form. Moreover, the majority group can fluctuate depending on the initially assigned agent characteristics and agent locations on the grid. When both HistIDs are high, it takes higher SPTol levels to break out from the GroupID0 majority.

Graph 5.8 Number of Groups Formed by HistID1, Supra-Additive Model



Next, the numbers of groups that are able to emerge when SPTol is added to the Supra-Additive model are calculated. The overall trend is that as the HistID1 mean increases, the number of GroupID1 groups increase; as the HistID2 mean increases, the number of GroupID2 groups increase, too. The larger HistID generates more groups in general. It is significant to note that both GroupID1 and GroupID2 groups are able to form at all HistID strengths when the SPTol is high enough to counter GroupID0 pressure (SPTol = 0.5-0.7).

Graph 5.9 Number of Groups Formed by HistID2, Supra-Additive Model



When HistID1 and HistID2 are examined in tandem, it is clear that the amount of difference between the two HistIDs matters. SPTol can help the smaller HistID means (0.1-0.2) as long as there is only a difference of 2.0 between the two HistIDs. For example, when HistID1 = 0.1, GroupID1 groups can form until the HistID2 mean equals 0.3 (a difference of 2.0 between the two HistIDs). Once the HistID2 = 0.4, no GroupID1 groups can form. The HistID2 mean is too strong and no SPTol level can assist GroupID1 group emergence. This trend is maintained for all HistID means.

5.6 Group Emergence: Model Comparison

In this section, the group emergence patterns and the number of formed groups for the Identity Salience and Supra-Additive models are compared. The expectation is that the models' different assumptions about multiple identities—and the effects from social pressure tolerance and agent interaction—will lead to different levels of group emergence. Emergence patterns will be compared descriptively and the number of formed groups will be compared with a t-test. The low, medium, and high HistID mean combinations used for the comparison are: HistID1 = 0.2, HistID2 = 0.8; HistID1 = 0.6, HistID2 = 0.4; and HistID1 = 0.9, HistID2 = 0.1.

When Illustrations 5.14 and 5.15 are compared, group emergence patterns are similar for the most part. There is some variation when SPTol = 0.6 and 0.9 for HistID1 = 0.2 and 0.6. The Identity Salience model seems to provide more opportunity for lone ideologues to flourish and form small groups; the Supra-Additive model does not have many ideologues at these SPTol levels, and if it does (i.e. HistID1 = 0.6, HistID2 = 0.4, SPTol = 0.9), there are not enough to form any groups. When HistID1 = 0.9 and HistID2 = 0.1, both models generate the same group emergence patterns.

Illustration 5.14 Group Emergence Patterns, Identity Salience Model

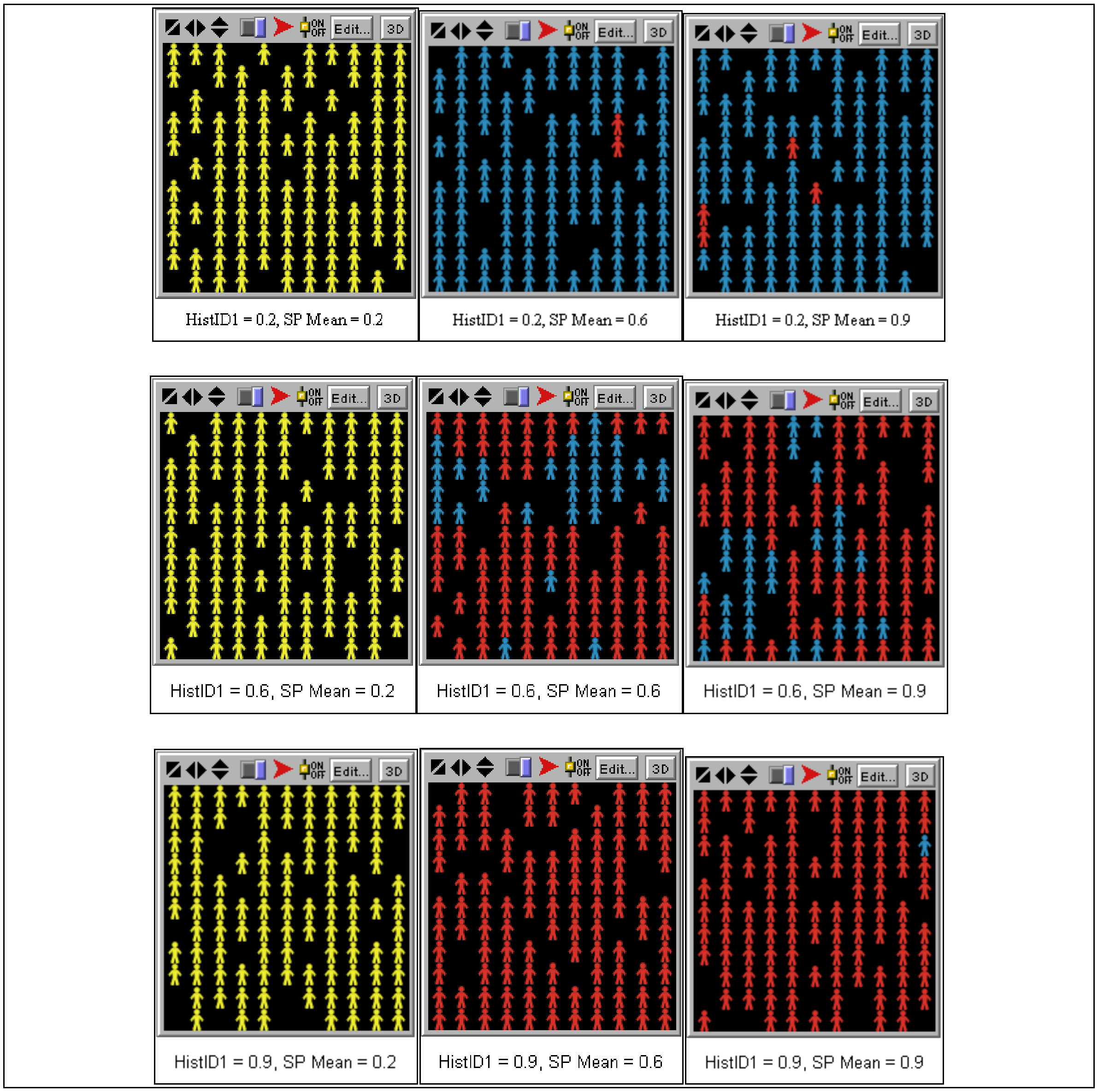
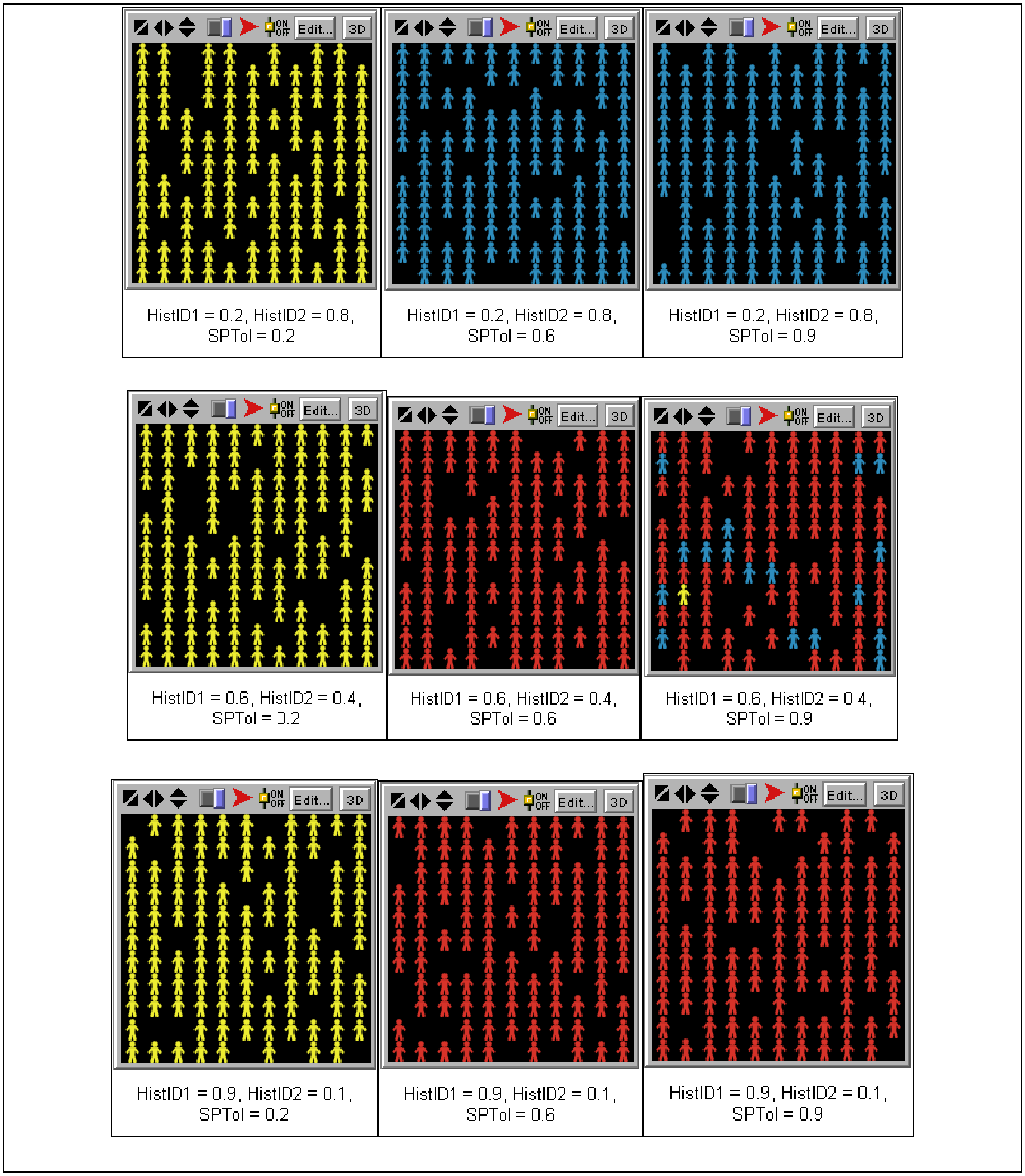


Illustration 5.15 Group Emergence Patterns, Supra-Additive Model



The next tool used to compare group emergence will be calculating totals of formed groups by GroupID for each model and determining if these totals are statistically different. Table 5.3 displays the group totals by GroupID for each model. A two-sample t-test with equal variance will be used to determine if $H_{2,}$ that the totals are different, can be accepted or rejected.

Table 5.3 Group Totals by GroupID

Supra-Additive					Identity Salience				
HistID1	SPTol	GrpID1	GrpID2	GrpID0	HistID1	SPTol	GrpID1	GrpID2	GrpID0
0.2	0.1	0	0	221	0.2	0.1	0	0	234
0.2	0.2	0	0	253	0.2	0.2	0	0	232
0.2	0.3	0	0	220	0.2	0.3	0	0	217
0.2	0.4	0	0	234	0.2	0.4	0	0	220
0.2	0.5	0	0	219	0.2	0.5	0	0	235
0.2	0.6	0	227	0	0.2	0.6	0	230	0
0.2	0.7	0	214	0	0.2	0.7	0	209	0
0.2	0.8	0	213	0	0.2	0.8	0	194	0
0.2	0.9	0	205	0	0.2	0.9	0	177	0
0.2	1	0	216	0	0.2	1	0	179	0
0.6	0.1	0	0	213	0.6	0.1	0	0	236
0.6	0.2	0	0	238	0.6	0.2	0	0	217
0.6	0.3	0	0	219	0.6	0.3	0	0	222
0.6	0.4	0	0	221	0.6	0.4	0	0	205
0.6	0.5	0	0	206	0.6	0.5	207	3	0
0.6	0.6	226	0	0	0.6	0.6	206	0	0
0.6	0.7	219	0	0	0.6	0.7	150	3	0
0.6	0.8	101	0	0	0.6	0.8	131	6	0
0.6	0.9	148	1	0	0.6	0.9	47	1	0
0.6	1	112	0	0	0.6	1	101	1	0
0.9	0.1	0	0	221	0.9	0.1	0	0	219
0.9	0.2	0	0	209	0.9	0.2	0	0	223
0.9	0.3	0	0	211	0.9	0.3	0	0	232
0.9	0.4	0	0	210	0.9	0.4	0	0	212
0.9	0.5	0	0	216	0.9	0.5	0	0	211
0.9	0.6	227	0	0	0.9	0.6	219	0	0
0.9	0.7	226	0	0	0.9	0.7	223	0	0
0.9	0.8	240	0	0	0.9	0.8	223	0	0
0.9	0.9	224	0	0	0.9	0.9	226	0	0
0.9	1	220	0	0	0.9	1	203	0	0

Table 5.4 Two-sample t-test with Equal Variances, GroupID1

Variable |	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
Supra-Add GrpId1 |	30	64.77	17.83	97.67	28.30	101.24
IdentSal GrpId1 |	30	64.53	17.02	93.24	29.72	99.35
combined |	60	64.65	12.22	94.67	40.19	89.11
diff |		0.233	24.65		-49.11	49.58

t = 0.0095
df = 58
p = 0.993

Table 5.5 Two-sample t-test with Equal Variances, GroupID2

Variable |	**Obs**	**Mean**	**Std. Err.**	**Std. Dev.**	**[95% Conf. Interval]**	
Supra-Add Grpid2 |	30	35.87	14.89	81.53	5.42	66.31
IdentSal Grpid2 |	30	33.43	13.73	75.23	5.34	61.52
combined |	60	34.65	10.04	77.79	14.56	54.74
diff |		2.43	20.25		-38.11	42.98

t = 0.1201
df = 58
p = 0.905

Table 5.6 Two-sample t-test with Equal Variances, GroupID0

Variable |	**Obs**	**Mean**	**Std. Err.**	**Std. Dev.**	**[95% Conf. Interval]**	
Supra-Add GrpId0 |	30	110.37	20.56	112.59	68.33	152.41
IdentSal GrpId0 |	30	103.83	20.65	113.10	61.60	146.06
combined |	60	107.1	14.45	111.93	78.19	136.01
diff |		6.53	29.14		-51.79	64.85

t = 0.2242
df = 58
p = 0.8234

Tables 5.4-5.6 show the t-test results and corresponding p-values. The p-values for the GroupID1, GroupID2, and GroupID0 comparisons are not statistically significant. Total groups formed for each GroupID are statistically the same when the Identity Salience and Supra-Additive models are compared across the same HistID1-HistID2-SPTol mean combinations. Because the descriptive analysis of emergence patterns determined the models to have similar outcomes and because the t-tests for GroupID1, GroupID2, and GroupID0 totals were not statistically different, H_2 is rejected.

5.7 Predicted Probabilities of Group Choice: Identity Salience Model

Next, the predicted probabilities are calculated to better determine the effect the HistID1 and SPTol means have on group choice. Figure 5.1 shows the MLogit equations and Table 5.7 displays the MLogit results for the model based upon the Identity Salience definition of multiple identities. GroupID0 is the base outcome. When comparing the GroupID1 v. GroupID0 choices, all the coefficients are significant. Similarly, when comparing GroupID2 v. GroupID0, all the coefficients are significant.

Figure 5.1 MLogit Equations, Identity Salience

$$\ln\Omega_{Grp1|Grp0}(x_i) = \beta_{0,\, Grp1|Grp0} + \beta_{1,\, Grp1|Grp0}\, \text{HistID1} + \beta_{2,\, Grp1|Grp0}\, \text{SPTol}$$

$$\ln\Omega_{Grp2|Grp0}(x_i) = \beta_{0,\, Grp2|Grp0} + \beta_{1,\, Grp2|Grp0}\, \text{HistID1} + \beta_{2,\, Grp2|Grp0}\, \text{SPTol}$$

Table 5.7 shows the MLogit results for all the *y*-combinations to assess the relationship among all GroupID choices given HistID1 and SPTol. First, all the coefficients for both HistID1 and SPTol are significant. However, some combinations have larger changes in the odd ratios than other combinations. For example, with a unit change in HistID1, the odds of choosing GroupID1 v. GroupID2 will change by a factor of e^b = 2516.19 holding SPTol constant.

The odds of choosing GroupID0 over GroupID2 are 227.94 times greater when HistID1 increases one unit. Finally, the odds of choosing GroupID1 v. GroupID0 are 11.04 times greater as the HistID1 mean increases one unit. The other GroupID combinations for HistID1 have very small factor changes. HistID1 greatly influences the odds of choosing GroupID1.

Table 5.7 MLogit Results, Identity Salience Model

Multinomial logistic regression			Number of obs = 17141			
			LR chi2(4) = 12858.58			
			Prob > chi2 = 0.0000			
Log likelihood = -6790.86			Pseudo R2 = 0.4863			

NewGrp	**Coef.**	**Std. Err.**	**z**	**P>|z|**	**[95% Conf.**	**Interval]**
1						
HistID1Mean	2.40	0.140	17.20	0.000	2.13	2.68
SPTolMean	12.46	0.269	46.34	0.000	11.94	12.99
_cons	-10.74	0.210	-51.11	0.000	-11.15	-10.33
2						
HistID1Mean	-5.43	0.146	-37.27	0.000	-5.71	-5.14
SPTolMean	11.26	0.279	40.40	0.000	10.71	11.81
_cons	-5.78	0.169	-34.18	0.000	-6.11	-5.45

(NewGrp==0 is the base outcome)

Table 5.8 Factor Changes in the Odds of Each GroupID

mlogit (N=17141): Factor Change in the Odds of NewGrp

Variable: HistID1Mean (sd=0.287)

Odds comparing
Alternative 1

to Alternative 2		**b**	**z**	**P>|z|**	**e^b**	**e^bStdX**
1	-2	7.83	43.90	0.000	2516.19	9.46
1	-0	2.40	17.20	0.000	11.04	1.99
2	-1	-7.83	-43.90	0.000	4×10^{-4}	0.106
2	-0	-5.43	-37.27	0.000	0.004	0.211
0	-1	-2.40	-17.20	0.000	0.091	0.502
0	-2	5.43	37.27	0.000	227.94	4.75

Variable: SPTolMean (sd=0.252)

Odds comparing
Alternative 1

to Alternative 2		**b**	**z**	**P>|z|**	**e^b**	**e^bStdX**
1	-2	1.20	4.44	0.000	3.33	1.35
1	-0	12.46	46.34	0.000	2.59e+05	23.25
2	-1	-1.20	-4.44	0.000	0.300	0.738
2	-0	11.26	40.41	0.000	7.77e+04	17.16
0	-1	-12.46	-46.34	0.000	0.000	0.043
0	-2	-11.26	-40.41	0.000	0.000	0.058

b = raw coefficient
z = z-score for test of b=0
P>|z| = p-value for z-test
e^b = exp(b) = factor change in odds for unit increase in X
e^bStdX = exp(b*SD of X) = change in odds for SD increase in X

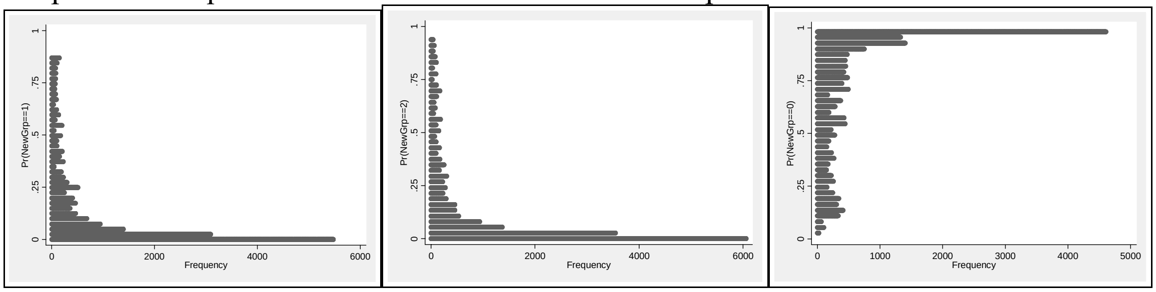
SPTol generates different GroupID choices than HistID1. With one unit change in SPTol, the odds of choosing GroupID2 over GroupID0 are 7.77e+04 times greater. The HistID1 mean has little effect on the odds of choosing GroupID2 v. GroupID0 (e^b = 0.004). The odds of choosing GroupID1 v. GroupID0 are larger for SPTol than with HistID1; the odds are 2.59e+05 times greater when considering GroupID1 vs. GroupID0. With one unit change in SPTol, the odds of choosing GroupID1 v. GroupID2 will change by a factor of 3.33 holding HistID1 constant. These odds are smaller than with HistID1. The factor change in the odds for the remaining combinations is small. Overall, it appears that SPTol aids in increasing the odds of choosing GroupID2.

Table 5.9 Predicted Probabilities Means

Variable	Obs	Mean	Std. Dev.	Min	Max
p(GroupID1)	17296	0.140	0.207	4.10×10^{-4}	0.871
p(GroupID2)	17296	0.130	0.208	2.50×10^{-4}	0.939
p(GroupID0)	17296	0.730	0.286	0.040	0.996

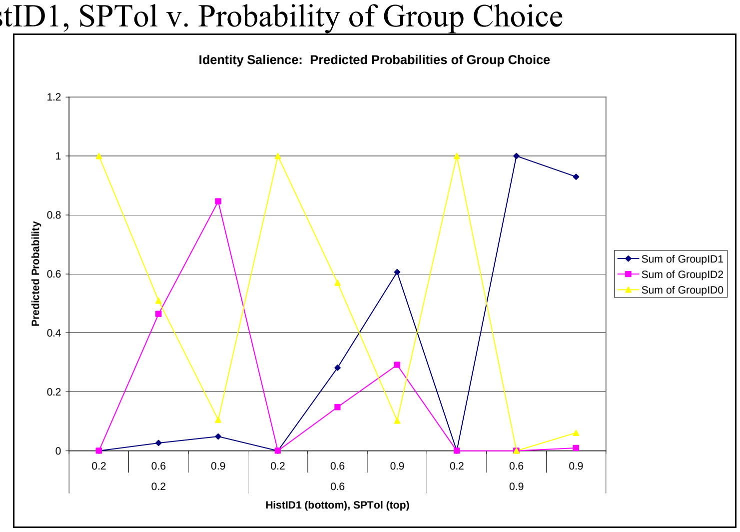
Now the predicted probabilities can be calculated (Table 5.9). It is interesting to note that the mean probability of choosing GroupID0 is the largest, 73%. Overall, it seems that when SPTol and agent interaction are added to HistID1 in agents' group choice decisions, choosing GroupID0 is most common. Graph 5.10 shows the frequencies of probabilities for each GroupID. GroupID0 is skewed to the high probabilities and GroupID1 and GroupID0 have a majority of low probabilities.

Graph 5.10 Frequencies of Probabilities for Each GroupID



However, calculating the predicated probabilities when HistID1 and SPTol change will show when agents choose each GroupID based upon agent characteristics. Graph 5.11 details the group choice probabilities based upon the changing relationship between HistID1 and SPTol. GroupID1 and GroupID2 are chosen over GroupID0 only when social pressure tolerance is high and agents are able to resist the pressure to maintain GroupID0. The probability of choosing GroupID0 decreases as SPTol increases. This pattern is constant across increasing HistID1 means.

Graph 5.11 HistID1, SPTol v. Probability of Group Choice



Even though GroupID0 dominates agents’ decisions, this high probability does not mean that GroupID1 or GroupID2 cannot emerge. Both the HistID1 and SPTol means must be high enough to resist the social pressure from the GroupID0 majority. Then, which GroupID forms is based upon which HistID is greater—when HistID1 is greater, GroupID1 forms and when HistID2 is greater, GroupID2 forms. When HistID1 is 0.2 and HistID2 is 0.8, GroupID2 cannot surpass GroupID0 totals until after the SPTol mean passes 0.6. Agents do choose GroupID2 and smalls group do emerge, but GroupID0 is the clear majority.

As identification with HistID1 becomes stronger (and identification with HistID2 decreases), when GroupID1 surpasses the GroupID0 majority occurs earlier with a lower SPTol mean. For example, when HistID1 is 0.9 and HistID2 = 0.1, the probability of choosing GroupID0 plummets to zero. Whereas with lower HistID1 means, it is not until the social pressure tolerance mean is at 0.9 that the other GroupIDs have higher totals. This change in when GroupID1 and GroupID2 totals are greater than the GroupID0 totals (given an increasing HistID1 mean) implies that stronger HistID identification and stronger social pressure tolerance levels both aid in choosing GroupID1 and GroupID2.

Finally, when both the HistID1 and SPTol means are 0.9 the GroupID1 probability decreases and the GroupID0 probability increases. This is more than likely an effect from upper and lower bounds and the neutrality definitions because it forces more equal agents at both extremes of the HistID1 distribution. Diminishing returns can be ruled out because there is no evidence of convergence at the lower or upper ends for both HistID1 and SPTol combinations.

Table 5.10 Changes in Probabilities for Each GroupID

HistID1Mean

	Avg|Chg|	1	2	0
Min->Max	0.111	0.052	-0.167	0.115
-+1/2	0.196	0.085	-0.294	0.209
-+sd/2	0.029	0.021	-0.044	0.024
MargEfct	0.094	0.071	-0.142	0.071

SPTolMean

	Avg|Chg|	1	2	0
Min->Max	0.604	0.583	0.323	-0.906
-+1/2	0.639	0.635	0.323	-0.958
-+sd/2	0.130	0.109	0.085	-0.194
MargEfct	0.412	0.336	0.281	-0.617

	1	2	0
Pr(y|x)	0.028	0.026	0.945

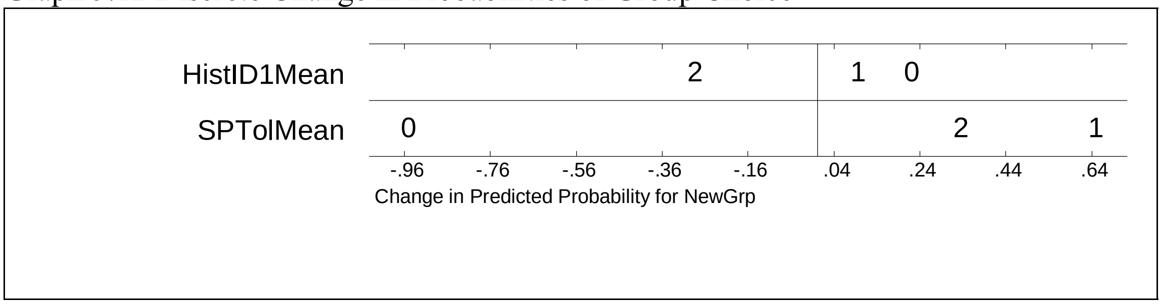
	HistID1Mean	SPTolMean
x=	0.571	0.471
sd(x)=	0.287	0.252

Measuring the discrete change in the probabilities of group choice can also aid in understanding the impact of HistID1 and SPTol on choosing each GroupID. Examining discrete change shows the magnitude of change in GroupID choice probabilities as HistID1 and SPTol change; it also incorporates the size of that change in each GroupID probability. Table 5.10 displays the marginal effect and discrete change in the probabilities of group choice. It initially appears that one unit change in SPTol has a bigger effect on GroupID choice than does a unit change in the HistID1 mean (discrete change is denoted by -+1/2).

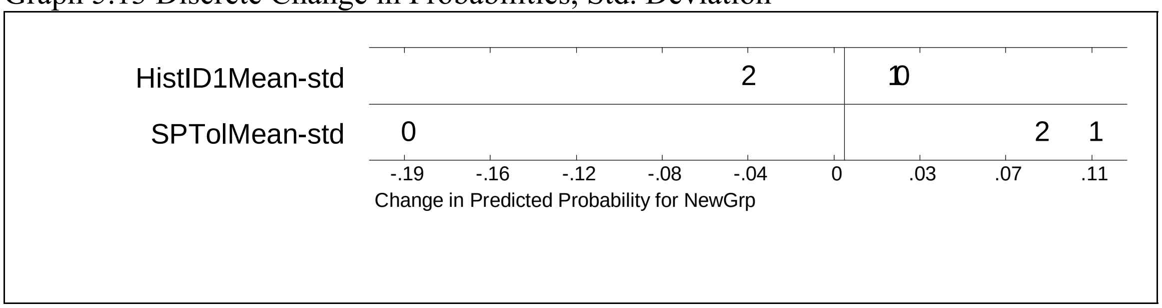
Plotting the discrete change shows the relationships among all the GroupID choice given one unit change in HistID1 and SPTol. Graph 5.12 confirms that one unit change in SPTol does have the largest effects on group choice. As SPTol increases, the probability of choosing GroupID1 increases the most (0.64); the probability of choosing

GroupID2 also increases but about by half of the GroupID1 increase (0.32). The probability of choosing GroupID0 decreases almost 100% (-0.96). The discrete change in the probability of GroupID1 and GroupID2 for SPTol supports the previous probability analysis that increases in social pressure tolerance helps agents to withstand pressure to choose GroupID0.

Graph 5.12 Discrete Change in Probabilities of Group Choice



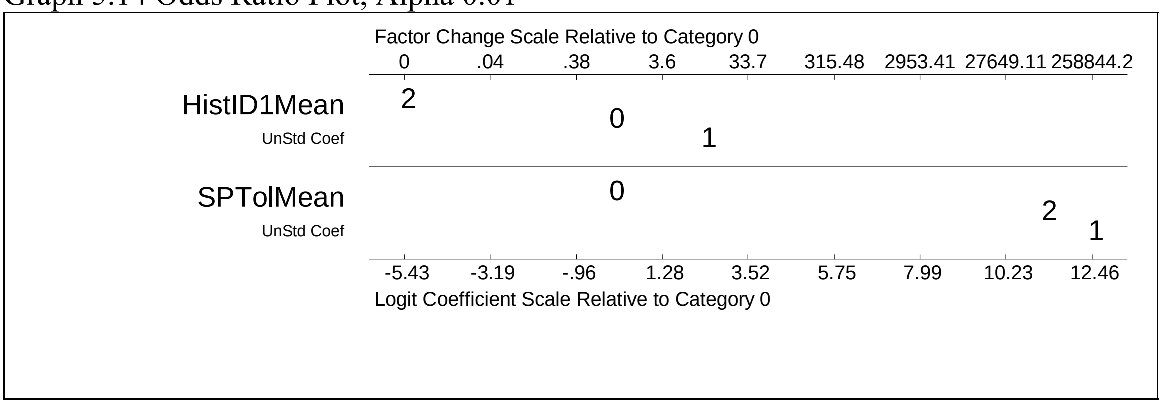
Graph 5.13 Discrete Change in Probabilities, Std. Deviation



As the HistID1 mean increases by one unit, it initially seems that the probability of GroupID0 (0.209) increases significantly more than the probability of choosing GroupID1 (0.085). However, looking at the discrete change in probability when HistID1 increases one standard deviation, the difference in the influence on GroupID1 and GroupID0 is essentially the same. As the HistID1 mean increases one standard deviation, the probability of GroupID1 increases by 0.021 and the probability of GroupID0 increases by 0.024. The effect on the probability of choosing GroupID2 is still twice as large as the effect on GroupID1 and GroupID0. As SPTol increases by one standard deviation, the impact on each GroupID is essentially the same.

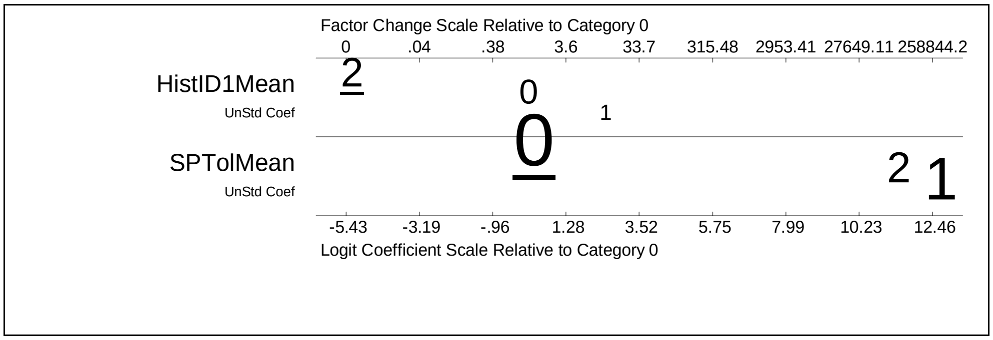
While discrete change helps us understand the magnitude of effect of HistID1 and SPTol on the probabilities of choosing each GroupID, considering an odds ratio plot will help elucidate the changing relationships among the group choices. Graph 5.14 depicts the odd ratio plot with $\alpha = 0.01$. All the group choices are significantly ordered by HistID1 and SPTol. All the factor change coefficients are positive. For HistID1, the magnitude of its effect on not choosing GroupID2 is twice as large as GroupID1. Though the HistID1 mean has a smaller effect on choosing GroupID1, an increase in the HistID1 mean still makes choosing GroupID1 more likely. For SPTol, the magnitude of its effect on GroupID1 and GroupID2 combined is twice as large as its effect on GroupID0. It is clear that higher SPTol does increase the odds of choosing either GroupID1 or GroupID2.

Graph 5.14 Odds Ratio Plot, Alpha 0.01



Finally, combining both the discrete change in the probability of group choice and the factor change in the odd ratios for each GroupID will give a complete picture of how HistID1 and SPTol affect group choice. While the factor change in the odd ratios is constant across HistID1 and SPTol, the discrete change in the probability of group choice captures changes as each variable changes. Graph 5.15 shows the combination plot at α = 0.01. It is apparent that SPTol is the main determinant of GroupID1 and GroupID2 choice. Negative change is denoted by underlined GroupID numbers.

Graph 5.15 Discrete Change/Odds Ratio Plot, α = 0.01



As the HistID1 mean increases one unit, it does increase the odds of choosing GroupID1 the most, and to a lesser extent GroupID0. This latter finding could be the local impact of a sudden increase in GroupID0 at the high HistID1 and SPTol ranges. This sudden change in totals would increase the discrete change in probabilities and overall effect of HistID1 on choosing GroupID0. Logically, an increase in the HistID1 mean decreases the odds of choosing GroupID2.

Finally, as SPTol increases one unit, it significantly increases the odds of choosing GroupID1 and GroupID2. It orders the group choice outcomes. An increase in the SPTol mean also greatly decreases the odds of choosing GroupID0. While the level of social pressure tolerance has the largest magnitude of effect on group choice, the strength of identification with HistID1 also aids in ordering group choice options. As both SPTol and HistID1 increase in strength, it is more likely that agents choose GroupID1. GroupID0 is mostly determined by HistID1 and GroupID2 by SPTol.

5.8 Predicted Probabilities of Group Choice: Supra-Additive Model

Next, the MLogit regression is estimated for the Supra-Additive model using the equations in Figure 5.2:

Figure 5.2 MLogit Equations, Supra-Additive

$$\ln\Omega_{Grp1|Grp0}(x_i) = \beta_{0,\ Grp1|Grp0} + \beta_{1,\ Grp1|Grp0}\,\text{HistID1} + \beta_{2,\ Grp1|Grp0}\,\text{HistID2} + \beta_{3,\ Grp1|Grp0}\,\text{SPTol}$$

$$\ln\Omega_{Grp2|Grp0}(x_i) = \beta_{0,\ Grp2|Grp0} + \beta_{1,\ Grp2|Grp0}\,\text{HistID1} + \beta_{2,\ Grp2|Grp0}\,\text{HistID2} + \beta_{3,\ Grp2|Grp0}\,\text{SPTol}$$

Table 5.11 presents the coefficients for each GroupID combination with GroupID0 as the base outcome. All the coefficients for all the y-combinations are statistically significant. Table 5.12 lists the remaining GroupID combinations and their coefficients.

Table 5.11 MLogit Results, Supra-Additive Model

Multinomial logistic regression — Number of obs = 54981; LR chi2(6) = 44501.74; Prob > chi2 = 0.0000; Pseudo R2 = 0.5359

Log likelihood = -19268.402

NewGrp	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
1						
HistID1Mean	0.340	0.079	4.30	0.000	0.185	0.495
HistID2Mean	-3.68	0.084	-43.69	0.000	-3.84	-3.51
SPTolMean	15.04	0.179	84.03	0.000	14.69	15.40
_cons	-10.01	0.122	-82.06	0.000	-10.25	-9.78
2						
HistID1Mean	-4.27	0.078	-54.52	0.000	-4.43	-4.12
HistID2Mean	1.90	0.074	25.82	0.000	1.76	2.04
SPTolMean	15.22	0.164	92.98	0.000	14.90	15.55
_cons	-10.36	0.111	-93.12	0.000	-10.58	-10.14

(NewGrp==0 is the base outcome)

Most y-combinations are significant, but only a few have a large effect on group choice (the SPTol mean has two combinations that are not significant). When considering y-combinations for the HistID1 mean, the factor change in the odds of choosing GroupID1 v. GroupID2 is e^b = 100.61. This corroborates the totals patterns; GroupID1 totals increase as HistID1 increases. Another large effect occurs when comparing GroupID0 v. GroupID2. When comparing GroupID0 v. GroupID2 the factor change in the odds is e^b = 71.63 as the HistID1 mean increases one unit. The remaining GroupID combinations are significant but the HistID1 mean has small factor changes.

When the HistID2 mean increases one unit, the factor change in the odds of choosing GroupID2 v. GroupID1 is e^b = 264.51. This also supports the patterns seen in the GroupID totals. As the HistID2 mean increases, more agents choose GroupID2. Finally, when comparing GroupID0 v. GroupID1, the factor change in the odds of choosing GroupID0 is e^b = 39.58. As the HistID2 mean increases one unit, the odds of choosing GroupID0 increases when compared to the odds of choosing GroupID1.

Examining the factor change in the odds for each GroupID as SPTol increases one unit reveals that it does significantly affect the odds of group choice for GroupID1 and GroupID2. When comparing GroupID1 vs. GroupID0, the factor change in the odds of choosing GroupID1 is e^b = 3.42 e+06. When comparing GroupID2 vs. GroupID0, the factor change in the odds of choosing GroupID2 is e^b = 4.09 e+06. It is interesting to note that when comparing the factor change in the odds for GroupID1 vs. GroupID2 and GroupID2 vs. GroupID1, each factor change is not statistically significant.

Table 5.12 Factor Change in the Odds of Each GroupID

mlogit (N=54981) Variable: HistID1Mean (sd=0.286)

Odds comparing Alternative 1 to Alternative 2

Alternative 1	Alternative 2	b	z	P>|z|	e^b	e^bStdX
1	-2	4.61	52.15	0.000	100.61	3.73
1	-0	0.340	4.30	0.000	1.40	1.10
2	-1	-4.61	-52.15	0.000	0.0099	0.27
2	-0	-4.27	-54.52	0.000	0.014	0.30
0	-1	-0.340	-4.30	0.000	0.712	0.908
0	-2	4.27	54.52	0.000	71.63	3.39

Variable: HistID2Mean (sd=0.293)

Odds comparing Alternative 1 to Alternative 2

Alternative 1	Alternative 2	b	z	P>|z|	e^b	e^bStdX
1	-2	-5.58	-64.39	0.000	0.004	0.195
1	-0	-3.68	-43.69	0.000	0.025	0.341
2	-1	5.58	64.38	0.000	264.51	5.12
2	-0	1.90	25.82	0.000	6.68	1.74
0	-1	3.68	43.69	0.000	39.58	2.94
0	-2	-1.90	-25.82	0.000	0.150	0.573

Variable: SPTolMean (sd=0.270)

Odds comparing Alternative 1 to Alternative 2

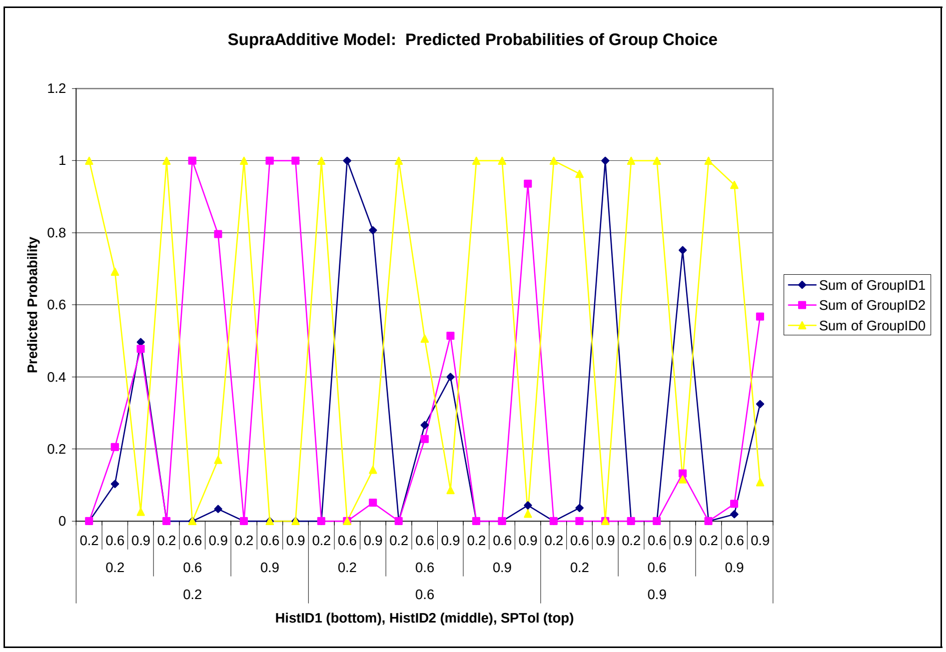
Alternative 1	Alternative 2	b	z	P>|z|	e^b	e^bStdX
1	-2	-0.180	-1.08	0.280	0.835	0.953
1	-0	15.04	84.03	0.000	3.42e+06	58.47
2	-1	0.180	1.08	0.280	1.20	1.05
2	-0	15.22	92.98	0.000	4.09e+06	61.38
0	-1	-15.04	-84.03	0.000	0.000	0.017
0	-2	-15.22	-92.98	0.000	0.000	0.016

Table 5.13 Predicted Probabilities for Group Choice

Variable	Obs	Mean	Std. Dev.	Min	Max
p(GroupID1)	55445	0.099	0.171	0.0000354	0.921
p(GroupID2)	55445	0.166	0.259	0.0000208	0.966
p(GroupID0)	55445	0.734	0.354	0.015	1.00

Next, considering the changes in predicted probability for each GroupID will provide a more practical interpretation of the MLogit results. Table 5.13 shows the mean probabilities for each group choice. The highest probability mean is for GroupID0. Both GroupID1 and GroupID2 have very low probabilities on average, even though the probabilities for each GroupID spans zero to one. However, calculating the probabilities for changing values for the HistID1, HistID2, and SPTol means can show how the probabilities change as agent characteristics change.

Graph 5.16 Probabilities of Group Choice



Graph 5.16 shows the probabilities for each GroupID as the HistID1, HistID2, and SPTol means increase. It is clear the GroupID0 remains dominant until the social pressure tolerance increases to at least medium values. It is difficult for agents to break out from the pressure from the GroupID0 majority just based upon their HistID strength.

This is consistent across all HistID1 and HistID2 means. SPTol must reach medium-to-high values before agents are able to choose either GroupID1 or GroupID2. Once successful tolerance levels are reached, agents then choose the GroupID based upon their higher HistID mean. When the HistIDs are equal and have a high enough SPTol level, GroupID1 and GroupID2 have similar probabilities of formation. This again reflects the possibility of fluctuating majority GroupIDs based upon agent characteristics and location on the grid.

Table 5.14 Change in Probabilities for Each GroupID

HistID1Mean

	Avg|Chg|	1	2	0
Min->Max	0.048	0.004	-0.072	0.069
-+1/2	0.083	0.005	-0.125	0.120
-+sd/2	0.014	0.001	-0.021	0.020
MargEfct	0.047	0.005	-0.071	0.066

HistID2Mean

	Avg|Chg|	1	2	0
Min->Max	0.029	-0.043	0.023	0.020
-+1/2	0.046	-0.069	0.037	0.033
-+sd/2	0.009	-0.013	0.010	0.004
MargEfct	0.029	-0.044	0.032	0.011

SPTolMean

	Avg|Chg|	1	2	0
Min->Max	0.617	0.367	0.558	-0.925
-+1/2	0.655	0.386	0.597	-0.983
-+sd/2	0.122	0.075	0.108	-0.183
MargEfct	0.282	0.174	0.250	-0.424

	1	2	0
Pr(y|x)	0.012	0.017	0.971

	HistID1Mean	HistID2Mean	SPTolMean
x=	0.567	0.577	0.502
sd(x)=	0.286	0.293	0.270

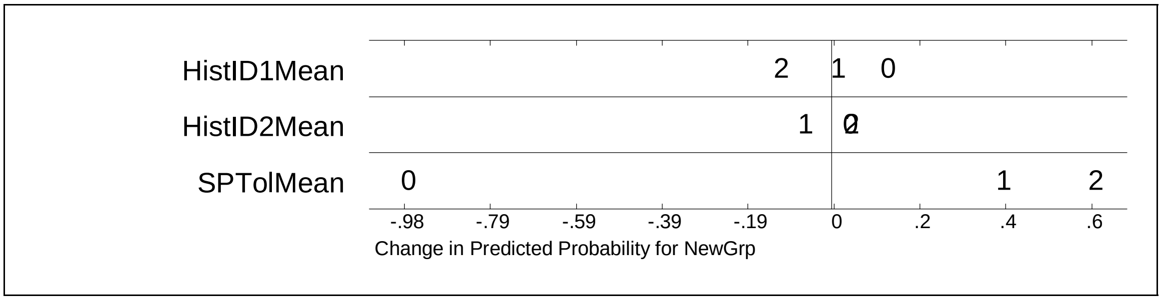
Now discrete change in the probabilities should be examined to understand how the probabilities change with a unit change centered on the mean of HistID1, HistID2, and SPTol. While the above analysis just considered the actual probabilities for each mean, the discrete change assesses the amount the probabilities change as HistID1, HistID2, and SPTol changes. If the probability curve has a low slope and does not change very fast, the discrete change in probability will be low; if the probability curve has a high slope and changes very fast, the discrete change in probability will be high. Table 5.14 shows the changes in GroupID probabilities.

As the HistID1 mean increases one unit holding the other variables constant at their means, there is very little change in the probabilities for GroupID1 and GroupID2. The probability of choosing GroupID1 barely increases by 0.005 and the probability of choosing GroupID2 only slightly decreases by 0.125. The probability of choosing GroupID0 actually increases by 0.120. The probability curves for all the identity variables are rather consistent.

The discrete change for the HistID2 mean has a similar pattern. As the HistID2 mean increases one unit holding the other variables constant at their means, the probability of choosing GroupID1 decreases by 0.069 and the probability of choosing GroupID2 increases by 0.037. The probability of choosing GroupID0 also increases by a similar amount, 0.033. The discrete change in probabilities for GroupID1, GroupID2, and GroupID0 is even less than for the HistID1 mean.

However, SPTol appears to have a bigger effect on the probabilities of group choice. As the SPTol mean increases one unit holding the other variables constant at their means, the probability of choosing GroupID1 increases by 0.386 and the probability of choosing GroupID2 increases even more by 0.597. Even more drastic is the change in probability for GroupID0—it *decreases* by 0.983. Moreover, SPTol helps the probability of GroupID2 more than GroupID1.

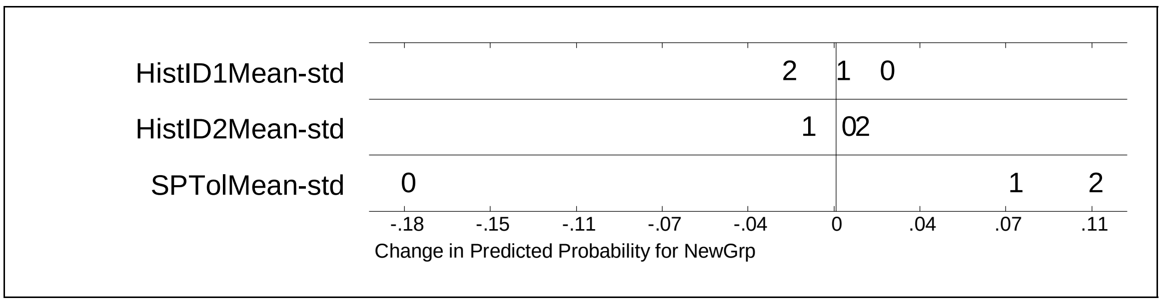
Graph 5.17 Discrete Change Plot



Plotting the discrete change for each GroupID can also illustrate the relationship among each identity variable and each group choice. Graph 5.17 shows the discrete change in probability for each GroupID. It is apparent that one unit increase in social pressure tolerance has the largest effect on group choice. The HistID1 mean seems to equally influence each GroupID, though it increases the probability of choosing GroupID0 the most. The probability in choosing GroupID1 is almost the same as HistID1 changes and the other variables are held constant at their means.

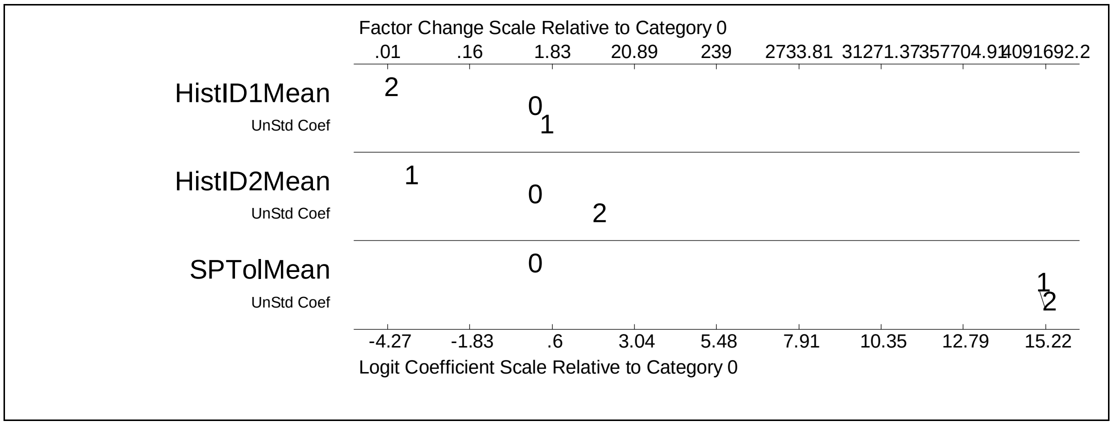
The discrete change for HistID2 is too small to differentiate between effects on GroupID2 and GroupID0, so examining the discrete change for one standard deviation might be more telling. Graph 5.18 shows the discrete change in probability with a standard deviation change in each identity variable. The discrete change in probabilities for HistID1 and SPTol stay the same. However, for the HistID2 mean, the discrete change in probabilities of GroupID2 and GroupID0 are more unpacked. That is, as the HistID2 mean increases one standard deviation, the probability of choosing GroupID2 increases more than it initially appeared in Graph 5.17, though the outcome on GroupID0 is very similar. One logical explanation for why the discrete change in the probability of choosing GroupID0 increases as the HistID1 and HistID2 means increases is that the GroupID0 totals are either 100% GroupID0 or absolutely no agents with GroupID0. The change is very fast, while the agent totals for GroupID1 and GroupID2 increase and decrease gradually.

Graph 5.18 Discrete Change in Probability, Std. Deviation



Next, examining an odd ratios plot can help determine an agent's odds in choosing between two GroupIDs that have similar discrete change in probabilities. Doing so provides more insight into the dynamics of group choice given agent characteristics. Graph 5.19 shows the odd ratios for each GroupID given the HistID1, HistID2, and SPTol means. The distance between each GroupID represents the magnitude of the effect of the identity variable. The factor change in the odd ratio values (e^b) can be found again in Table 5.14. Coefficients for GroupIDs that are not statistically significant at $\alpha = 0.01$ have a line drawn between them. Finally, any negative change in the odd ratios is shown by underlining that particular GroupID number.

Graph 5.19 Odd Ratios Plot, α = 0.01

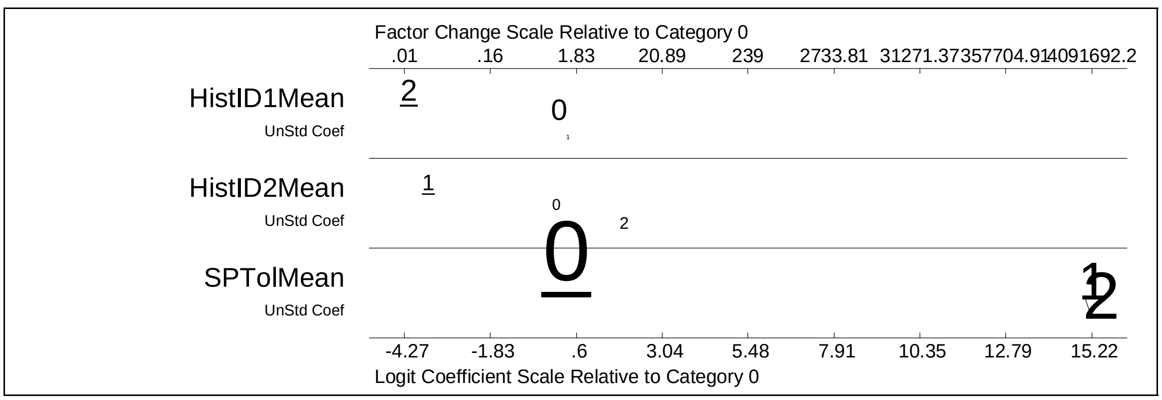


For a unit increase in the HistID1 mean, the odds of choosing GroupID1 (e^b = 1.40) vs. GroupID0 is only slightly greater than choosing GroupID0. It makes sense that as an agent's connection to HistID1 becomes stronger, they will be more likely to choose GroupID1. However, the HistID1 mean has almost the same magnitude of effect on the odds of choosing GroupID0. This can be explained by the high (usually 100%) GroupID0 totals that exist before agents have enough social pressure tolerance to choose GroupID1. The HistID1 mean has less influence in agents choosing GroupID2 as HistID1 increases one unit.

The HistID2 mean has the largest effect (e^b = 6.68) in determining GroupID2 choice (vs. GroupID0). This effect is twice as large as the effect on determining GroupID1 choice. It is more likely that an agent will choose GroupID2 or GroupID0 than GroupID1 as the HistID2 mean increases in strength. Again, the magnitude of effect on GroupID0 can be explained by agents maintaining GroupID0 until the HistID *and* SPTol mean are strong enough withstand the social pressure to choose GroupID0.

However, the effect of SPTol on group choice is largest of all the identity variables for the Supra-Additive model. As the SPTol mean increases one unit, the odds in choosing GroupID1 increase by e^b = 3.42 e+06 and the odds in choosing GroupID2 increase by e^b = 4.09 e+06. What is interesting though is that SPTol increases the odds of choosing GroupID1 and GroupID2 as it becomes stronger, but the effect of choosing GroupID1 vs. GroupID2 is not statistically significant. What is significant is that agents choose a GroupID other than GroupID0, but which group is not significant. SPTol determines if an agent can choose GroupID1 or GroupID2, but the HistID means determine which group that will be.

Graph 5.20 Discrete Change/Odd Ratios Plot, α = 0.01



Finally, the discrete change in probabilities and the factor change in odd ratios can be combined to determine a complete picture of how the identity variables affect GroupID choice. Because the factor change in odd ratios is constant across all levels of HistID1, HistID2, and SPTol, combining this information with the discrete change in probabilities (which can increase or decrease as the variables change) adds current odds to the big picture. Large discrete change in the probability of group choice (high current odds of group choice) increases the effect of an identity variable on group choice. The size of the GroupID number is proportional to the discrete change in the odds of group choice.

Overall, the substantive effect of an increase in the social pressure tolerance mean is the largest for all of the identity variables. As SPTol becomes stronger, the odds increase by a factor of 15.04 for GroupID1 and a factor of 15.22 for GroupID2. But the current odds of choosing GroupID1 and GroupID2 are also very high increasing the influence of SPTol in agents choosing GroupID1 and GroupID2. Similarly, the factor change in the odds of choosing GroupID0 is zero. The discrete change in the odds of *not* choosing GroupID0 is also the highest of all the identity variables. Again, choosing between GroupID1 vs. GroupID2 (and vice versa) is not statistically significant.

The magnitude of effect of the HistID1 mean on GroupID1 is so small it is difficult to see the "1." The odds do increase for choosing GroupID1 as HistID1 increases, but the current odds of choosing GroupID1 are so small that the substantive effect is also small. An increase in the HistID1 mean has more of substantive impact on maintaining GroupID0 and on not choosing GroupID2. The magnitude of effect of the HistID2 mean is similarly small on all the group choices. An increase in the HistID2 mean has the largest substantive effect in not choosing GroupID1.

Given the combined discrete change and odd ratios plot, it is clear that while an increase in the HistID1 and HistID2 means help increase the odds of choosing GroupID1 and GroupID2, respectively, the magnitude of effect of an increase in the SPTol mean is the main determinant of GroupID1 and GroupID2. Low social pressure tolerance is also the main determinant of GroupID0. Even though all the identity variables work in tandem to generate GroupID1, GroupID2, and GroupID0 choices, SPTol has the largest effect on an agent's group choice. Group choice then depends on the level of either HistID mean.

5.9 Predicted Probabilities of Group Choice: Model Comparison

Next, the predicted probabilities from the two models are compared to see if there are any statistical differences in group choice. A two-proportion z-test is used to determine if the models' results are statistically different according to H_3:

> **H_3: Predicted probabilities of group choice will be different across comparable HistID mean combinations between the two models.**

The mean combinations used for this comparison are found in Table 5.15 in the left hand columns. The significance level is 95%.

The predicted probability of group choice in Tables 5.15 – 5.17 show that agents need medium to high SPTol levels to be able to break out of the GroupID0 environment at t = 0 and choose either GroupID1 or GroupID0. There are only two mean combinations that are considered statistically the same. Both are predicted probabilities for GroupID2 (Table 5.16): HistID1 = 0.2, HistID2 = 0.8, SPTol = 0.6; and, HistID1 = 0.6, HistID2 = 0.4, SPTol = 0.9. However, the majority of mean combinations are considered statistically different. It is therefore difficult to accept H_3 because the majority of mean combinations are considered statistically different.

Table 5.15 Z-test Results for GroupID1

			Identity Salience	Supra-Additive			
			N=15564	N=54981			
HistID1	HistID2	SPTol	Pr(GrpID1) (sd)	Pr(GrpID1) (sd)	Diff (sd)	z	p>|z|
0.2	0.8	0.2	0.002 (0.000)	0.000 (0.000)	0.002 (0.000)	8.89	0.000
0.2	0.8	0.6	0.072 (0.002)	0.013 (0.000)	0.059 (0.002)	40.141	0.000
0.2	0.8	0.9	0.010 (0.002)	0.033 (0.001)	0.062 (0.003)	33.68	0.000
0.6	0.4	0.2	0.004 (0.001)	0.000 (0.000)	0.004 (0.001)	13.02	0.000
0.6	0.4	0.6	0.2132 (0.003)	0.091 (0.001)	0.122 (0.004)	41.77	0.000
0.6	0.4	0.9	0.605 (0.004)	0.628 (0.002)	-0.024 (0.004)	-5.36	0.000
0.9	0.1	0.2	0.008 (0.001)	0.001 (0.000)	0.007 (0.001)	16.22	0.000
0.9	0.1	0.6	0.352 (0.004)	0.258 (0.002)	0.094 (0.004)	23.14	0.000
0.9	0.1	0.9	0.880 (0.003)	0.949 (0.001)	-0.069 (0.003)	-30.51	0.000

Table 5.16 Z-test Results for GroupID2

			Identity Salience	Supra-Additive			
			N=15564	N=54981			
HistID1	HistID2	SPTol	Pr(GrpID2) (sd)	Pr(GrpID2) (sd)	Diff (sd)	z	p>|z|
0.2	0.8	0.2	0.005 (0.001)	0.001 (0.000)	0.003 (0.001)	7.88	0.000
0.2	0.8	0.6	0.361 (0.004)	0.359 (0.002)	0.003 (0.004)	0.57	0.566
0.2	0.8	0.9	0.869 (0.003)	0.950 (0.001)	-0.081 (0.003)	-35.37	0.000
0.6	0.4	0.2	0.006 (0.001)	0.001 (0.000)	0.005 (0.001)	12.02	0.000
0.6	0.4	0.6	0.062 (0.002)	0.042 (0.001)	0.020 (0.002)	10.28	0.000
0.6	0.4	0.9	0.307 (0.004)	0.306 (0.002)	0.001 (0.004)	0.24	0.811
0.9	0.1	0.2	0.0001 (0.000)	0.000 (0.000)	0.0001 (0.000)	2.34	0.019
0.9	0.1	0.6	0.012 (0.001)	0.006 (0.000)	0.006 (0.001)	8.33	0.000
0.9	0.1	0.9	0.052 (0.002)	0.022 (0.001)	0.031 (0.002)	20.27	0.000

Table 5.17 Z-test Results for GroupID0

			Identity Salience	Supra-Additive			
			N=15564	N=54981			
HistID1	HistID2	SPTol	Pr(GrpID0) (sd)	Pr(GrpID0) (sd)	Diff (sd)	z	p>|z|
0.2	0.8	0.2	0.994 (0.001)	0.999 (0.000)	-0.005 (0.001)	-11.42	0.000
0.2	0.8	0.6	0.567 (0.004)	0.628 (0.002)	-0.061 (0.004)	-13.81	0.000
0.2	0.8	0.9	0.033 (0.001)	0.017 (0.001)	0.016 (0.002)	12.34	0.000
0.6	0.4	0.2	0.995 (0.001)	1.00 (0.000)	-0.005 (0.001)	-13.48	0.000
0.6	0.4	0.6	0.725 (0.004)	0.867 (0.001)	-0.142 (0.004)	-42.16	0.000
0.6	0.4	0.9	0.088 (0.002)	0.066 (0.001)	0.023 (0.003)	9.75	0.000
0.9	0.1	0.2	0.992 (0.001)	0.999 (0.000)	-0.008 (0.001)	-16.36	0.000
0.9	0.1	0.6	0.636 (0.004)	0.737 (0.002)	-0.101 (0.004)	-24.51	0.000
0.9	0.1	0.9	0.068 (0.002)	0.030 (0.001)	0.039 (0.002)	22.17	0.000

When the model versions' that include SPTol are compared to the Basic Models, the predicted probabilities' trends are quite different. Agent interaction makes it very difficult to break from the social pressure to choose GroupID0 at start-up. SPTol provides a way for agents to choose another GroupID, but for the most part, an agent's tolerance level needs to be at least 0.6 before this choice can occur. Another difference is that GroupID0 was almost never chosen in the Basic Model. However, in the Social

Pressure models in this Chapter, the predicted probability of choosing GroupID0 is consistently high (until SPTol is high enough to influence agent choice).

A final difference, also seen in the Basic Model, is that HistID1, HistID2, and SPTol have a larger impact on group choice than the same variables in the Identity Salience model (compare the combined odd ratio-discrete change Graphs 5.15 and 5.20). This subtle difference in discrete change in odds of group choice leads to difference probabilities of group choice.

5.10 Conclusion

When comparing the Identity Salience model version to the Supra-Additive model version when both include social pressure, the GroupID totals and group emergence trends are very similar. Social pressure tolerance must be at least 0.6 in order to GroupID1 and GroupID2 to form. The higher HistID wins out generating group formation of its corresponding GroupID. When the two HistIDs are equal, any GroupID could become the majority GroupID. This phenomenon depends upon the initially assigned agent characteristics and agent interaction around the grid. GroupID totals and group emergence patterns therefore vary when the HistIDs are equal (and SPTol levels are 0.6 or higher).

However, the fundamental dynamics are different for each model and how each variable influences group choice. For both models, social pressure tolerance levels drive agents' ability to break out of the GroupID0 majority at the model start-up. For the Identity Salience model, SPTol levels also determine which GroupID is chosen, GroupID1 or GroupID0. For the Supra-Additive model, SPTol does not determine which GroupID is chosen, only that another one beside GroupID0 is chosen. The HistID mean is what determines if GroupID1 or GroupID2 is chosen.

Hypotheses 1 and 2 were not rejected. When SPTol is added in to the Identity Salience and Supra-Additive models, it does not generate statistically different results when aggregate data like agent totals and group emergence are examined. The models' results can be said to be the same. However, just like in Chapter Four, the individual level data found in agents' predicted probability of group choice is considered statistically different. Finally, the magnitude of effects of HistID1, HistID2, and SPTol (discrete change in the odds of group choice) are much greater in the Supra-Additive model than in the Identity Salience model. This leads to differences in predicted probabilities of group choice between the two model versions.

Chapter Six

The Buckle Factor

> “In the family, yes [we discussed the golf club because] we all have the same idea; we were in agreement with one another. In one way, [the discussion] would not affect us, but in our business, it would. I was not direct; I was very funny [about discussing the club]. There were two young guys in training [at my business]. I was not totally for [the club], and I was not totally against [the club]. During these times, everyone in Tepoztlán was very heated [about the club]…Then [my employees] began to dispute it, but very strongly. One said, for example, ‘Fine, [building the club] is progress.’ And then the other one said, ‘This [kind of] progress is trash’….Then in the next moment they turn to look at me and asked, ‘What is your opinion?’ *Aye*...Well it was like I was at tennis match, right, watching the ball [go back and forth]! And when they asked me, ‘And what do you think?’ I told them, ‘Well, it’s that I…’ [Then they interrupted] ‘No, no no! You are either for [the club] or against [it]! There is no middle ground!’ *Hijolé!* It was enough to frighten anyone, but at that time no one would have come forth to make an arrest.”[41] Javier Garcia

Javier Garcia elucidates the strategic options people have in deciding which social movement side to support and group to choose. He was for the construction of the golf club, but in public or in the presence of anti-club people, he was social pressure to maintain neutrality or say he was actually against the club. Mr. Garcia even participated in marches against the club to save his market stall. Changing groups, claiming

[41] “Con la familia, sí , bueno, todos tenemos la misma idea; todos estábamos de acuerdo. De algún modo no nos afectaba, pero en el negocio, sí. Y no fui directo; yo fui muy chistoso. Estaban dos chavos entrenando. Yo no era totalmente pro y no era totalmente en contra. ..En ese tiempo estaban todos bien caldeados aquí en Tepoztlán. Todo mundo...Y entonces comenzaron a alegar---pero ya muy fuerte. Entonces uno decía, por ejemplo, ‘Bueno, pues, es progreso.’ Y el otro decía , ‘El progreso es basura’....Bueno, en un momento que voltearon a verme, me dicen, ‘Y tú, ¿qué opinas?’ Aye!...Pues yo estaba como en el tenís, ¿no? Yo no más veía la bolita! Y cuando me dicen, ‘Y tú, ¿qué opinas?’ yo les digo, ‘Pues, es que yo...’—‘No, no, no! Eres pro o contra! Aquí no hay media cinta.’ ¡Híjole! Hasta da miedo, pero en ese tiempo no se hubiera hecho un arresto; nadie se hubiera prestado.”

neutrality, and even participation again the club were strategic choices Mr. Garcia made to stay safe and protect his livelihood.

How are these responses to social pressure best captured for a model? Social pressure effects people in two ways: 1. people succumb to the majority to maintain social ties or protect interests; or, 2. people are more determined to stand their ground. There is something more in withstanding social pressure than a simple tolerance threshold, however. Choosing to give into to social pressure is not a cut-and-dry decision that occurs at a specific point. The decision is only relevant when the individual disagrees with the majority. Moreover, an individual's tolerance threshold could change depending on the social and political environment (i.e. increased violence, threat to livelihood), social movement issues, and relevant identities.

One way to capture the intricacies of social pressure is to add another agent characteristic that determines behavior if the agent has a lower tolerance threshold than its neighbors' *and* disagrees with them: the Buckle Factor (0/1 variable). Substantively, the Buckle Factor not only determines if an agent will always give in to social pressure, but also creates political ideologues. These ideologues do not have the Buckle Factor (it is equal to 0) and stand their ground by not giving in to the opposing majority GroupID should their threshold be too low.

Methodologically, the Buckle Factors increases model dynamics. It is rare to have a model run that hits equilibrium and maintains this static result. Agents without the Buckle Factor can continuously influence cascades that may change group emergence patterns. Agents with the Buckle Factor assist in these cascades by being influence by the ideologue or by determining the ease in which one GroupID forms. The addition of this variable provides the full model of how pre-existing identities conceptualized with both the Identity Salience and Supra-Additive definitions, given social pressure, effect group emergence. The theoretical questions that the Buckle Factor introduces include: when and how does the Buckle Factor affect group emergence; when and under which circumstances does the Buckle Factor influence cascades; and, when does the Buckle Factor influence group choice given the influence from identity strength and social pressure levels?

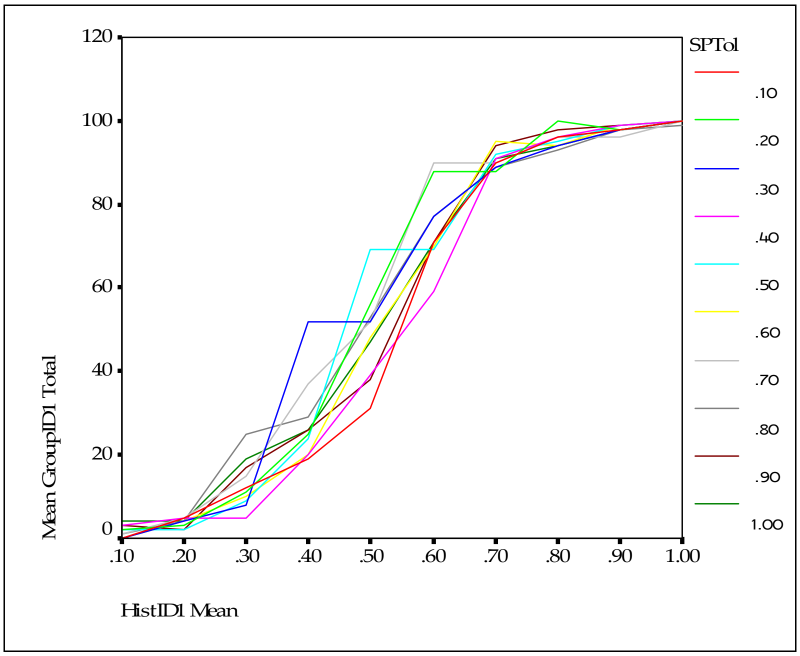
The hypotheses for the Buckle model version are that all results are different between the Identity Salience and Supra-Additive models: H_1, agent totals for each GroupID are different; H_2, group emergence patterns and total groups formed for each GroupID are different; and, H_3, predicted probabilities of group choice for each GroupID are different. The Chapter is organized by these hypotheses. First, agent totals for each model will be presented then compared to test H_1. Second, group emergence patterns will be examined for set HistID and SPTol mean combinations. Then the total number of groups formed for each GroupID is calculated and compared. Finally, mlogit results are presented for each model version and then their predicted probabilities are compared to test H_3.

6.1 Agent Totals by GroupID: Identity Salience Model

To begin to examine how the Buckle Factor influences agents' GroupID choices, the total number of agents for each GroupID are considered. Graph 6.1 shows the total agents with Group ID1 as the means of HistID1 and Social Pressure Tolerance increase.

Overall, the total of agents GroupID1 increase as the HistID1 and SPTol means become stronger.

Graph 6.1 HistID1 and SPTol v. GroupID1 Means

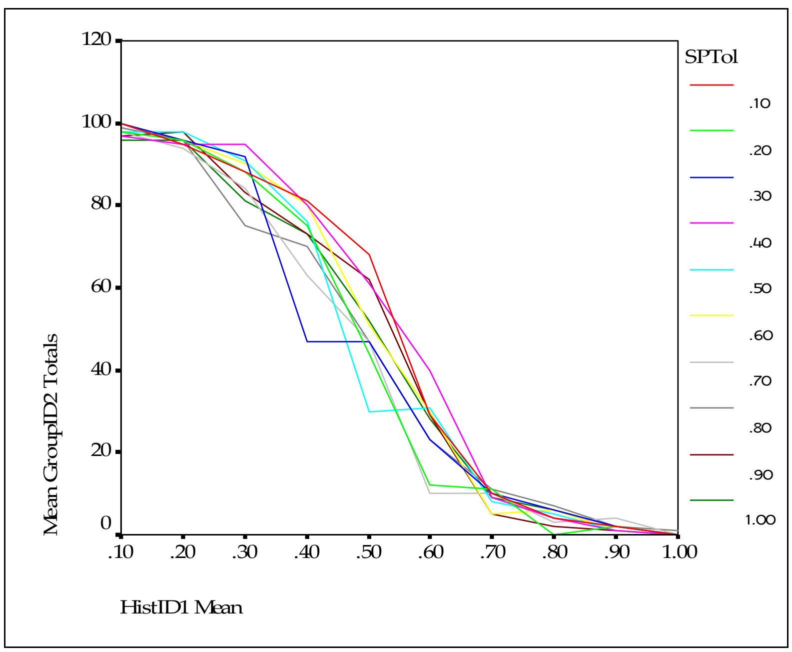


Substantively, for agents with low HistID1 strengths (0.1-0.3), that is, low affinity for HistID1, no amount of social pressure tolerance will equate into choosing GroupID1. If agents only weakly identify with a historical identity, not even high social pressure tolerance makes up for weak identification. For medium levels of HistID1 means (0.4-0.6), even low tolerance levels begin to assist in GroupID choice. As social pressure tolerance becomes stronger, the GroupID1 totals begin to rise.

However, there is a transition for medium HistID1 means. The inflection point of the logistic curve occurs during these values. Even though the agent totals still continue to rise, as HistID1 means gain strength, increased SPTol means begin to reach their upper limit. That is, there are diminishing returns on GroupID1 totals from high social pressure tolerance levels.   High HistID1 means begin to yield the same agent totals regardless of the level of social pressure tolerance. Social pressure tolerance levels help totals when HistID1 is low or medium, but begin to make a negligible impact when HistID1 is high.

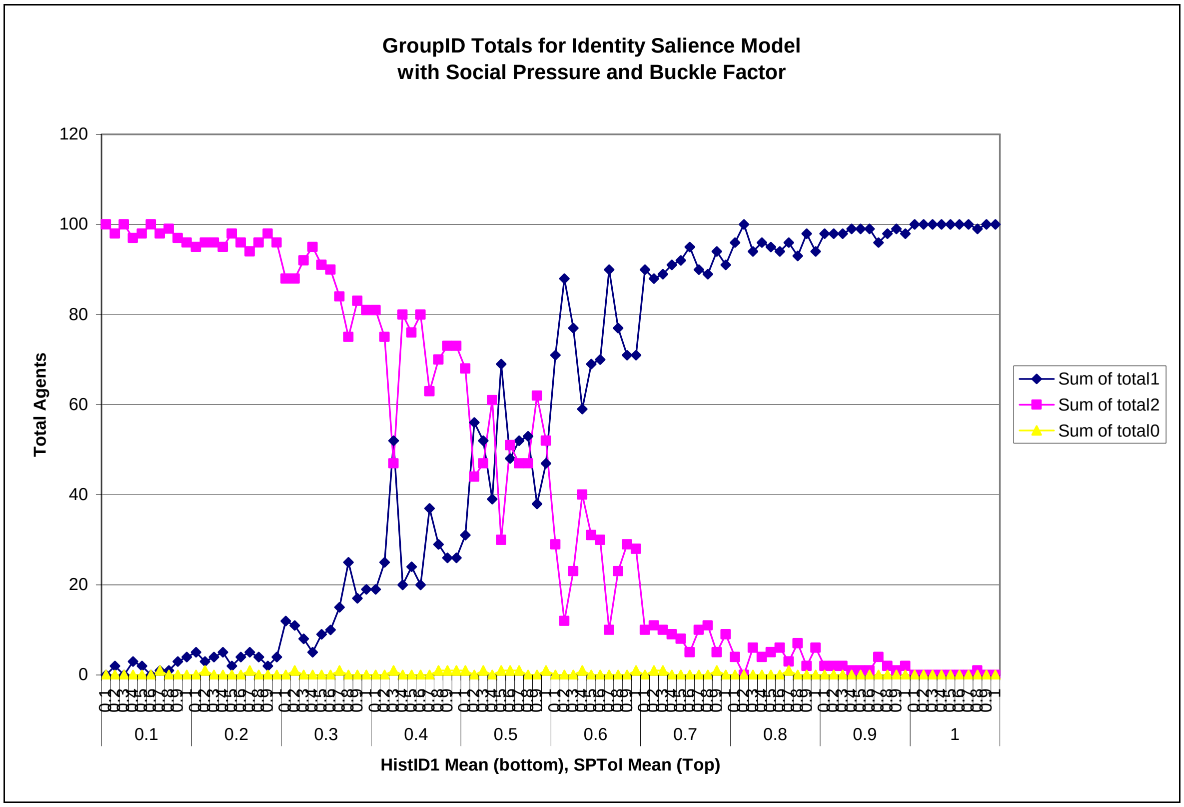
Graph 6.2 shows the agent totals of GroupID2. The logistic curve is opposite from the GroupID1 totals. As the SPTol and HistID1 means increase, the number of agents with GroupID2 decrease. For this model version, this decrease is logical given HistID2 is defined at (HistID1 -1). However, similar to the GroupID1 graph, there is a transition period for medium HistID1 means

Graph 6.2 HistID1 and SPTol v. GroupID2 Means



Agent totals for GroupID2 also demonstrate diminishing returns from increasing Social Pressure Tolerance levels, but for *low* levels of HistID1 means.   When HistID1 is low and HistID2 is at its highest levels, all social pressure tolerance levels generate similar agent totals. When HistID1 means are high and HistID2 means are low, all social pressure tolerance means return low GroupID2 totals. HistID2 is so low that any social pressure tolerance cannot aid in GroupID2 choice.

Graph 6.3 GroupID Totals, Identity Salience Model



Both GroupID1 and GroupID2 graphs show that the largest variation in agent totals occur when HistID1 is 0.4, 0.5 and 0.6. Substantively, this implies that both groups are able to form during these medium HistID1 means. Graph 6.3 shows this middle ground where both GroupID1 and GroupID2 have good probability of emergence, even though the overall total of agents is lower than with other mean combinations. When both HistID1 and HistID2 equal 0.5, all SPTol levels return similar agents totals.

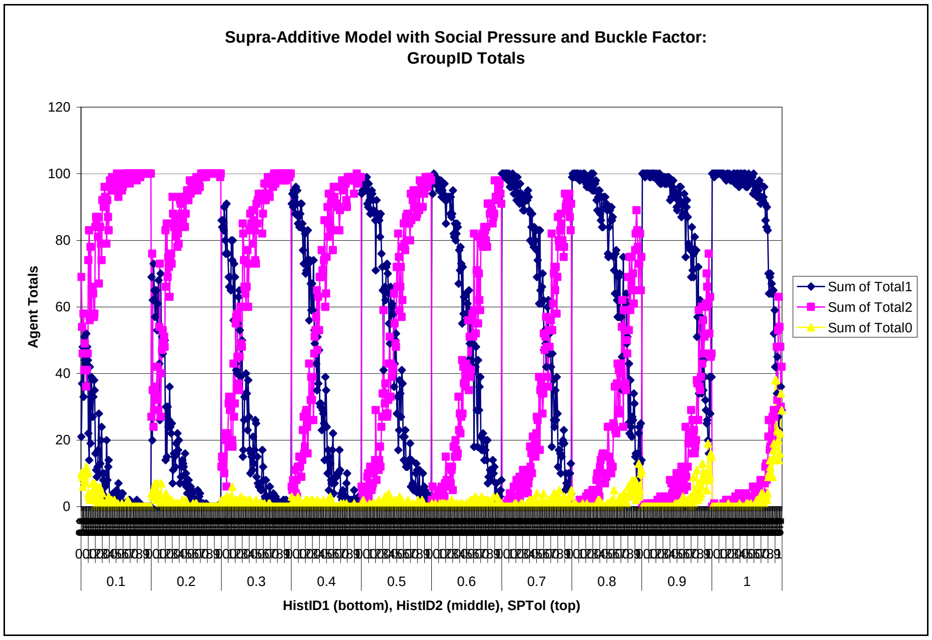
Finally, GroupID0 does not emerge at all for this model version. There are a few ideologues aided by not having the Buckle Factor. However, the majority of agents choose either GroupID1 or GroupID2. The lone ideologue that occurs in a run does not have the ability to influence other agents to remain with their originally assigned GroupID0.

In sum, when the HistID1 and HistID2 means are low in identification strength, no amount of social pressure tolerance will assist agents in choosing GroupID1 or GroupID2. When the HistID means are of medium values, group totals do respond to increasing SPTol means. However, SPTol has diminishing effects when the agents have strong (high) HistID identification strength. Finally, GroupID0 does not form at all for this version of the Identity Salience model with the Buckle Factor. There are a few ideologues, but they cannot influence their surrounding neighbors.

6.2 Agent Totals by GroupID: Supra-Additive Model

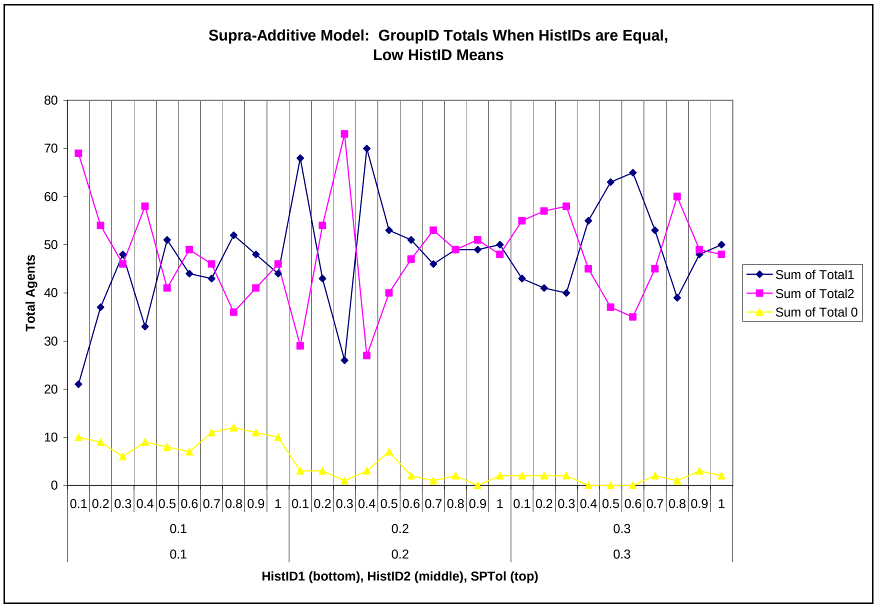
We can now examine how the Buckle Factor affects the Supra-Additive GroupID totals. Graph 6.4 shows the agent totals for all three GroupIDs. Overall, the general pattern seen is that GroupID1 totals gradually increase as HistID1 increases and GroupID2 decreases as HistID1 increases. The opposite is true for the effect of HistID2 on totals. As HistID2 increases, GroupID1 totals decrease. GroupID2 totals increase as HistID2 becomes stronger.

Graph 6.4 GroupID Totals, Supra-Additive Model

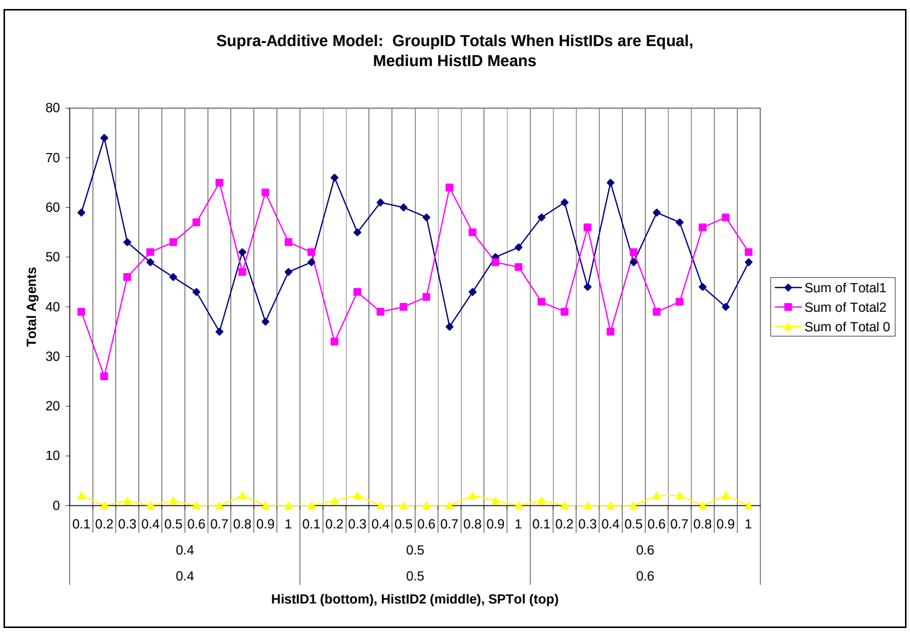


However, what is interesting to note is that the effect from social pressure tolerance on GroupID1 and GroupID2 totals seems negligible except when the two GroupIDs are equal. Graphs 6.5-6.7 show that the most variation in totals occurs when HistID1 is the same as HistID2. In fact, as the two HistIDs become closer in value, variation in agent totals increase. When one HistID is 0.6 and the other is 0.9, for example, there is more variation than when one HistID is 0.2 and the other is 0.9 (and vice versa). It initially appears that SPTol helps to decrease this variation as it becomes stronger, but does not help overall agent totals. GroupID0 also increases when the HistIDs are 0.1 and 0.9-1.0.

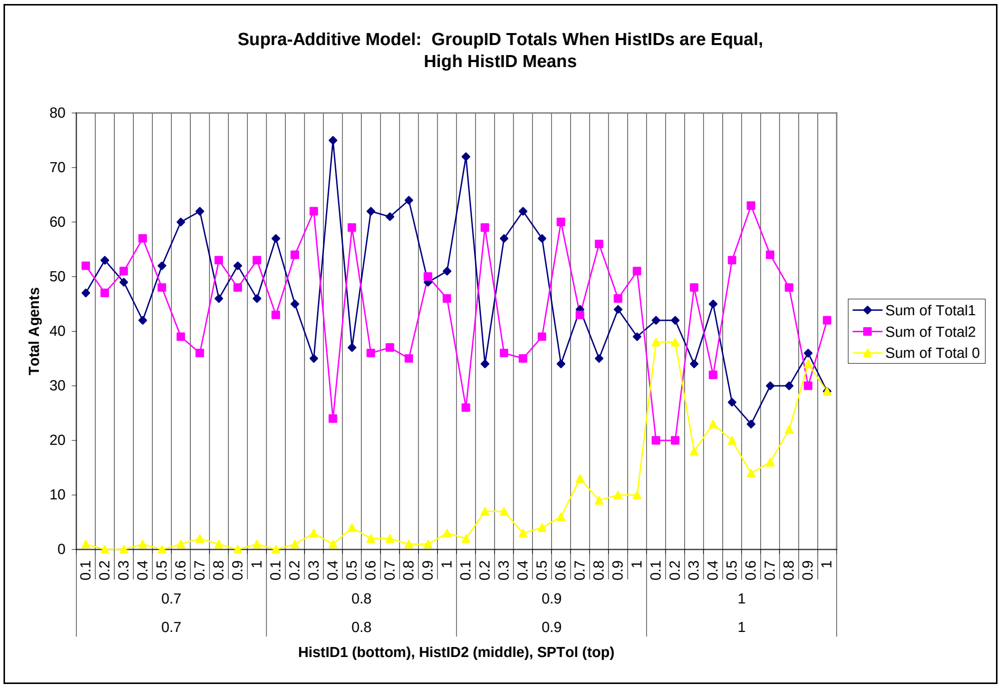
Graphs 6.5 GroupID Totals, Equal HistID Means (low)



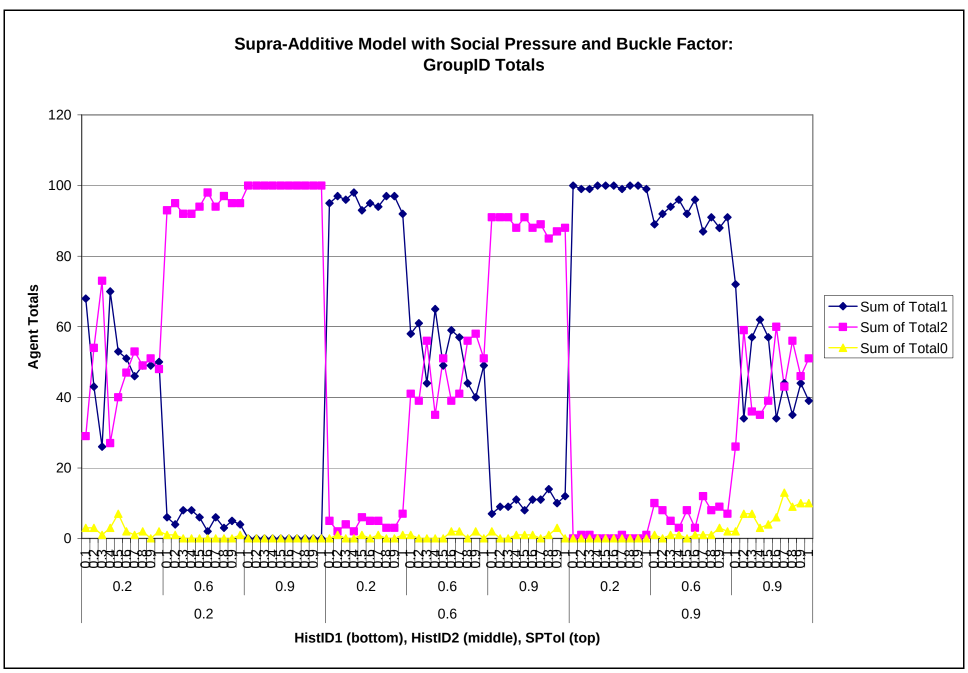
Graph 6.6 GroupID Totals, Equal HistID Means (medium)



Graph 6.7 GroupID Totals, Equal HistID Means (high)



Graph 6.8 GroupID Totals, Supra-Additive Model

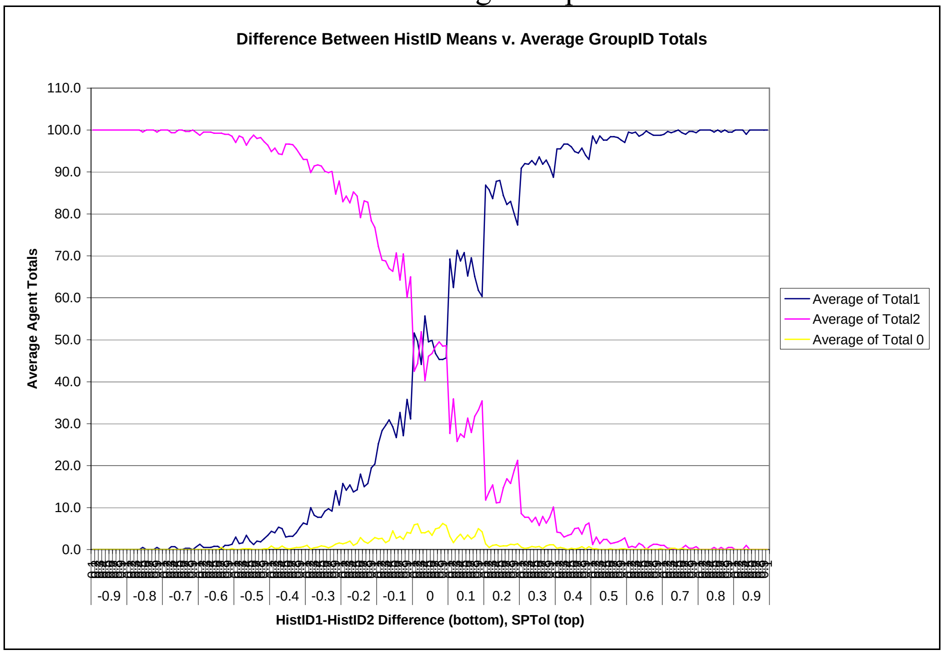


Graph 6.8 shows a parsed down graph using only high, medium, and low values for HistID1, HistID2, and SPTol. It initially appears that SPTol affects GroupID totals in two ways: 1.) when the two HistIDs are the same value, increasing SPTol means decrease variation, and 2.) as the difference between the two HistIDs increase, benefits from SPTol decrease. This latter trend implies diminishing returns from increasing social pressure tolerance. When both HistIDs are equal and both are of low and high strengths, more GroupID0 agents are generated.

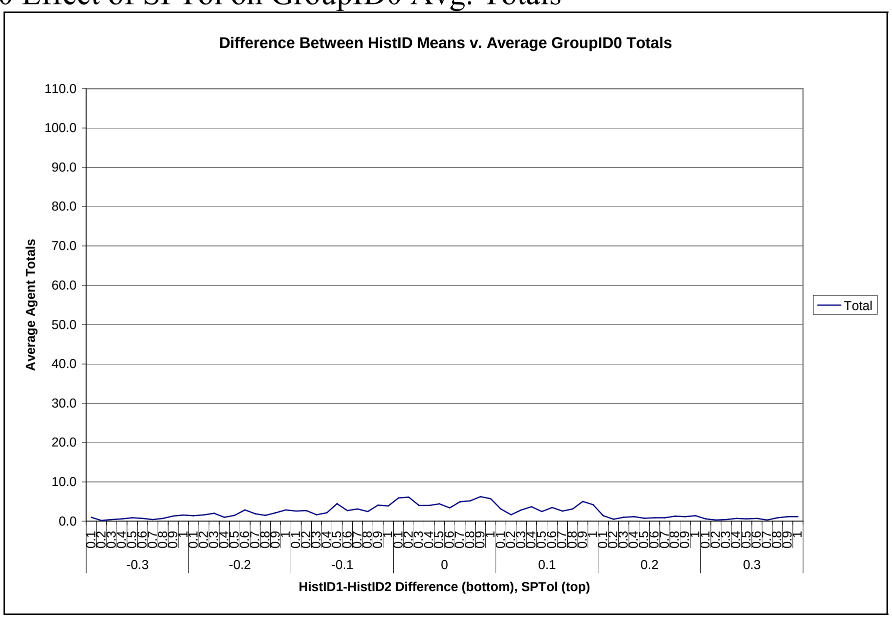
To further investigate the affect of SPTol on GroupID totals when HistID1 and HistID2 are equal, Graph 6.9 presents the average group totals according to the difference between the two HistIDs. Positive numbers indicate that HistID1 is larger and negative numbers indicate that HistID2 is larger. It is clear that when the two HistIDs have a larger difference between them, the less social pressure tolerance can provide an increase in GroupID totals. This result confirms that there are diminishing returns from increasing SPTol.

SPTol does help the lower HistID as HistID1 and HistID2 become closer in value. This assistance in GroupID totals (specifically GroupID1 and GroupID2) is most marked when the difference between the two HistIDs is from -0.3 to 0.4. When HistID1 and HistID2 are equal, SPTol helps to decrease the variation in the average totals for GroupID1 and GroupID2. It is also interesting to note that SPTol does not help GroupID0 totals when the two HistIDs are very close in value, -0.1 to 0.1. Graph 6.10 shows the average GroupID0 totals when the HistID difference is zero. While there is variation as SPTol increases, the trend is essentially a flat line.

Graph 6.9 Difference Between HistIDs v. Avg GroupID Totals



Graph 6.10 Effect of SPTol on GroupID0 Avg. Totals



Lastly, Graphs 6.5-6.9 confirm agent totals' trends when the HistIDs are equal. SPTol helps decrease variation in agent totals for GroupID1 and GroupID2 as SPTol becomes stronger. The largest variation occurs when the HistIDs are of medium strength (0.4-0.6). GroupID0 totals increase when HistID1 and HistID2 are low and also when they are both high. There is a slight increase in agent totals when the HistIDs are within

+/- 0.1 or equal, but there is no effect from SPTol. The variation at the both extremes in GroupID0 totals seen in Graph 6.4 at the beginning of this section is most logically caused by the neutrality definition and the upper and lower boundaries. There will be more neutral agents at each extreme of the HistID1 and HistID2 distributions.

In sum, the general group totals trend is that GroupID1 totals increase as the mean of HistID1 increases and the mean of HistID2 decreases, and that GroupID2 totals increase as the mean of HistID2 increases and the mean of HistID1 decreases. However, when social pressure tolerance becomes important is less straightforward. There are diminishing returns from SPTol as the difference between the two HistIDs increase. When HistID1 and HistID2 become closer in value, SPTol increases the agent totals for the lower HistID. When the HistIDs are equal, SPTol helps to decreases the variation between GroupID1 and GroupID2. Agents choose GroupID0 when they are political ideologues or ideologues (do not have the Buckle Factor) and are neutral.

6.3 Agent Totals by GroupID: Model Comparison

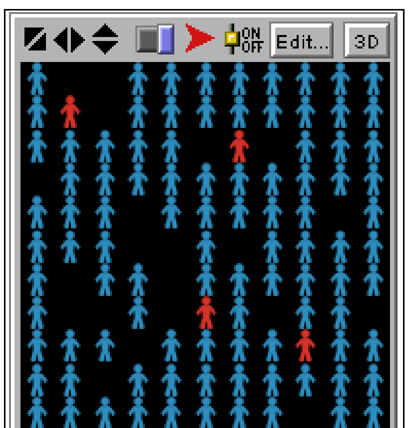
To test H_1, agent totals for each GroupID can be compared with a chi-square test to determine if the totals are significantly different. Low (0.2), medium (0.6), and high (0.9) mean combinations for HistID1 and SPTol will be used for the comparison. Table 6.1 shows the chi-square results for each mean combination.

Most of the mean combinations are not statistically different between the Identity Salience and Supra-Additive models (at 95% significance level). There is one combination, HistID1 = 0.2, HistID2 = 0.8, and SPTol = 0.6, where p = 0.043. Further examination shows that for this combination in the Identity Salience model, ideologues are able to choose GroupID1, but they are not able to cause any cascades because there are too few and the social pressure to choose GroupID2 is too great. Illustration 6.1 shows this example.

Table 6.1 Chi-square Results for Agent Totals Comparison

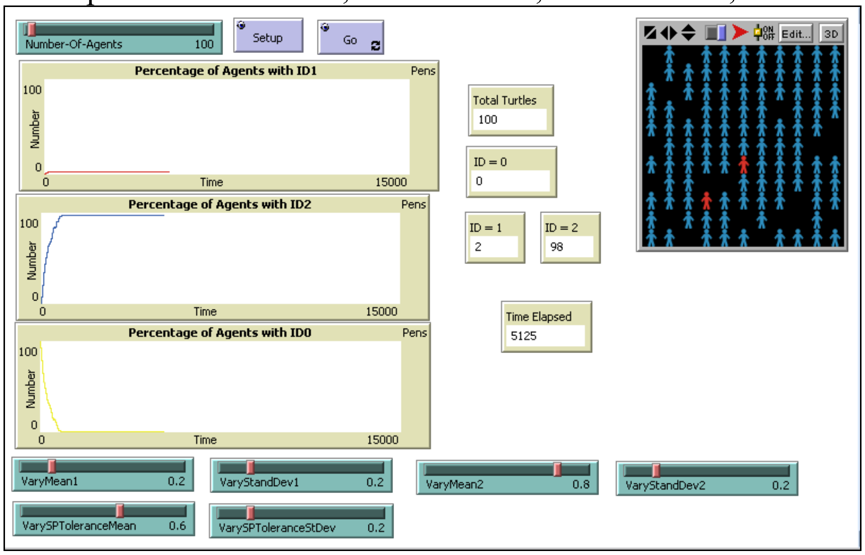
			Identity Salience Totals			Supra-Additive Totals					
HistID1	**HistID2**	**SPTol**	**GrpID1**	**GrpID2**	**GrpID0**	**GrpID1**	**GrpID2**	**GrpID0**	**Chi-Square**	**df**	**p-value**
0.2	0.8	0.2	3	96	1	0	100	0	4.08	2	0.130
0.2	0.8	0.6	4	96	0	0	100	0	4.08	1	0.043
0.2	0.8	0.9	2	98	0	1	99	0	0.338	1	0.561
0.6	0.4	0.2	88	12	0	82	18	0	1.41	1	0.235
0.6	0.4	0.6	70	30	0	82	17	1	5.54	2	0.063
0.6	0.4	0.9	71	29	0	67	33	0	0.374	1	0.541
0.9	0.1	0.2	98	2	0	100	0	0	2.02	1	0.155
0.9	0.1	0.6	99	1	0	100	0	0	1.01	1	0.316
0.9	0.1	0.9	99	1	0	99	1	0	0.000	1	1.000

Illustration 6.1 Mean Combination HistID1 = 0.2, SPTol = 0.6



HistID1 = 0.2, SPTol = 0.6

Illustration 6.2 Supra-Additive Model, HistID1 = 0.2, HistID2 = 0.8, SPTol = 0.6.



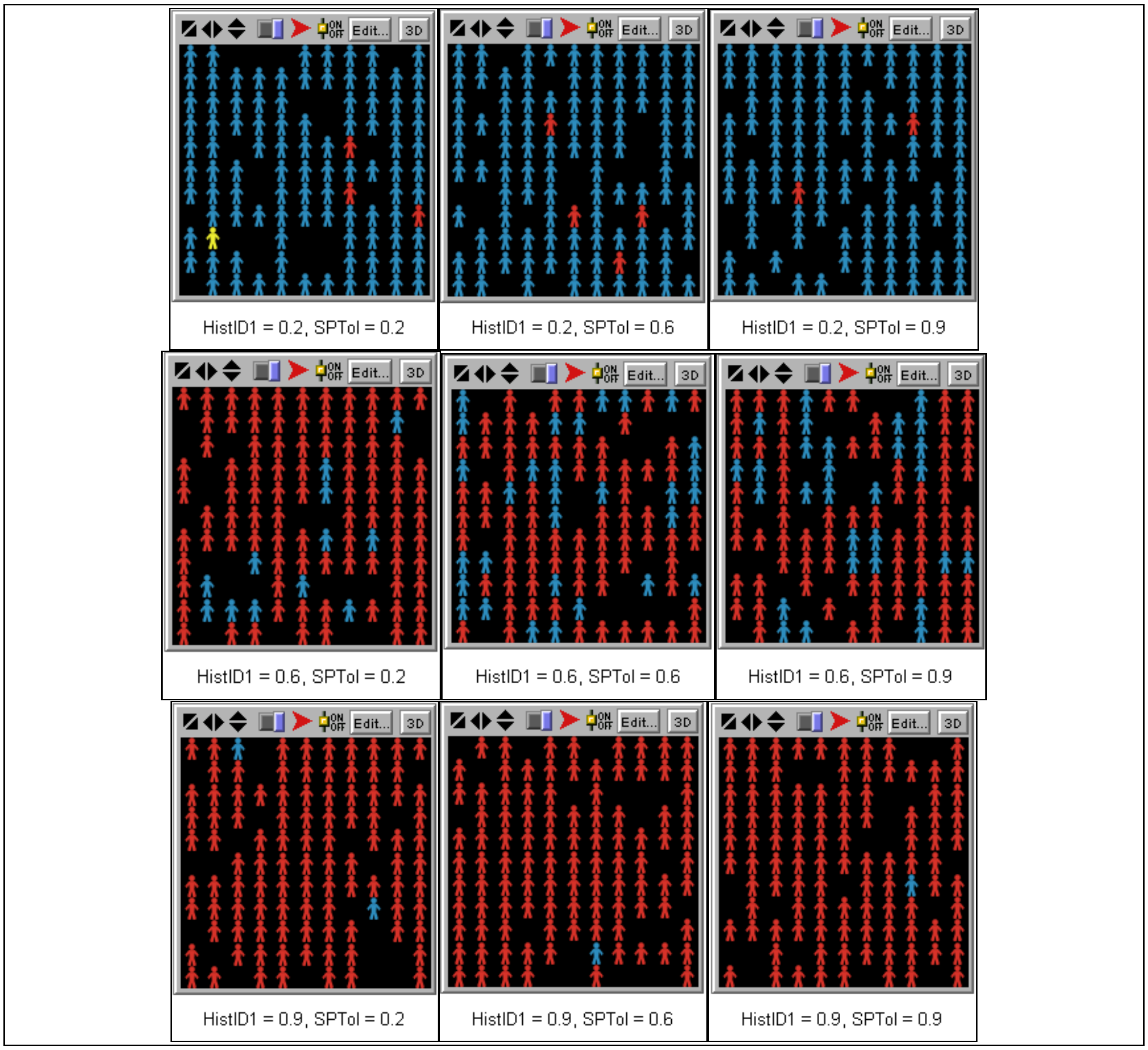
Retesting of the Supra-Additive model for this same mean combination shows that ideologues are able to emerge and maintain their GroupID1 choice, but it just depends on the agents' assigned characteristics. Illustration 6.2 shows this possibility. Overall, it is difficult to accept H_1—that the agent totals from the Identity Salience and Supra-Additive models are different. Both models have similar agent total trends even with SPTol and the Buckle Factor added in. Moreover, the chi-square test shows that the majority of the mean combinations are statistically similar and the one combination that is considered significantly different can be explained by agents' assigned characteristics. In conclusion, H_1 is rejected.

6.4 Group Emergence: Identity Salience Model

While examining the behavior of GroupID totals provides some insight into group formation, visually exploring the dynamics of group emergence is beneficial, too.

Illustration 6.3 shows the group outcomes for increasing HistID1 and SPTol mean combinations. Each section is grouped by low (0.2), medium (0.6), and high (0.9) HistID1 means. GroupID1 is represented by red agents, GroupID2 is represented by blue agents, and GroupID0 is represented by yellow agents.

Illustration 6.3 Group Emergence by HistID1 and SPTol Means



For low HistID1 means, GroupID2 prevails across all social pressure tolerance levels. When HistID2 = 0.8 and group emergence is biased toward the higher HistID strength. Even low SPTol does not prevent GroupID2 formation. There are some GroupID1 ideologues, but the low HistID1 mean coupled does not allow any group cascades. High social pressure tolerance does not assist GroupID1 emergence because the HistID1 mean is too low.

For medium HistID1 means, there is more group formation of both GroupID1 and GroupID2. However, GroupID1 now succeeds. HistID2 = 0.4, so it is not too low to be absent in influencing group emergence. In fact, as social pressure tolerance increases, more GroupID2 groups, albeit small groups, to appear. Unlike when HistID1 was 0.2, social pressure tolerance does aid group formation. However, HistID2 is still too low to create larger groups.

Finally, when HistID1 is high, the emergence of GroupID1 dominates. HistID2 is now too low to create any groups, though there are a few ideologues. However, they cannot influence other agents even when SPTol is high. Some agents might temporarily choose GroupID2 if the Buckle Factor is present, but these agents are not able to maintain the new GroupID.

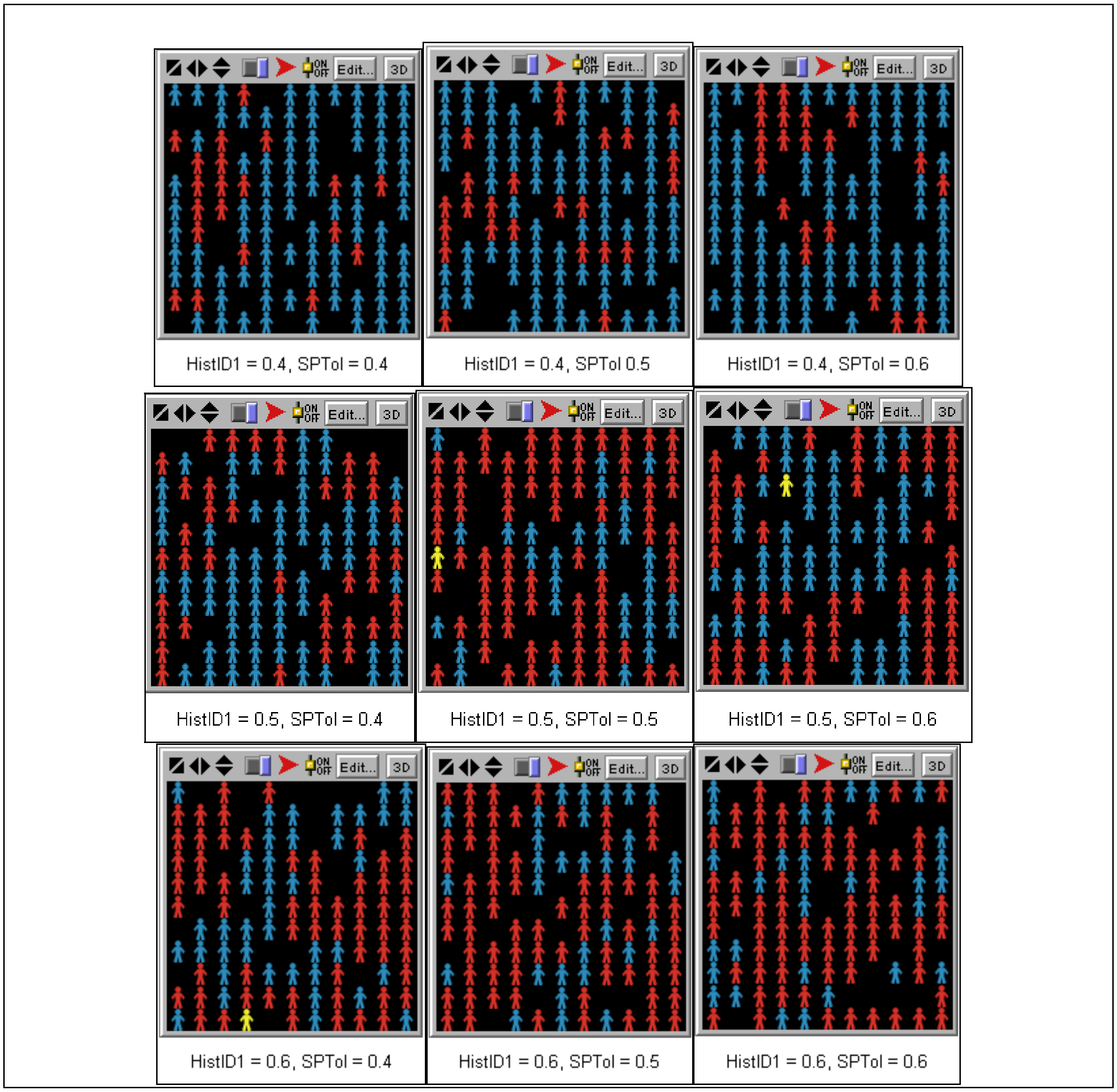
The Buckle Factor influences group emergence in three ways. Agents that do have the Buckle Factor present will quickly give in to the majority pressure causing fast cascades of one GroupID. This effect is seen when the two HistIDs are very different (one is high and the other one is low). Another way the Buckle Factor influences group emergence is in providing the opportunity for political ideologues. These agents *do not* have the Buckle Factor and are able to hold their ground even when one HistID and the social pressure tolerance mean are low.

The third way in which the Buckle Factor affects group emergence is in assisting agents with a minority GroupID to begin to form groups. However, several variables—environmental and characteristics endogenous to agents—must be in place. The two HistIDs must not be too different in value so that social pressure tolerance can help the lower HistID. Ideologues then must be able "to find" agents with the Buckle Factor present to influence their choice. The help from social pressure tolerance coupled with increasing numbers of neighbors surrounding this ideologue will generate larger minority groups. The agents with the Buckle Factor are able to keep their minority GroupID choice. The correct agent characteristics coupled with advantageous agent location results in minority group emergence.

Agents are most able to create minority groups where there is an open space on the grid. An agent in a relatively unpopulated location will have less neighbor influence and would need less social pressure tolerance to maintain their GroupID. An ideologue will choose or keep a minority GroupID in any location. However, if they are able to move to an open space on the grid there is a better opportunity to influence another agent with the Buckle Factor. In turn, this agent with the Buckle Factor would not be as influenced by the majority GroupID because of the surrounding empty spaces. This role for location and environment highlights the importance of population density and social spaces where minority ideas could flourish, but these variables will be explored at another time.

Given that both GroupID1 and GroupID2 are able to form when the HistIDs are relatively close in value, it is worth while pursuing group emergence for all medium mean combinations. Illustration 6.4 shows group formation for 0.4, 0.5, and 0.6 HistID1 means. SPTol values are also 0.4, 0.5, and 0.6 to help capture changes in agent totals seen around the inflection point in Graph 6.3.

Illustration 6.4 Group Emergence for Medium HistID1 and SPTol Means



When HistID1 = 0.4, GroupID2 formation is consistently larger regardless of social pressure tolerance means. HistID2 = 0.6 and this higher HistID mean benefits greater group emergence. GroupID1 is never able to cascade into larger groups.

Theoretically, larger GroupID1 groups could occur if there are enough ideologues who are able to locate neighbors with the Buckle Factor. The opposite group emergence pattern occurs when the HistIDs mean are reversed—HistID1 = 0.6 and HistID2 = 0.4. GroupID1 is consistently larger regardless of social pressure tolerance levels.

When HistID1 and HistID2 both increase to 0.5, inconsistencies arise in determining the majority GroupID. Because both HistIDs are equal, group formation is even more dependent upon initially assigned agent characteristics, agent placement on the grid, and whether or not randomly moving ideologues will locate other agents with the Buckle Factor. When SPTol = 0.4, GroupID2 prevails. When SPTol = 0.5, GroupID1 prevails. However, when SPTol increases to 0.6, GroupID2 prevails again. Illustrations 6.5-6.6 provide some insight as to why these results are initially confusing. Group formation is sensitive to agent characteristics and outcomes can change depending on these variables assigned at start-up.

Illustration 6.5 HistID1 and SPTol = 0.5, Higher GroupID1

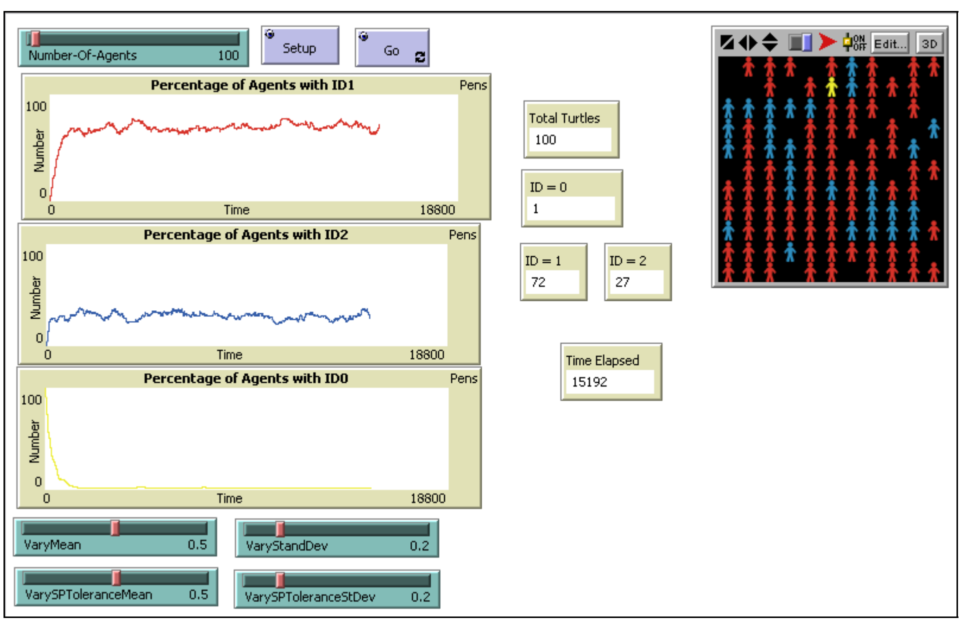


Illustration 6.5 shows the world output when GroupID1 is able to garner the larger numbers. The graphs detail that the red agents are able to immediately gain enough agents to set this group emergence trend. While there are agents who immediately choose GroupID2, there are not enough to challenge GroupID1. There is volatile variation around an equilibrium which indicates that GroupID2 agents are able to influence some change because of the Buckle Factor and have more than just a few political ideologues. However, the majority status of GroupID1 ensures that it eventually gains numbers again. Other HistID1/SPTol mean combinations either hit equilibrium quickly or have very little variation around an equilibrium point (the low standard deviation of the HistID1 and SPTol means points to the influence from initially assigned agent characteristics and not population diversity).

Illustration 6.6 HistID1 and SPTol = 0.5, Higher GroupID2

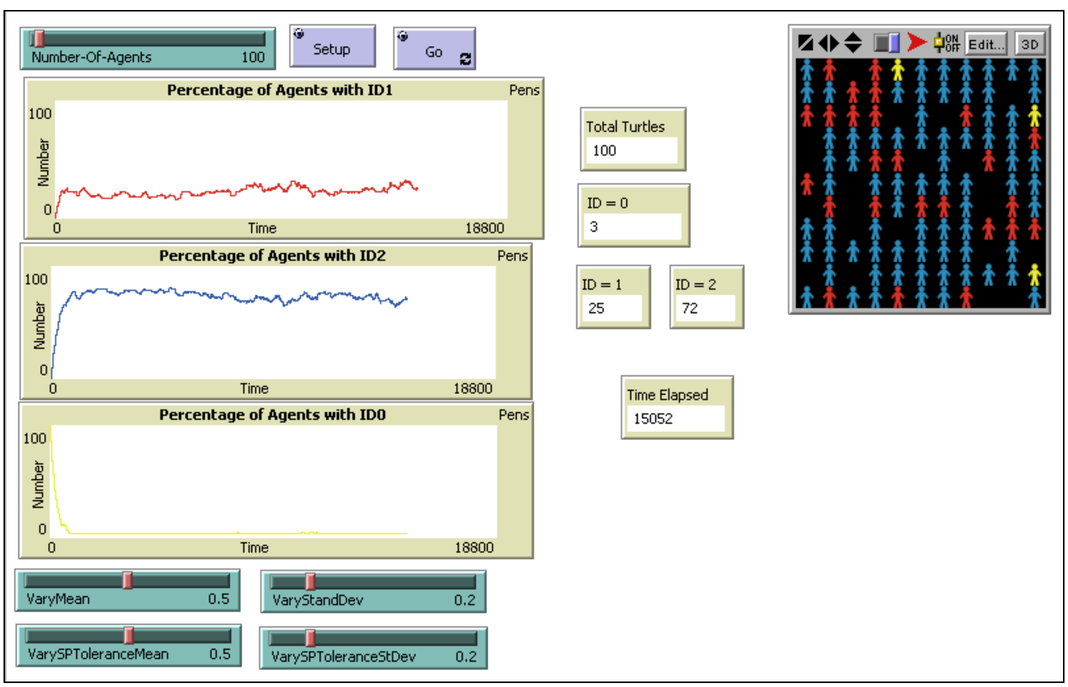
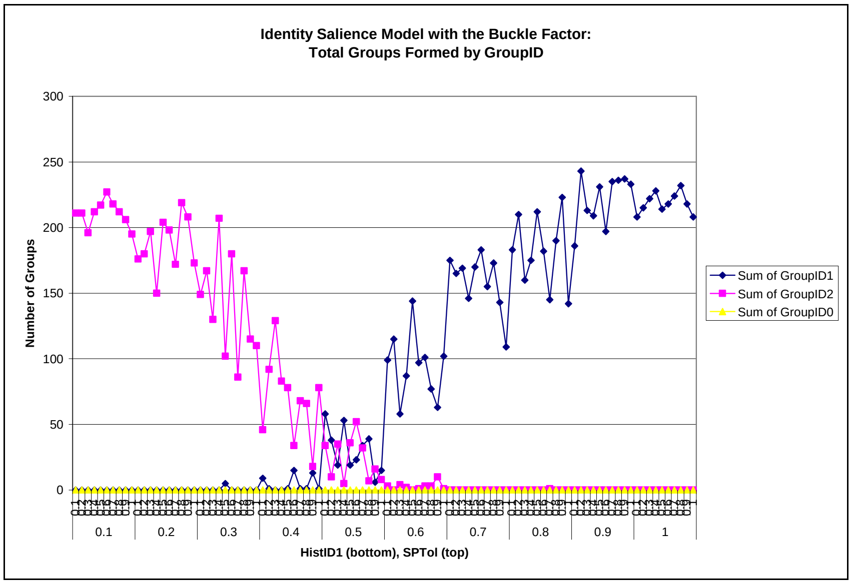


Illustration 6.6 depicts the exact opposite—GroupID2 is able to win even though the HistID1 and SPTol means are the same as before. In this run, agents “lock-in” their GroupID2 choice early on and GroupID1 agents are never able to cause much change. There is variation around an equilibrium point, though the GroupID2 majority is not challenged. In both examples there are some GroupID0 ideologues. They are not able to influence any agents.

In sum, group emergence is dominated by one GroupID when the HistID1 mean is low or high. There are only a few ideologues because of the Buckle Factor not being present in their agent characteristics. However, they are not able to influence any cascades because of the power of the majority GroupID. Moreover, social pressure tolerance does not aid minority group formation in any way for these HistID1 mean values. This pattern of group emergence for low or high HistID1 means is consistent with the analysis of GroupID totals.

Medium HistID1 and SPTol means generate the most fluctuation in group emergence. Though one group usually is larger, both GroupID1 and GroupID2 are able to form when HistID1 is 0.4 (for SPTol 0.4-0.6), 0.5 (for SPTol 0.4 and 0.6), and 0.6 (for SPTol 0.4-0.6). However, when HistID1 and SPTol are both 0.5, either GroupID could flourish depending upon the initial make-up of agent characteristics and their location on the grid. For this middle ground, the Buckle Factor is extremely important providing ideologues (the Buckle Factor is not present) and those who can follow them (the Buckle Factor is present). Nevertheless, these agents must still find each other on the grid and in an open location where they can take advantage of lower neighbor influence.

Graph 6.11 Total Groups Formed, Identity Salience Model

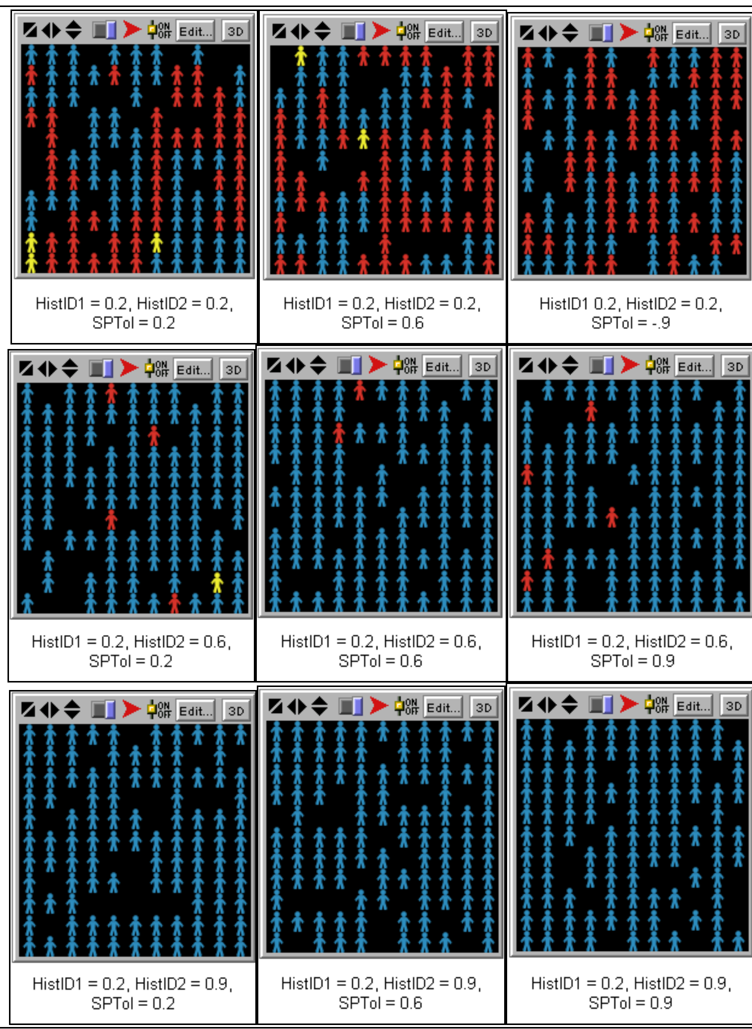


Next, the number of groups formed for each GroupID are calculated (Graph 6.11). The number of GroupID1 groups increase and the number of GroupID2 groups decrease and the HistID1 mean becomes stronger. No GroupID0 groups are able to emerge. Both GroupID1 and GroupID2 groups are able to emerge at the same time when the HistID means are 0.5. When the HistID1 mean is 0.4 and 0.6 there are a few GroupID1 and GroupID2 groups, respectively. Their ability to form depends upon SPTol levels and the opportunity for ideologues to influence enough agents. When the HistID means are equal, though, it is clear that both GroupID1 and GroupID2 have no difficulties in forming groups.

6.5 Group Emergence: Supra-Additive Model

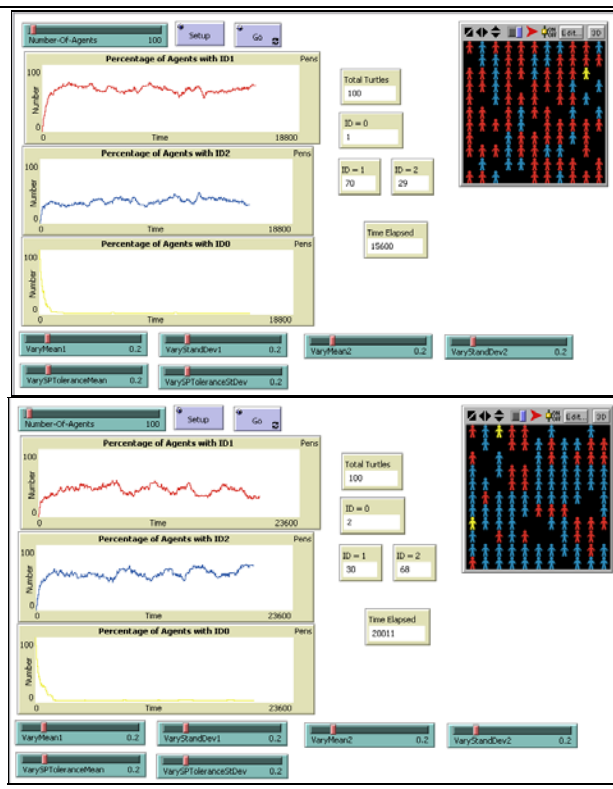
Looking at group emergence patterns also help elucidate GroupID totals. The illustrations below show group emergence categorized by the HistID1 mean (low, medium, high). Within each illustration, HistID2 and SPTol means are also varied (low, medium, high). Overall, two important factors surface influencing group emergence for this version of the Supra-Additive model: 1.) Group emergence for the majority of runs is determined by the larger HistID mean, and, 2.) Influence from Social Pressure Tolerance and the Buckle Factor is seen when the HistID1 and HistID2 means are similar, assisting in variation of group totals within each run and in surges in group formation overall.

Illustration 6.7 Group Emergence Patterns, HistID1 (low)



Examining low HistID1 means immediately shows the difference in group emergence when the two HistIDs are close in value and when they are not. As HistID2 increases, group formation is easily dominated by GroupID2, seemingly regardless of SPTol values. When HistID2 = 0.6, there are a few GroupID1 ideologues, but they are not able to influence their neighbors' GroupID choices because of the level of HistID2 strength (a majority is quickly created) and isolation. They can influence a few agents with the Buckle Factor and low SPTol values, but these particular agents are again influenced by the GroupID2 majority and change their GroupID back to GroupID2. However, when both HistIDs are low, both GroupID1 (red agents) and GroupID2 (blue agents) emerge (with a few GroupID0 ideologues, yellow agents).

Illustration 6.8 Variation in Majority GroupID, Same HistID



Further examination of group formation with these agent parameters discovers that either GroupID1 or GroupID2 could dominate if the initial conditions are favorable (Illustration 6.8). Depending upon agents' assigned characteristics, including whether or not they have the Buckle Factor, group emergence may put either GroupID1 or GroupID2 in the majority. Which GroupID becomes the majority group appears to be decided quickly in the beginning of the run; after this lead has been established, there is variation above and below this point.

If there are many agents with the Buckle Factor, the variation around this equilibrium point is volatile. Agents make frequent GroupID changes because they are pressured by their neighbors with a majority GroupID (i.e. a percentage of neighbors with the same GroupID that is higher they their SPTol threshold). If there are few agents with the Buckle Factor, variation around the equilibrium point is small. Illustrations 6.9 is an example of these instances.

Illustration 6.9 Low Volatility Around Equilibrium Point

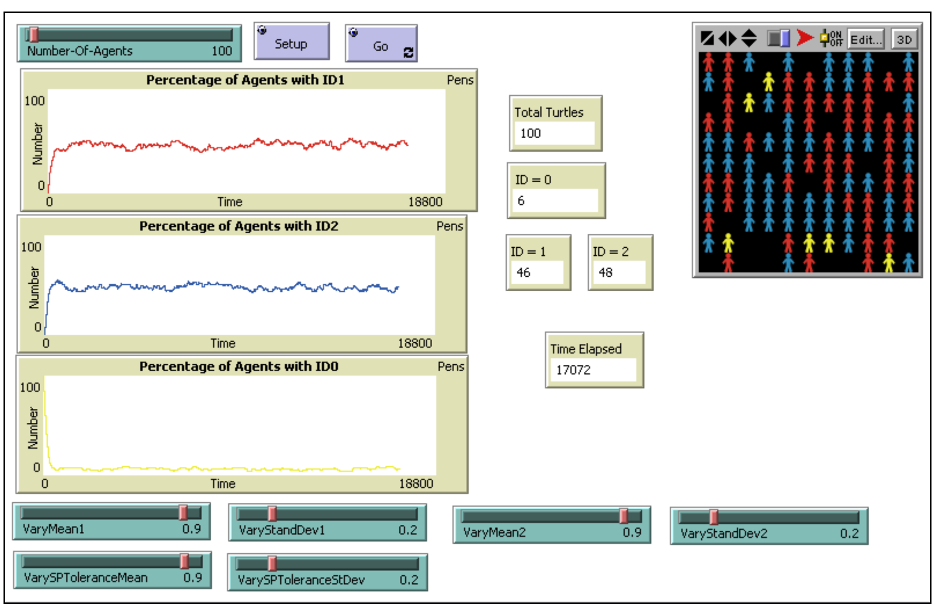
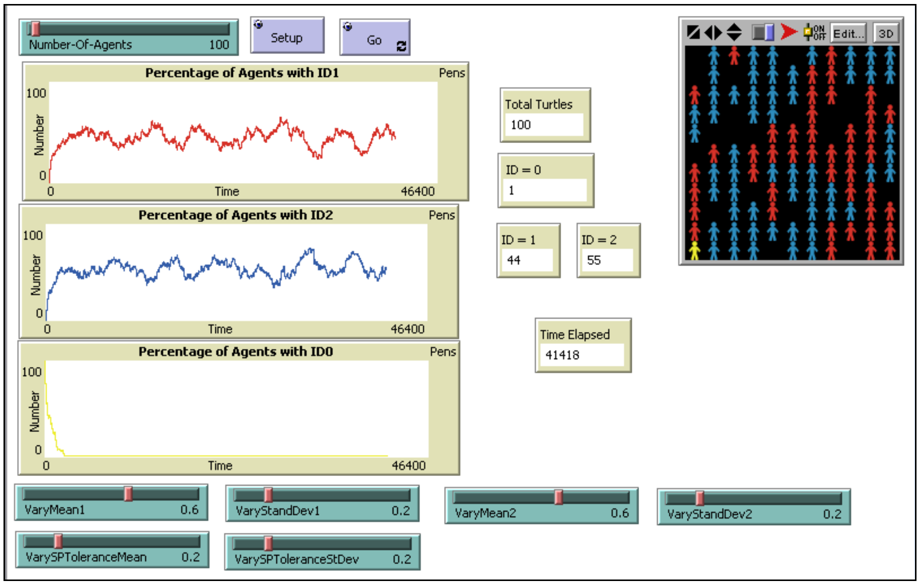


Illustration 6.10 High Volatility Around Equilibrium Point



Substantively, low or high volatility would be identified as stable group emergence patterns or unstable group emergence patterns. Low volatility indicates that once the groups are formed, their numbers and participant make-up does not change that much. However, high volatility suggests high turnover in group numbers, group membership, and changing group emergence patterns. Depending on a person's location and surrounding influential neighbors, they could become more neutral about the cause (not maintaining consistent, fervent support) or change groups entirely in order to cope with social pressure.

This volatility manifested itself in Tepoztlán in two ways. A common way to deal with social pressure to be against the construction of the golf club was to claim neutrality among strident anti-golf club neighbors or family members. There were two neutral subpopulations: those who were sincerely ambivalent about the benefits and drawbacks of the construction, and those who were actually in favor of the construction, but for various reasons (fear, choosing family/friend relationships over opinion, etc.) verbally claimed neutrality. This choice served as an exit option and resulted in stable group formation.

Also rooted in maintaining the peace within families and neighborhoods, the other form in which volatility expressed itself was in people agreeing with whatever current majority opinion in which they found themselves. Among elder family members who might be against the construction of the golf clubs, younger family members would agree with them to prevent fights. Among supporters of the club, a non-Tepozteco might concur in order to be accepted in the town. Fundamentally, buckling had as much to do with strategically prioritizing peace and relationship ties as it did with giving into social pressure. This type of neutrality results in unstable group formation.

In sum, when the HistIDs are similar, the effects from the Buckle Factor and Social Pressure Tolerance may determine which GroupID is able to establish a cascade and may explain why there is variation around an equilibrium point. The Buckle Factor assists in these different outcomes by serving as a catalyst for variation within one run, and can produce surges of group formation of one GroupID. Agents that have the Buckle Factor present and a low SPTol level change their GroupID according to the prevailing, surrounding majority. They will be constantly changing their GroupIDs until they are surrounded by a stable majority of one GroupID. This constant GroupID flipping is what causes the intra-run variation in GroupID totals. That is, the Buckle Factor increases model dynamics.

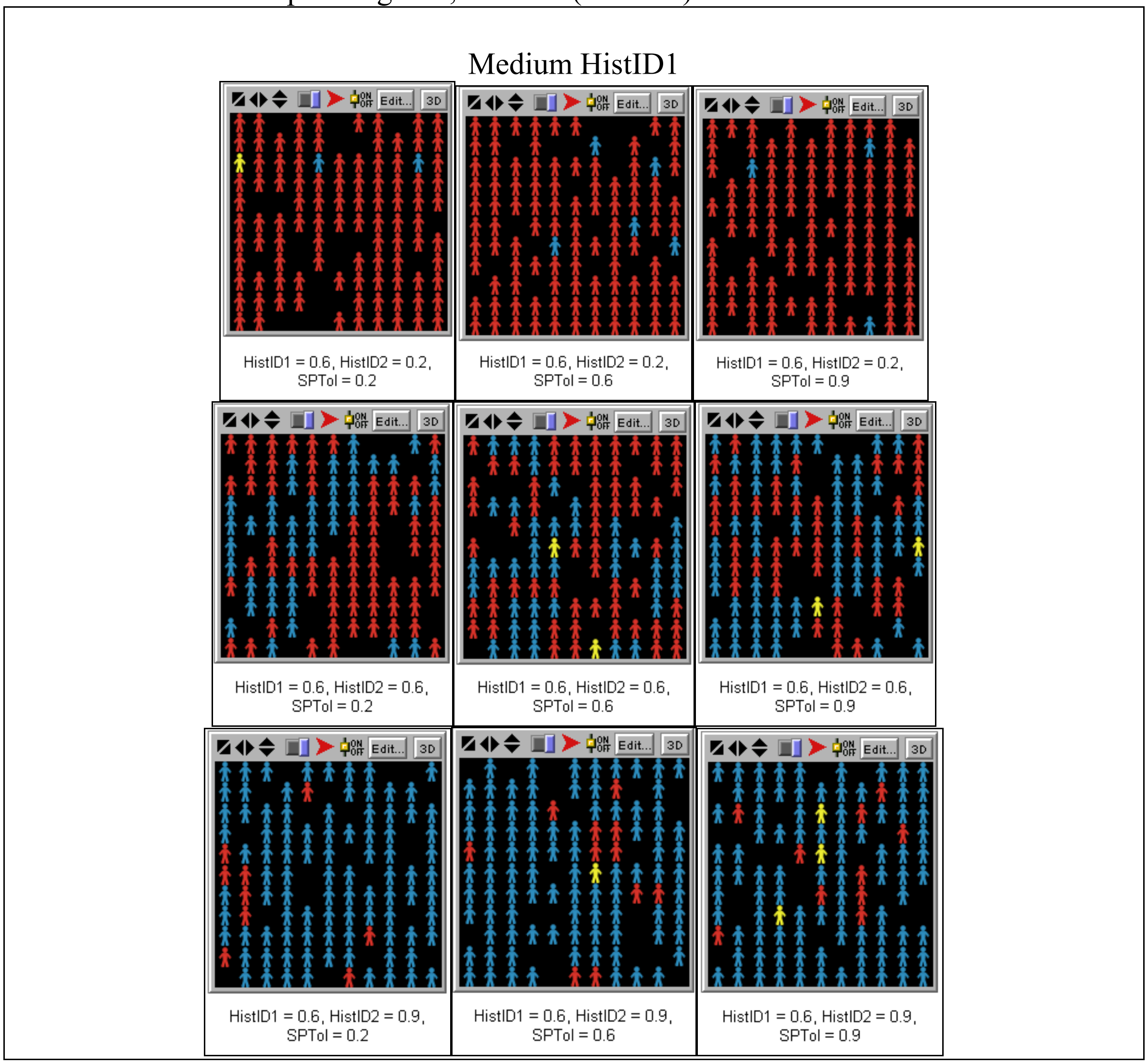
However, when these agents are surrounded by GroupID majority, they help build up the numbers necessary to influence other agents and cause GroupID clustering. While social pressure tolerance appears not to affect group emergence when the two HistIDs are dissimilar, it could help determine, in conjunction with the Buckle Factor, which GroupID will prevail. These two variables essentially serve as tie-breakers. If there are enough agents with higher social pressure tolerance levels to maintain their GroupID choice regardless of neighborhood pressure, these political ideologues may influence other neighbors' choices causing a surge in the number of agents with the ideologue's GroupID. Furthermore, if there are enough agents with low SPTol *and* have the Buckle Factor present, these agents would be easily influenced by a GroupID cluster.

When the HistID1 mean = 0.6, GroupID1 clearly dominates (Illustration 6.11). However, there are several ideologues within each run, but they cannot create group surges except when HistID1 and HistID2 are equal. When the HistIDs are different, SPTol does not seem to influence group emergence in terms of changing clustering patterns.

Both GroupID1 and GroupID2 flourish again when HistID1 and HistID2 are equal. SPTol seems to only influence groups by supporting some neutral ideologues (yellow agents). Similar to the low HistID1 group emergence patterns, when both HistIDs are equal, group formation is sensitive to the initially assigned agent characteristics. Illustration 6.12 shows the two different possible outcomes. Note how the equilibrium point around which GroupID choice varies is set early in the beginning of the run. Because the HistIDs means are equal, agents are just as likely to choose either

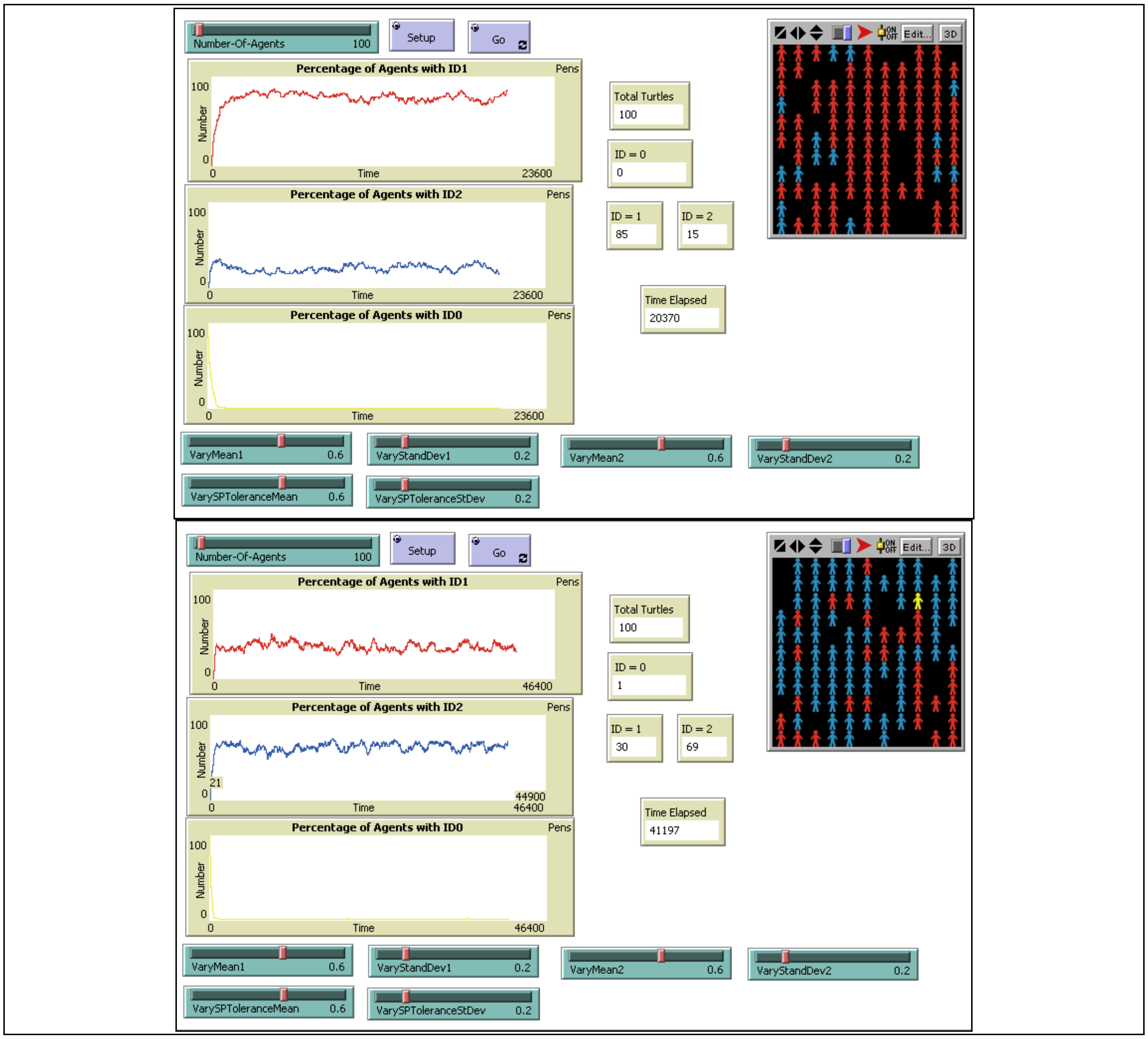
GroupID1 or GroupID2.[42] The Buckle Factor and SPTol levels then finally decide how the agents decide.

Illustration 6.11 Group Emergence, HistID1 (medium)



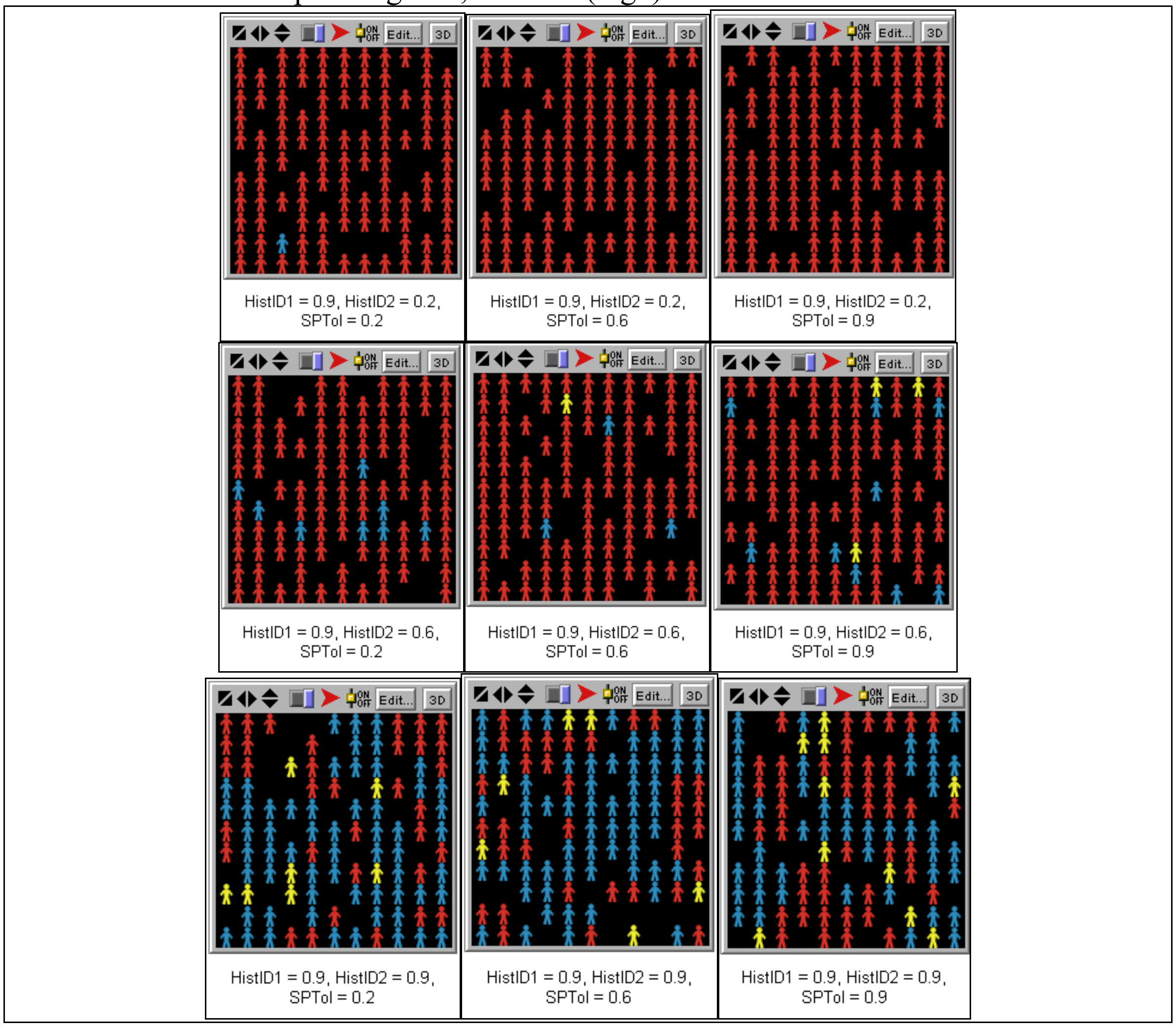
[42] Again, these experiments use a standard deviation of 0.2 for all means providing some variation in the distribution from which the variables come. This phenomenon of changing group majorities could change when the standard deviations (or increased diversity in agent characteristics) change.

Illustration 6.12 Variation in GroupID Majority, HistID1 (medium)



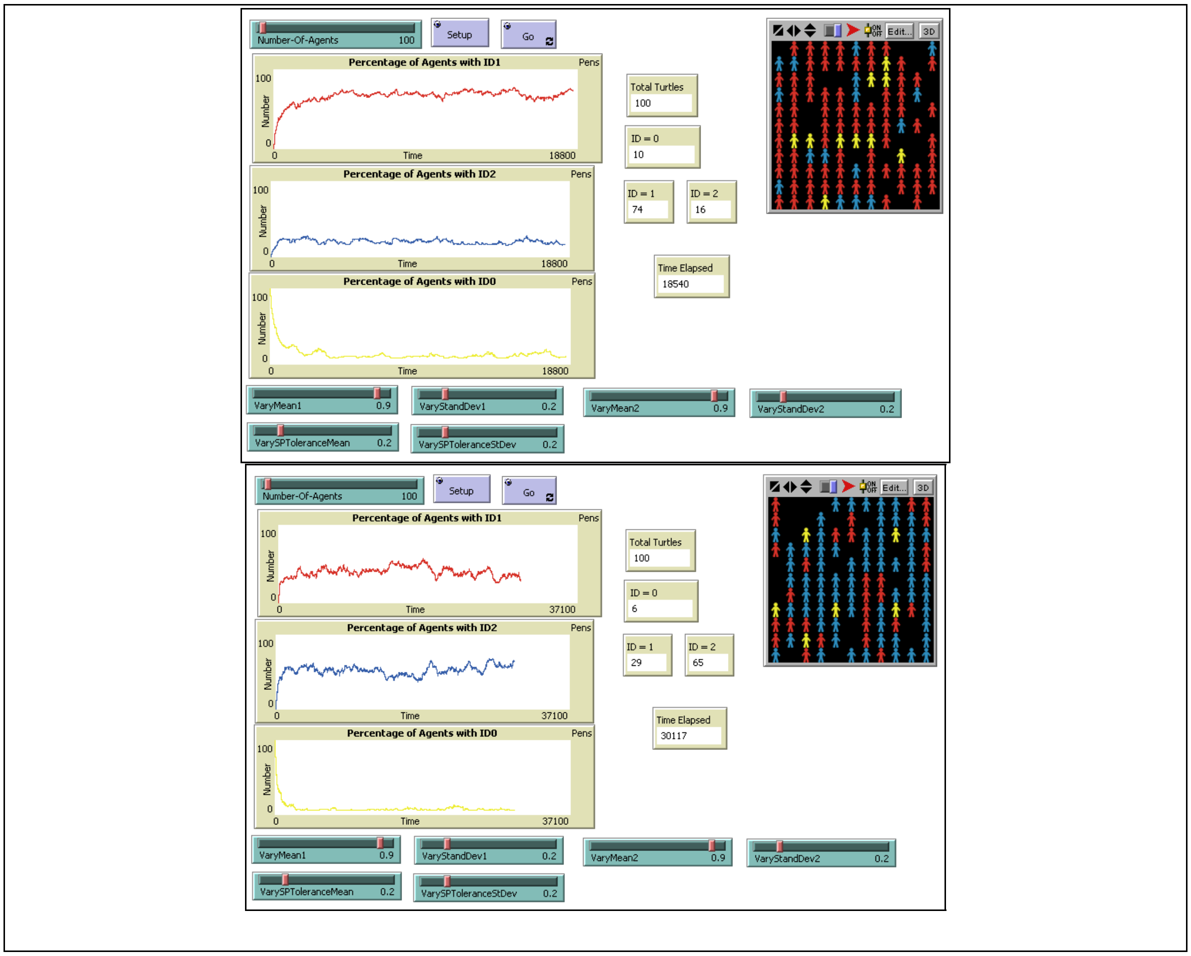
High HistID1 means follow similar group emergence patterns to when the means are low and medium. When HistID2 is low, GroupID1 dominates. When HistID2 is medium more ideologues begin to appear. However, they are not able to initiate larger GroupID2 clusters. Even though the SPTol mean increases in strength, there are no increases in GroupID2 agents.

Illustration 6.13 Group Emergence, HistID1 (high)



When HistID1 and HistID2 means are both high, both GroupID1 and GroupID2 agents form group clusters (Illustration 6.13). GroupID2 ideologues can effect change given the stronger HistID preference. However, three environmental factors occur as seen with the lower HistID1 means: there must be several ideologues agents (with high social pressure tolerance); with each move around the grid, these agents must be surrounded by several other agents with the Buckle Factor and a lower social pressure tolerance threshold; and, the various ideologues' locations must create enough new agents so that the new agents are surrounded by the same GroupID and can retain this new GroupID.

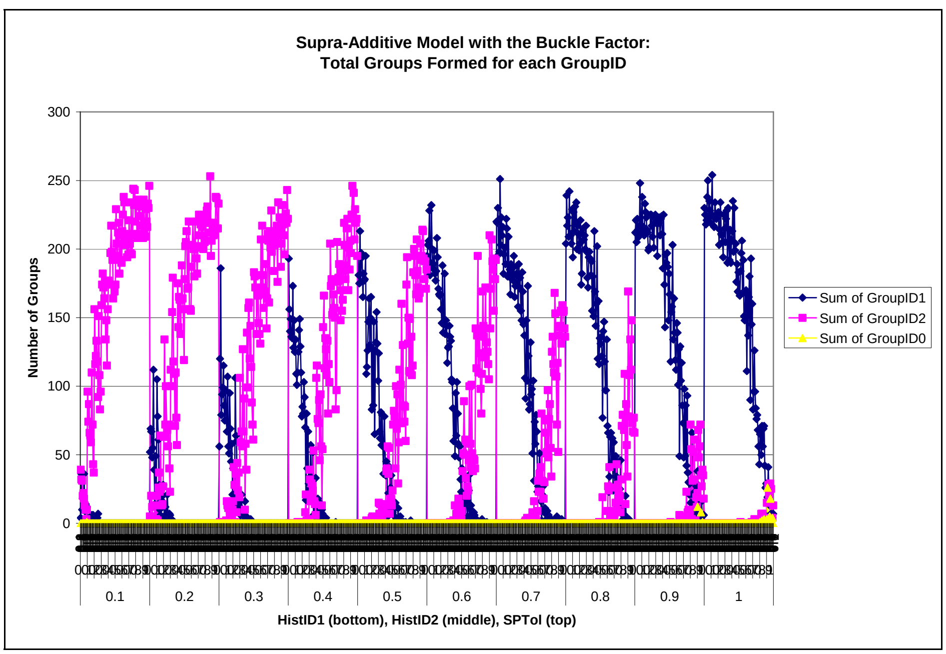
Illustration 6.14 Different GroupID Majorities, Same Mean Combination



As with the previous equal HistID combinations, initial agent characteristics can determine and generate different group emergence patterns. GroupID1 or GroupID2 could become the majority GroupID, or both GroupID1 and GroupID2 develop relatively equal numbers of agents and group clusters. Illustration 6.14 shows the different group formation patterns for the same HistID1, HistID2, and SPTol mean combination. Again, the majority GroupID is determined very quickly, but given the Buckle Factor and SPTol levels, some agents will change their GroupID creating the variation around the equilibrium point.

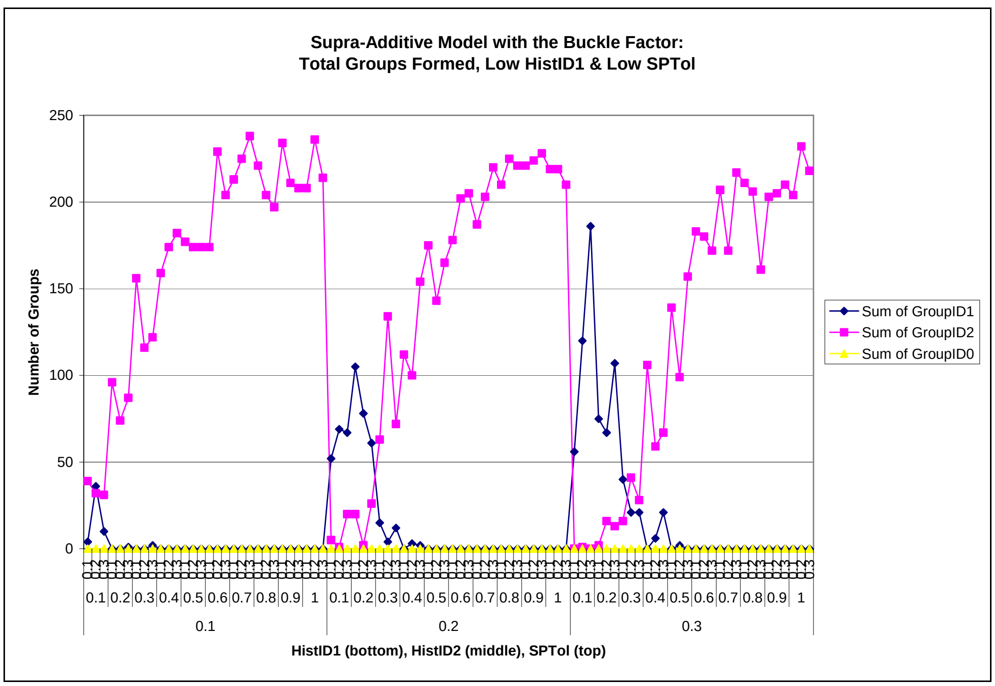
In conclusion, group emergence is driven by the larger HistID. If HistID1 is larger than HistID2, GroupID1 emerges as the majority group. If HistID2 is larger than HistID1, GroupID2 emerges as the majority group. However, if HistID1 and HistID2 are equal, the Buckle Factor and SPTol help determine which GroupID becomes the larger group. Which group emerges as the majority depends upon the initially assigned agent characteristics, their random placement on the checkerboard, and their interaction with neighbors. Ideologues could have the potential to cause cascades of one GroupID, increasing agent totals and ensuring this group's majority status.

Graph 6.12 Total Groups Formed, Supra-Additive Model



Next, the number of groups formed for the Supra-Additive model is examined. GroupID1 groups are able to form at low HistID1 means (0.1-0.3) until the HistID2 mean is 0.2 higher than the HistID1 mean. For example, if the HistID1 mean is 0.2, GroupID1 groups are able to form until the HistID2 mean reaches 0.4. This trend is true for medium HistID1 means (0.4-0.6), too. When both HistID1 and HistID2 means are the same, both GroupID1 and GroupID2 groups form at the same time regardless of SPTol levels.

Graph 6.13 Total Groups Formed, Low HistID1 and SPTol



In general, as the HistID1 mean becomes stronger, more GroupID1 groups form; as the HistID2 mean becomes stronger, more GroupID2 groups form. When SPTol levels are low (0.1-0.3), GroupID1 groups are still able to form as long as the HistID1 mean is great than or equal to the HistID2 mean (Graph 6.13). GroupID1 groups can still form up until the HistID2 mean is 0.2 larger than the HistID1 mean. It seems that SPTol levels, once the Buckle Factor is added in, do not greatly affect group emergence. In the previous models, a minimum SPTol level of 0.5 or 0.6 was needed to see group emergence.

6.6 Group Emergence: Model Comparison

Next, the group emergence patterns and total number of groups formed generated by the Identity Salience and Supra-Additive models will be compared. H_3 is that the emergence patterns and total number of groups are significantly different between the two models. The following mean combinations are used in this comparison: HistID1 = 0.2, HistID2 = 0.8, SPTol = 0.2, 0.6, 0.9; HistID1 = 0.6, HistID2 = 0.4, SPTol = 0.2, 0.6, 0.9; and, HistID1 = 0.9, HistID2 = 0.1, SPTol = 0.2, 0.6, and 0.9.

Group emergence patterns from both the Identity Salience and Supra-Additive models are similar. For all HistID1 mean combinations, SPTol does not seem to change group formations as tolerance levels increase. When the HistID1 mean is 0.2, the blue, GroupID2 agents dominated the grid. When the HistID1 mean is 0.6, both GroupID1 and GroupID2 agents are present. Finally, when the HistID1 mean is 0.9, the red, GroupID1 agents dominate the grid. Both models follow these emergence trends.

Illustration 6.15 Group Emergence Patterns, Identity Salience Model

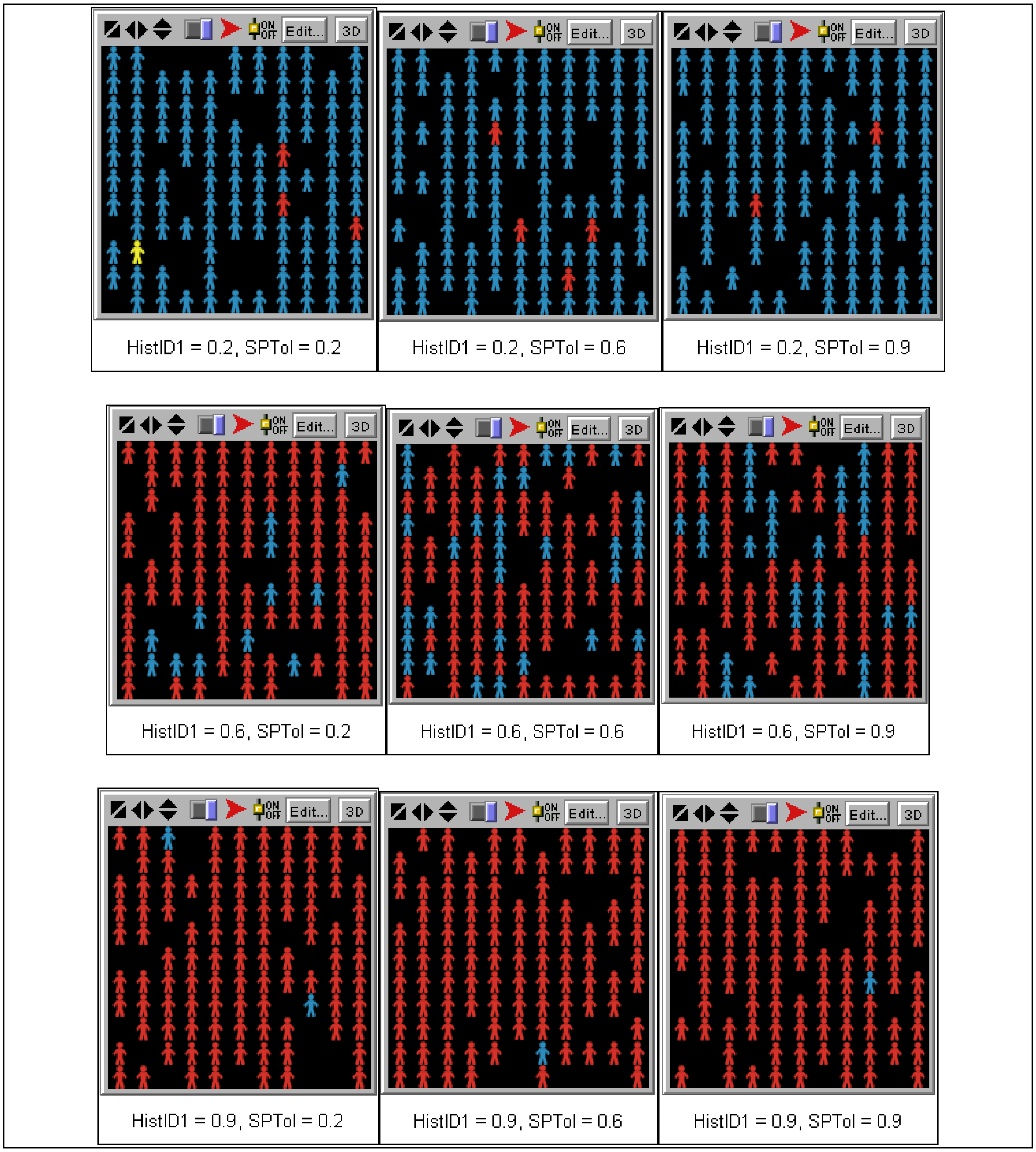
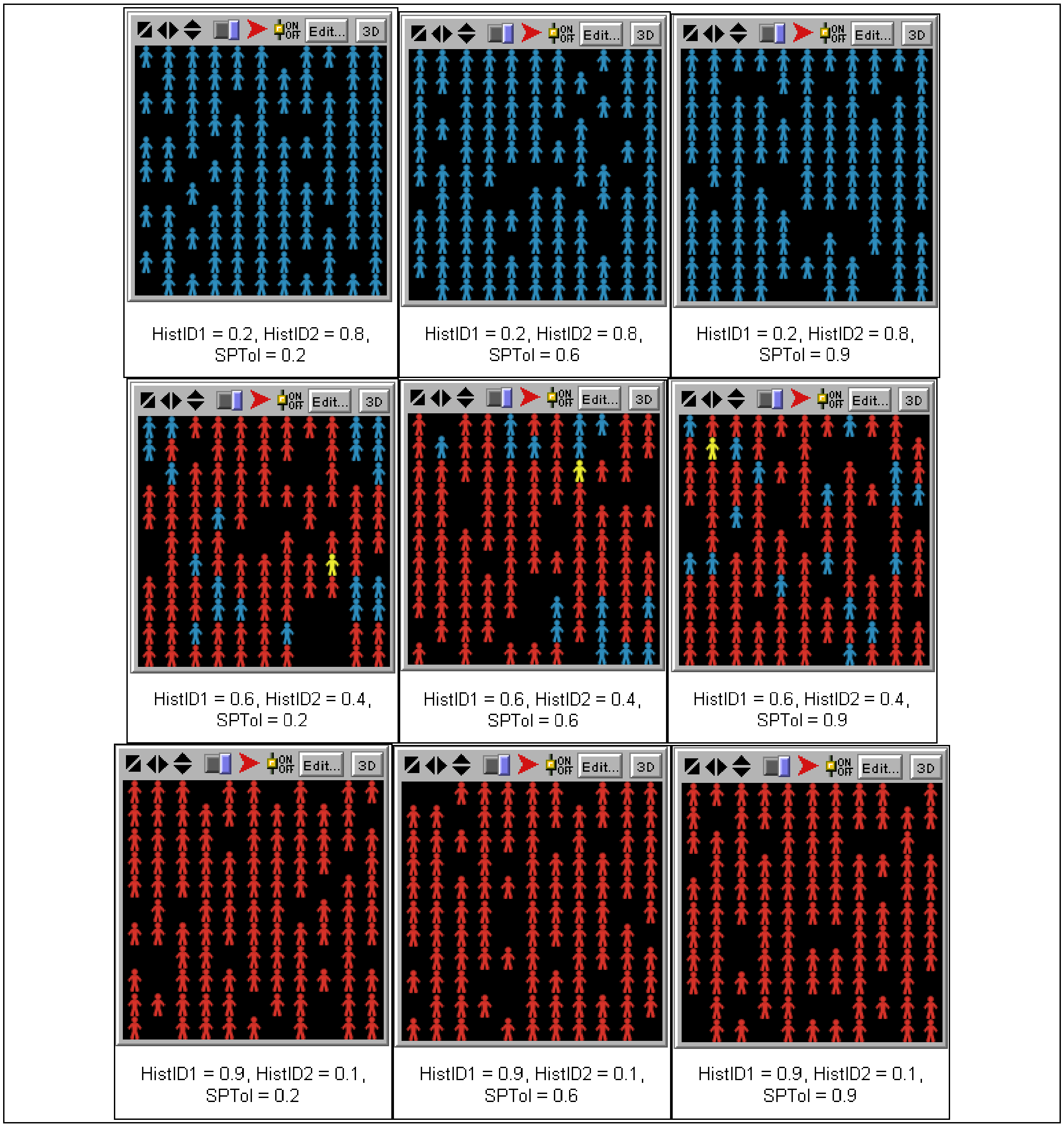


Illustration 6.16 Group Emergence Patterns, Supra-Additive Model



The only slight difference that appears to exist is the opportunity for ideologues to exist and maintain their GroupID preference. The Identity Salience model seems to provide an environment for ideologues to exist when the HistID1 mean is low or high.

However, there are so few ideologues that it is difficult to definitely rule out the random characteristics assignment for each agent. That is, the existence of these ideologues in the Identity Salience model and none in the Supra-Additive model can be explained by agents' characteristics when the model run starts.

Table 6.2 Total Groups Formed, Model Comparison

			Identity Salience Totals			Supra-Additive		
HistID1	HistID2	SPTol	GrpID1	GrpID2	GrpID0	GrpID1	GrpID2	GrpID0
0.2	0.8	0.1	0	176	0	0	210	0
0.2	0.8	0.2	0	180	0	0	225	0
0.2	0.8	0.3	0	197	0	0	221	0
0.2	0.8	0.4	0	150	0	0	218	0
0.2	0.8	0.5	0	204	0	0	220	0
0.2	0.8	0.6	0	198	0	0	201	0
0.2	0.8	0.7	0	172	0	0	216	0
0.2	0.8	0.8	0	219	0	0	200	0
0.2	0.8	0.9	0	208	0	0	210	0
0.2	0.8	1	0	173	0	0	205	0
0.6	0.4	0.1	99	3	0	128	0	0
0.6	0.4	0.2	115	0	0	129	0	0
0.6	0.4	0.3	58	4	0	144	0	0
0.6	0.4	0.4	87	2	0	136	1	0
0.6	0.4	0.5	144	0	0	133	0	0
0.6	0.4	0.6	97	1	0	105	0	0
0.6	0.4	0.7	101	3	0	103	1	0
0.6	0.4	0.8	77	3	0	84	1	0
0.6	0.4	0.9	63	10	0	60	2	0
0.6	0.4	1	102	1	0	83	2	0
0.9	0.1	0.1	186	0	0	212	0	0
0.9	0.1	0.2	243	0	0	221	0	0
0.9	0.1	0.3	213	0	0	205	0	0
0.9	0.1	0.4	209	0	0	222	0	0
0.9	0.1	0.5	231	0	0	214	0	0
0.9	0.1	0.6	197	0	0	209	0	0
0.9	0.1	0.7	235	0	0	217	0	0
0.9	0.1	0.8	236	0	0	248	0	0
0.9	0.1	0.9	237	0	0	215	0	0
0.9	0.1	1	233	0	0	214	0	0

Examining the total groups formed in each model may offer more insight into whether or not group emergence is different between the Identity Salience and Supra-Additive models. Table 6.2 shows the group totals for each GroupID in each model. The HistID mean combinations are: HistID1 = 0.2, 0.6, 0.9; and HistID2 = 0.8, 0.4, and 0.1. The SPTol mean is from 0.1 to 1.0. A t-test is conducted to test H_2 and to see if the totals are significantly different. Results are below for each GroupID, Tables 6.3 – 6.4. There is no test for GroupID0 because both the Identity Salience and Supra-Additive models have the same totals (zero GroupID0 groups).

Table 6.3 Two Sample t-test with Equal Variances, GroupID1

Variable |	**Obs**	**Mean**	**Std. Err.**	**Std. Dev.**	**[95% Conf. Interval]**	
IdentSal GrpID1 |	30	105.43	17.20	94.21	70.26	140.61
Supra-Add GrpID1 |	30	109.40	16.79	91.96	75.06	143.74
combined |	60	107.42	11.92	92.32	83.57	131.27
diff |		-3.97	24.04		-52.08	44.15

t = -0.165
df = 58
p = 0.870

Table 6.4 Two Sample t-test with Equal Variances, GroupID2

Variable |	**Obs**	**Mean**	**Std. Err.**	**Std. Dev.**	**[95% Conf. Interval]**	
IdentSal GrpID2 |	30	63.47	16.45	90.12	29.81	97.12
Supra-Add GrpID2 |	30	71.10	18.60	101.88	33.06	109.14
combined |	60	67.28	12.32	95.44	42.63	91.94
diff |		-7.63	24.83		-57.35	42.08

t = -0.307
df = 58
p = 0.760

The t-tests for GroupID1 and GroupID2 confirm that both models cannot be considered different. The descriptive analysis of group emergence patterns corroborates this, too. H_2 is rejected, group emergence patterns and total groups formed are the statistically the same between the Identity Salience and Supra-Additive models.

6.7 Predicted Probabilities of Group Choice: Identity Salience Model

While the descriptive statistics provide much initial information about agent totals and the behavior of group emergence, calculating predicted probabilities and their discrete change will offer insight into the dynamics of the identity variables and how they affect group choice. Using Stata 9 and the SPost ado file, a multinomial logistic regression generated the necessary probabilities and subsequent plots for the following analysis. Table 6.5 shows these initial results. The following MNLM was fitted:

Figure 6.1 MLogit Equations, Identity Salience Model

$$\ln\Omega_{Grp1|Grp0}(x_i) = \beta_{0,\,Grp1|Grp0} + \beta_{1,\,Grp1|Grp0}\,\text{HistID1} + \beta2_{,\,Grp1|Grp0}\,\text{SPTol} + \beta_{3,\,Grp1|Grp0}\,\text{Buckle Factor}$$

$$\ln\Omega_{Grp2|Grp0}(x_i) = \beta_{0,\,Grp2|Grp0} + \beta_{1,\,Grp2|Grp0}\,\text{HistID1} + \beta2_{,\,Grp2|Grp0}\,\text{SPTol} + \beta_{3,\,Grp2|Grp0}\,\text{Buckle Factor}$$

where the third outcome GroupID0 is specified as the base category:

Table 6.5 MLogit Results, Identity Salience Model

Multinomial logistic regression — Number of obs = 8825; LR chi2(6) = 7930.14; Prob > chi2 = 0.0000; Pseudo R2 = 0.498

Log likelihood = -3989.74

NewGrp	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
1						
HistID1Mean	3.25	0.231	14.09	0.000	2.78	3.70
SPTolMean	1.19	0.172	6.93	0.000	0.857	1.53
Buckle	-3.29	0.204	-16.15	0.000	-3.69	-2.89
_cons	1.73	0.246	7.04	0.000	1.25	2.21
2						
HistID1Mean	-7.92	0.249	-31.84	0.000	-8.41	-7.43
SPTolMean	1.56	0.194	8.05	0.000	1.18	1.94
Buckle	-3.65	0.210	-17.37	0.000	-4.06	-3.24
_cons	7.28	0.244	29.81	0.000	6.80	7.76

(NewGrp==0 is the base outcome)

All coefficients are significant at the 0.01 level for the above outcome combinations. However, all the *y* combinations should be considered. Table 6.6 lists these combinations. The remaining y combinations are also significant. For one unit increase in the HistID1 mean, the factor change in the odds of choosing GroupID1 vs. GroupID2 is the largest (e^b = 7.08e+04). For one unit increases in the SPTol mean, the factor change in the odds of choosing GroupID2 vs. GroupID0 is the largest (e^b = 4.76), though choosing GroupID1 vs. GroupID0 has a similar factor change (e^b = 3.30).

Table 6.6 Coefficients for All NewGrp Combinations

mlogit (N=8825): Factor Change in the Odds of NewGrp

Variable: HistID1Mean (sd=0.280)

Odds comparing Alternative 1 to Alternative 2		b	z	P>|z|	e^b	e^bStdX
1	-2	11.17	49.83	0.000	7.08e+04	22.74
1	-0	3.25	14.09	0.000	25.77	2.48
2	-1	-11.17	-49.83	0.000	0.000	0.044
2	-0	-7.92	-31.84	0.000	0.000	0.109
0	-1	-3.25	-14.09	0.000	0.039	0.403
0	-2	7.92	31.84	0.000	2747.38	9.16

Variable: SPTolMean (sd=0.285)

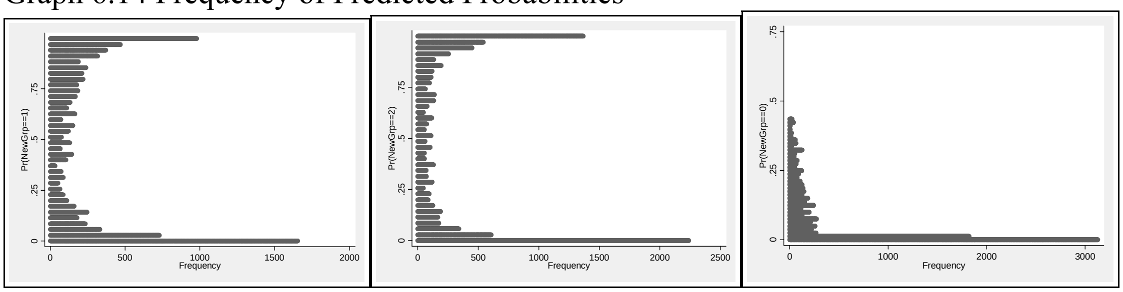
Odds comparing Alternative 1 to Alternative 2		b	z	P>|z|	e^b	e^bStdX
1	-2	-0.366	-2.70	0.007	0.693	0.901
1	-0	1.195	6.93	0.000	3.30	1.41
2	-1	0.366	2.70	0.007	1.44	1.11
2	-0	1.56	8.05	0.000	4.76	1.56
0	-1	-1.19	-6.93	0.000	0.303	0.711
0	-2	-1.56	-8.05	0.000	0.210	0.641

Variable: Buckle (sd=.50002833)

Odds comparing Alternative 1 to Alternative 2		b	z	P>|z|	e^b	e^bStdX
1	-2	0.358	4.50	0.000	1.43	1.20
1	-0	-3.289	-16.15	0.000	0.037	0.193
2	-1	-0.358	-4.50	0.000	0.699	0.836
2	-0	-3.647	-17.38	0.000	0.026	0.162
0	-1	3.289	16.15	0.000	26.81	5.18
0	-2	3.647	17.38	0.000	38.34	6.19

As the Buckle Factor changes from zero (not present) to one (present) the factor change in the odds of choosing GroupID0 vs. GroupID1 (e^b = 26.8) and GroupID0 vs. GroupID2 are the largest (e^b = 38.34). That is, if the Buckle Factor is present and an agent will choose the majority GroupID, the odds are in favor maintaining GroupID0. This implies that there is a start-up element involved in breaking out of the initially assigned GroupID0 and choosing another GroupID.

Graph 6.14 Frequency of Predicted Probabilities



N = 8871

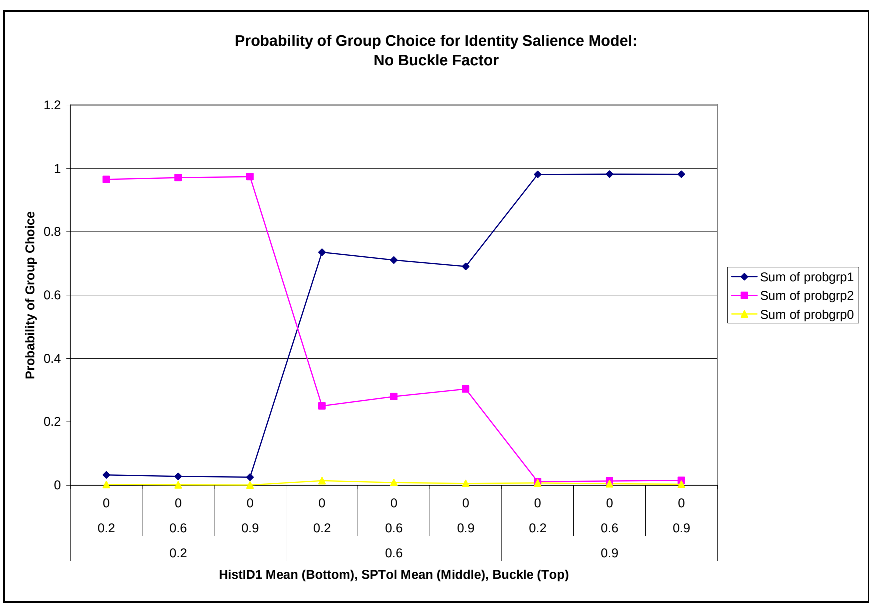
However, the predicted probabilities of group choice may be easier to understand and better explain the dynamics among the identity variables. First, Graph 6.14 shows dot plots of the frequency distributions of probabilities for GroupID1, GroupID2 and GroupID0, and Table 6.7 details the descriptive statistics of these probabilities. The predicted probabilities of GroupID1 and GroupID2 are similarly distributed with tales on either extreme with probabilities occurring for all values. These tales indicate that several x variable combinations yield all-or-nothing probabilities for either GroupID choice. The distribution of the probabilities for GroupID0 is skewed to the low end of the values. That is, more x combinations provide opportunities for choosing either GroupID1 or GroupID2.

Table 6.7 Predicted Probabilities Summary

Variable	Obs	Mean	Std. Dev.	Min	Max
p1	8871	0.4709728	0.3955752	0.0007975	0.9979994
p2	8871	0.4573329	0.4175786	0.0004934	0.9989959
p0	8871	0.0716943	0.1009252	0.0000571	0.435325

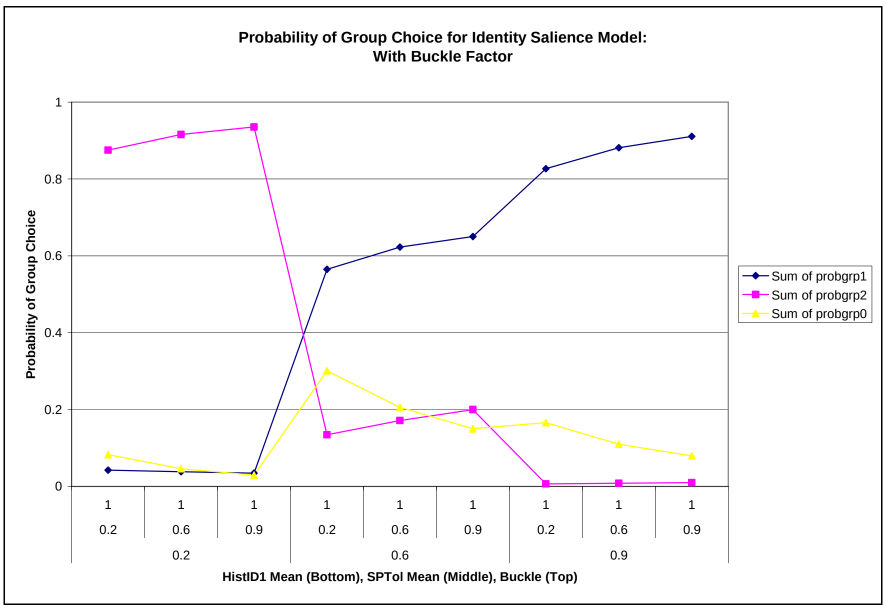
Calculating the probabilities for low, medium, and high HistID1 and SPTol mean combinations will also help to determine if there is a significant difference between outcomes with the Buckle Factor and without the Buckle Factor. Graph 6.15 and Graph 6.16 show the probabilities of GroupID choice without the Buckle Factor and with the Buckle Factor, respectively. Graph 6.17 shows the difference in probability between the two. If the difference is positive, the probability of GroupID choice without the Buckle Factor is larger; if the difference is negative, the probability with the Buckle Factor is larger.

Graph 6.15 Probability of Group Choice w/o Buckle Factor



If the Buckle Factor is missing, it does not aid GroupID0 emergence. As SPTol becomes stronger, it seems to have almost no effect on increasing probabilities for any GroupID. It slightly assists GroupID2 probabilities when HistID1 is 0.6. When HistID1 is low, GroupID2 has a higher probability of formation. However, by the time HistID1 increases to 0.6, GroupID1 has the higher probability of emergence. Both groups can form when HistID1 is 0.6.

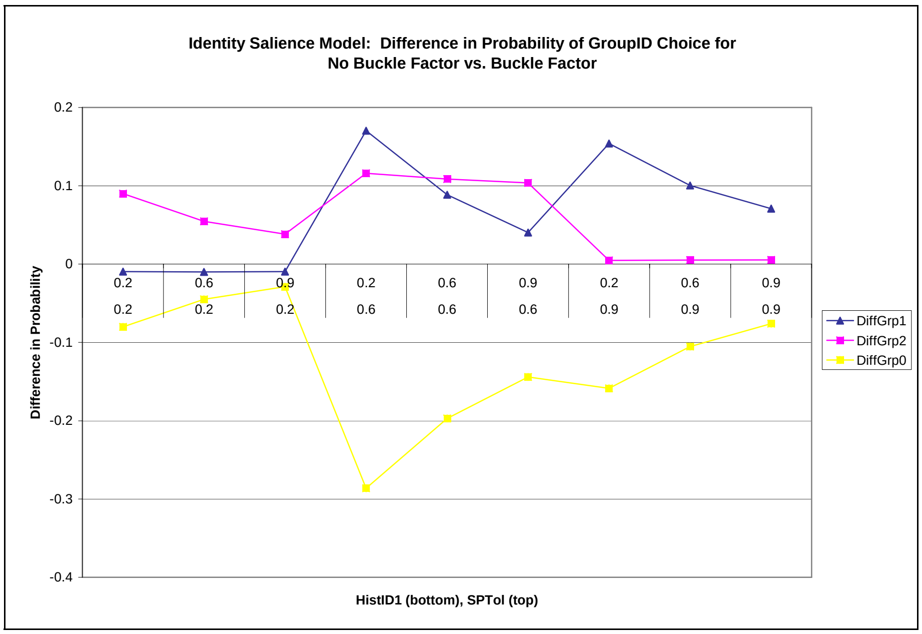
Graph 6.16 Probability of Group Choice w/ Buckle Factor.



When the Buckle Factor is present, the probability for GroupID0 emergence is higher. For each HistID1 mean, as SPTol becomes stronger, the probability of choosing GroupID0 decreases. Low social pressure tolerance aids in agents maintaining GroupID0. Overall, the general trend for GroupID1 and GroupID2 probabilities is the same as when agents do not have the Buckle Factor. However, increasing SPTol means help both GroupID1 and GroupID2 boost their probabilities a small amount. Even though

SPTol is considered in group choice decisions for all agents, if the Buckle Factor is not present, group choice defers to the larger HistID. When the Buckle Factor is present, SPTol becomes an important determining factor in group choice.

Graph 6.17 Difference Between Probabilities of GroupID Choice



Graph 6.17 shows the difference in the probabilities for group choice according to the Buckle Factor. The average difference in the probability of group choice is small for both GroupID1 (0.07) and GroupID2 (0.06). In general, not having the Buckle Factor increases the probability of choosing GroupID1 and GroupID2. The Buckle Factor does not make much of a difference in choosing GroupID1 when the HistID1 mean is low and in choosing GroupID2 when the HistID2 mean is low. However, the average difference in the probability of choosing GroupID0 is -0.12. That is, the probability of choosing GroupID0 for an agent with the Buckle Factor increases by 0.12.

Table 6.8 Discrete Change in Probabilities

HistID1Mean				
	Avg|Chg|	**GrpID1**	**GrpID2**	**GrpID0**
Min->Max	0.62979174	0.92699862	-0.94468763	0.01768898
-+1/2	0.66016512	0.97303203	-0.99024765	0.01721566
-+sd/2	0.42291284	0.61320281	-0.63436927	0.02116643
MargEfct	1.782584	2.5810031	-2.6738759	0.09287287

SPTolMean				
	Avg|Chg|	**GrpID1**	**GrpID2**	**GrpID0**
Min->Max	0.05383011	-0.03769585	0.08074516	-0.04304931
-+1/2	0.07834748	-0.04730523	0.11752123	-0.070216
-+sd/2	0.02226397	-0.01426059	0.03339598	-0.01913534
MargEfct	0.07806612	-0.05025944	0.11709918	-0.06683974

Buckle				
	Avg|Chg|	**GrpID1**	**GrpID2**	**GrpID0**
0->1	0.1495288	-0.04305673	-0.18123648	0.22429319

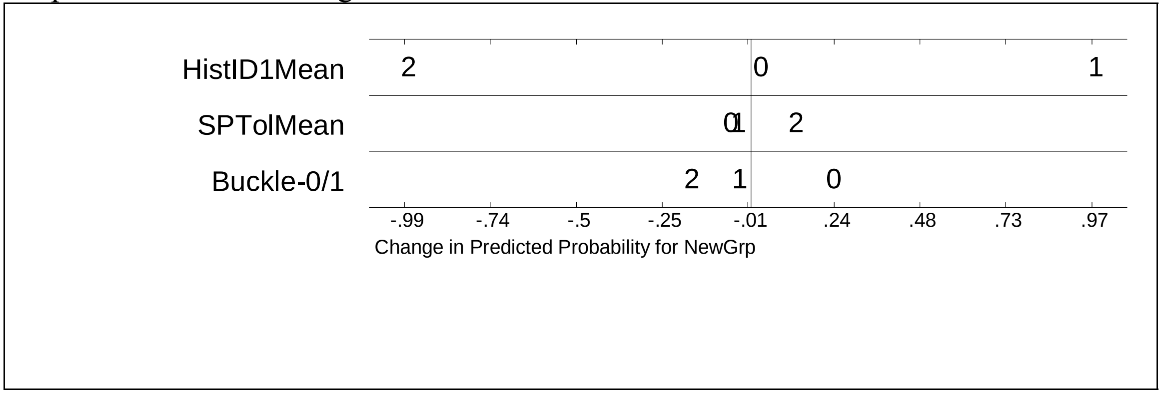
	GrpID1	**GrpID2**	**GrpID0**
Pr(y|x)	0.51152647	0.43678018	0.05169333

	HistID1	**SPTol**	**Buckle**
x=	0.510108	0.459626	0.500057
sd(x)=	0.279752	0.285106	0.500028

Pr(y|x): probability of observing each y for specified x values
Avg|Chg|: average of absolute value of the change across categories
Min->Max: change in predicted probability as x changes from its minimum to its maximum
0->1: change in predicted probability as x changes from 0 to 1
-+1/2: change in predicted probability as x changes from 1/2 unit below base value to 1/2 unit above
-+sd/2: change in predicted probability as x changes from 1/2 standard dev below base to 1/2 standard dev above
MargEfct: the partial derivative of the predicted probability/rate with respect to a given independent variable

Next, discrete change in the probability of choosing each GroupID can be best presented with Graph 6.18. This graph shows the amount of change in predicted probability of choosing GroupID1, GroupID2, and GroupID0 with one unit change in each x variable. Table 6.8 above provides the discrete change values used in Graph 6.18.

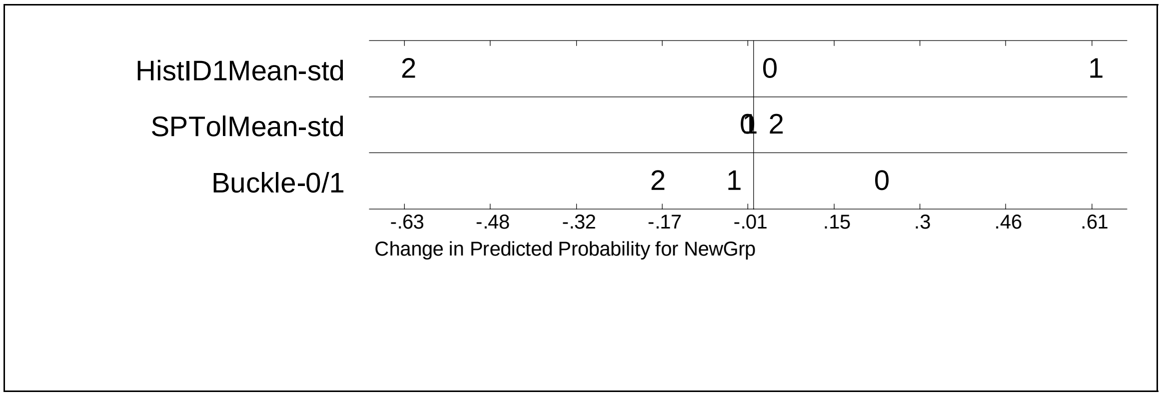
Graph 6.18 Discrete Change in Predicted Probabilities



As HistID1 increases by one unit, the probability of choosing GroupID1 increases 0.97 and the probability of choosing GroupID2 decreases by 0.99. This amount of change is profound making the HistID1 mean very important in choosing GroupID1 or in not choosing GroupID2. As SPTol increases by one unit, the probability of choosing GroupID2 increases by 0.18, the probability of choosing GroupID1 *decreases* by 0.05, and the probability of choosing GroupID0 also decreases by 0.07. There is very little discrete change between the probabilities for GroupID0 and GroupID1. This implies that SPTol assists agents more in choosing GroupID2.

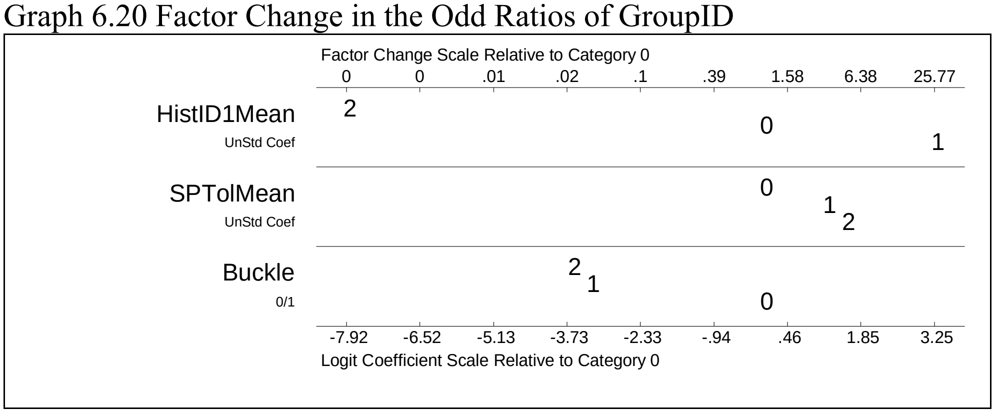
As Buckle goes from 0 (not present) to 1 (present), the probability of choosing GruopID0 *increases* by 0.22, and the probability of choosing GroupID1 and GroupID2 both *decrease* (by 0.04 and 0.18, respectively). This result implies that agents with the Buckle Factor have a higher probability in choosing GroupID0. This could be because at time step zero all agents belong to GroupID0 and to break away from the majority groups is difficult. If the agent characteristics are amenable to choosing another GroupID, it still takes time for agents to move from the majority GroupID0 and form other groups (there are still agent interactions that include GroupID0 groups).

Graph 6.19 Discrete Change in Probabilities, Std. Deviation



Examining discrete change in one standard deviation increase in each *x* variable can also provide further information about how each identity variable influences GroupID choice (Graph 6.19). The results are relatively the same for the HistID1 mean. However, for the SPTol mean, the difference in discrete change between the probabilities of choosing GroupID1 and GroupID0 is less than initially appeared in Graph 6.18. Moreover, the advantage SPTol provides to the probability of choosing GroupID2 is also not as great. While GroupID2 is still favored, it is only slightly more than the decrease in the probability of choosing the other two GroupIDs. Finally, for the Buckle Factor, the decrease in the probability for GroupID2 and GroupID1 is actually greater.

Graph 6.20 Factor Change in the Odd Ratios of GroupID



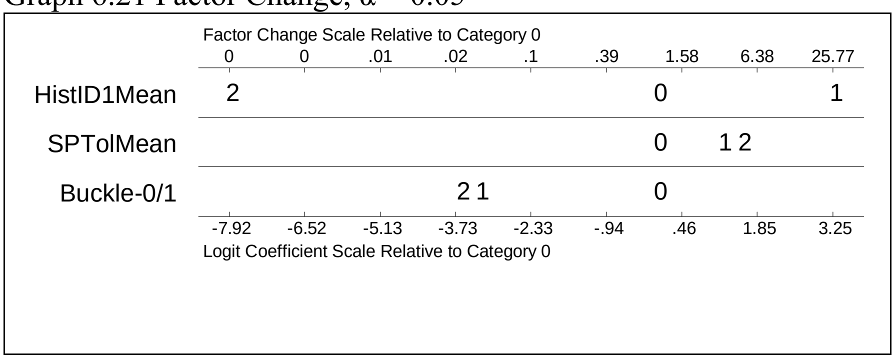
Next, the factor change in the odds of group choice will be examined (Graph 6.20). The magnitude of the effect of the identity variable on group choice is depicted by the distance among GroupIDs. As the HistID1 mean increases by one unit, the change in odds of choosing GroupID1 vs. GroupID0 increases by factor of 2.48. However, the factor change in odds of choosing GroupID2 vs. GroupID0 is only 0.11. The affect of choosing GroupID1 with one unit increase is apparent when one considers the factor change in odds between GroupID1 vs. GroupID2 (see Table 6.6). Choosing GroupID1 vs. choosing GroupID2 has a factor change in the odds of 22.74. The odds also increase in choosing GroupID0 vs. GroupID2 by a factor change of 9.16. Clearly, GroupID1 is favored by an increase in the HistID1 mean.

As the Social Pressure Tolerance mean increases by one unit, the factor change in the odds of choosing GroupID1 and GroupID2 (both vs. GroupID0) increase by 1.4 and 1.56, respectively. It is interesting to highlight that the factor change in the odds of choosing GroupID2 vs. GroupID1 increases by 1.11, while the factor change in the odds of choosing GroupID1 vs. GroupID2 increases by only 0.9. An increase in SPTol assists choosing GroupID2, as corroborated by the agent totals and group emergence analysis.

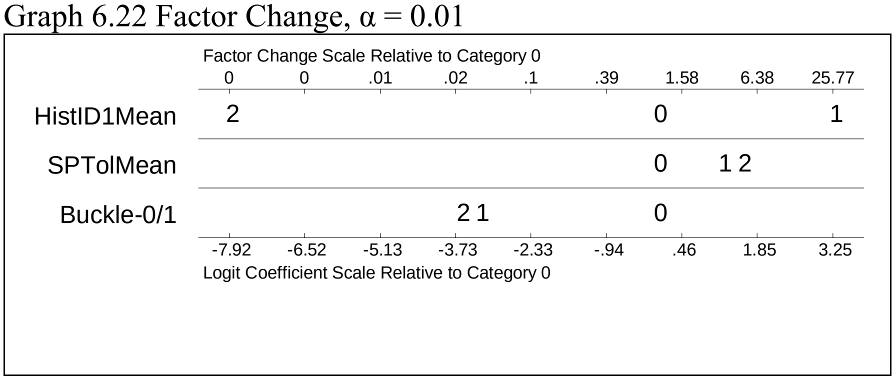
Finally, as Buckle goes from 0-1, the factor change in odds barely increases for GroupID1 (by 0.19) and GroupID2 (by 0.16). Table 6.6 shows that the largest factor change in odd ratios occurs with GroupID0 vs. GroupID1 and GroupID0 vs. GroupID2. The factor change in the odds of choosing GroupID0 vs. the other GroupIDs increases by 5.2 (vs. GroupID1) and 6.2 (vs. GroupID2). That is, as the Buckle Factor becomes present, the change in the odds of choosing GroupID0 vs. the other two GroupIDs increases. The next two largest changes in the odds occur during GroupID1 vs. GroupID2 (1.2), and vice versa (0.83).

A logical explanation for why the Buckle Factor favors GroupID0 emergence could be one of timing and frequency of occurrence. If the Buckle Factor is present for an agent, the odds are in favor of maintaining GroupID0 at the beginning of a run. The majority GroupID0 influences more agents' decision most often. There are several identity variable combinations that yield only GroupID0 agents, and at the beginning of every run agents must break out of the GroupID0 majority status. However, once agents do begin to change GroupIDs, then odds shift to GroupID1 and GroupID2.

Graph 6.21 Factor Change, α = 0.05

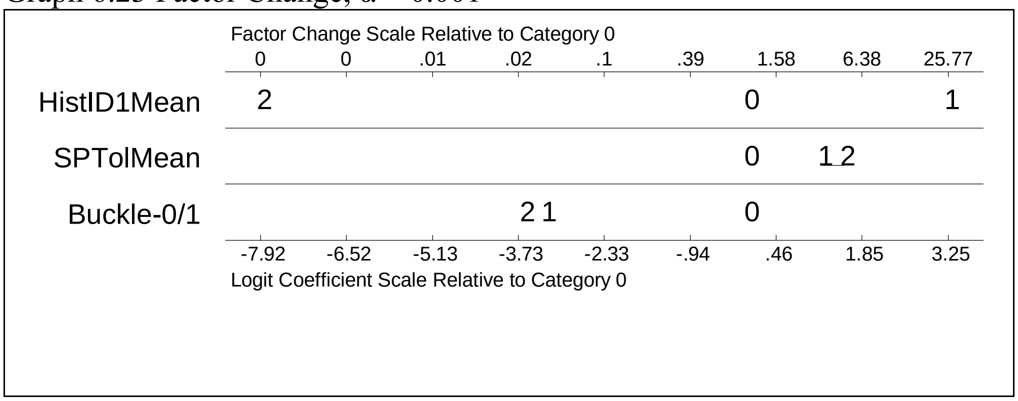


Graph 6.22 Factor Change, α = 0.01



Next, Graphs 6.21-6.22 show the factor change in the odds of GroupID choice and which change in group choice is significant. SPost graphs show the lack of statistical significance by drawing a line between y-outcomes. When the significance levels are 0.05 and 0.01, all coefficients are statistically significant. The effect of each identity variable significantly determines GroupID choice.

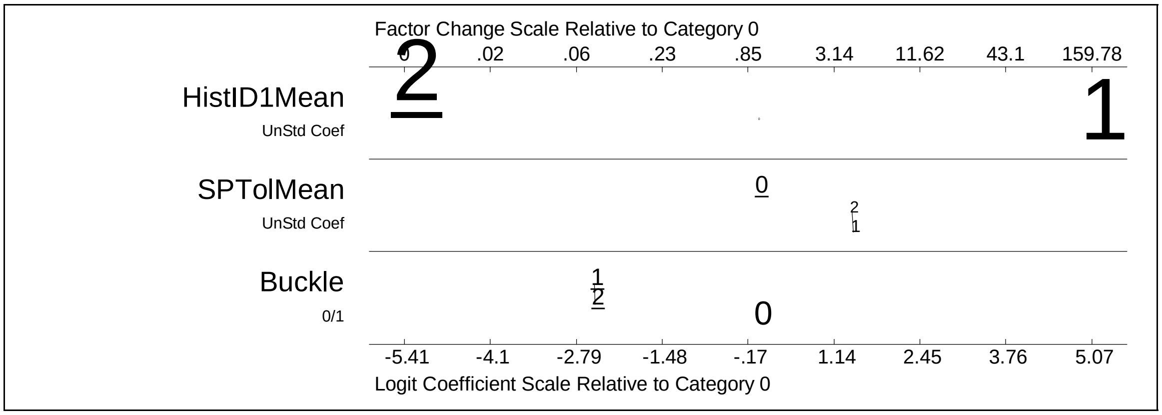
Graph 6.23 Factor Change, $\alpha = 0.001$



Not until an extremely low alpha does the effect of SPTol on GroupID1 and GroupID2 choice becomes not significant, as seen in Graph 6.23. While SPTol significantly determines choosing GroupID2 over GroupID1, the GroupIDs are not significantly ordered by social pressure tolerance. This result is interesting but not very practical at this extremely low significance level.

A final graph that can help depict the effect of the identity variables on group choice combines discrete change, factor change, and significance levels. Graph 6.24 provides this information using $\alpha = 0.01$. In this odd ratios plot the size of the GroupID number is proportional to the amount of discrete change. Again, Long and Freese (2006) explain that “if the odds increase by a factor of 10 but the current odds are 1 in 10,000, the substantive impact is small” (266). In contrast, the substantive impact could be great if the current odds are good. Underlined GroupIDs have negative discrete change.

Graph 6.24 Odds Ratio/Discrete Change Plot, α = 0.01



It is immediately apparent that HistID1 not only influences group choice the most, but also specifically determines the magnitude of discrete change in choosing GroupID1 and in *not* choosing GroupID2. The factor change is large and the current odds are large enough to have big substantive impact on group choice outcome. With one unit increase in the HistID1 mean, the factor change in the odds of choosing GroupID1 and the magnitude of effect on this group choice increases, while the factor change in the odds of choosing GroupID2 and its corresponding influence in determining GroupID2 decreases.

The Buckle Factor has the next largest effect on group emergence. As Buckle goes from zero to one, the factor change in the odds of choosing GroupID0 *increases*. Meanwhile, the factor change in the odds of choosing both GroupID2 and GroupID1 decrease. However, the Buckle Factor determines decisions more in not choosing GroupID2 than in not choosing GroupID1. That is, the Buckle Factor does not play a big role in agents' decisions not to choose GroupID1.

Social Pressure Tolerance affects group emergence the least. It still orders GroupID1 and GroupID2 choices though this effect is not statistically significant. With one unit increase in the SPTol mean, the factor change in the odds of choosing GroupID1 and GroupID2 increases, but which GroupID is not statistically different. Finally, the odds of choosing GroupID0 decrease as agents' tolerance levels increase.

Overall, Graph 6.24 shows that each identity salience variable affects the emergence of a different GroupID. HistID1 has the largest influence on group emergence and is the main determinant in choosing GroupID1. The variable with the second largest impact is the Buckle Factor. Whether or not an agent has the Buckle Factor significantly determines agents maintaining GroupID0. Finally, social pressure tolerance assists in choosing GroupID1 and GroupID2, though this effect is not significant.

6.8 Predicted Probabilities for Group Emergence: Supra-Additive Model

Reviewing GroupID totals and each group's emergence pattern are helpful to get a picture of how HistID1, HistID2, SPTol and the Buckle Factor may influence group choice and group formation dynamics. Next, multinomial logistic regression results will help determine how each variable affects each GroupID and in what manner. The following MNLN was fitted:

Figure 6.2 MLogit Equations, Supra-Additive Model

$$\ln\Omega_{Grp1|Grp0}(x_i) = \beta_{0,\,Grp1|Grp0} + \beta_{1,\,Grp1|Grp0}\,\text{HistID1} + \beta_{2,\,Grp1|Grp0}\,\text{HistID2} + \beta_{3,\,Grp1|Grp0}\,\text{SPTol} + \beta_{4,\,Grp1|Grp0}\,\text{Buckle Factor}$$

$$\ln\Omega_{Grp2|Grp0}(x_i) = \beta_{0,\,Grp2|Grp0} + \beta_{1,\,Grp2|Grp0}\,\text{HistID1} + \beta_{2,\,Grp2|Grp0}\,\text{HistID2} + \beta_{3,\,Grp2|Grp0}\,\text{SPTol} + \beta_{4,\,Grp2|Grp0}\,\text{Buckle Factor}$$

Table 6.9 displays the mlogit results. With the base outcome as NewGroupID = 0, all the coefficients are significant.

Table 6.9 MLogit Results for Supra-Additive Model

Multinomial logistic regression	Number of obs = 24215
	LR chi2(8) = 15937.58
	Prob > chi2 = 0.0000
Log likelihood = -14021.058	Pseudo R2 = 0.3624

NewGrp	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
1						
HistID1Mean	4.85	0.126	38.52	0.000	4.60	5.09
HistID2Mean	-5.60	0.132	-42.50	0.000	-5.86	-5.34
SPTolMean	1.77	0.102	17.35	0.000	1.57	1.97
Buckle	-1.79	0.069	-25.93	0.000	-1.93	-1.66
_cons	2.15	0.107	20.13	0.000	1.94	2.36
2						
HistID1Mean	-2.20	0.105	-20.97	0.000	-2.41	-1.99
HistID2Mean	1.52	0.116	13.10	0.000	1.29	1.74
SPTolMean	1.72	0.097	17.73	0.000	1.53	1.91
Buckle	-1.68	0.066	-25.27	0.000	-1.81	-1.55
_cons	2.19	0.104	21.08	0.000	1.98	2.39

(NewGrp==0 is the base outcome)

However, as Table 6.9 shows, not all the NewGroupID combinations are significant at α=0.01. All the y-combination coefficients for HistID1, HistID2 and the Buckle Factor have p-values significant at the 0.01 level. SPTol has two y-comparisons that are significant at the 0.5 level. When comparing GroupID1 to GroupID2, and also when comparing GroupID2 to GroupID1, the resulting coefficients are significant at 95%. It is important to notice though that the factor change in the odds ratios for one unit increase in SPTol is high for both comparisons. Therefore, these combinations may still have a significant impact on group choice and emergence patterns.

Table 6.10 Factor Change in the Odds of Each GroupID

mlogit (N=24215)

Variable: HistID1Mean (sd=0.282)

Odds comparing Alternative 1 to Alternative 2			**b**	**z**	**P>|z|**	**e^b**	**e^bStdX**
1	-2	|	7.05	70.08	0.000	148.71	7.27
1	-0	|	4.85	38.52	0.000	127.35	3.92
2	-1	|	-7.05	-70.08	0.000	0.001	0.138
2	-0	|	-2.20	-20.98	0.000	0.111	0.538
0	-1	|	-4.85	-38.52	0.000	0.008	0.255
0	-2	|	2.20	20.98	0.000	9.02	1.86

Variable: HistID2Mean (sd=.28163929)

Odds comparing Alternative 1 to Alternative 2			**b**	**z**	**P>|z|**	**e^b**	**e^bStdX**
1	-2	|	-7.12	-70.53	0.000	0.001	0.135
1	-0	|	-5.60	-42.50	0.000	0.004	0.207
2	-1	|	7.12	70.53	0.000	232.22	7.42
2	-0	|	1.52	13.10	0.000	4.56	1.53
0	-1	|	5.60	42.50	0.000	270.25	4.84
0	-2	|	-1.52	-13.10	0.000	0.219	0.652

Variable: SPTolMean (sd=.28495253)

Odds comparing Alternative 1 to Alternative 2			**b**	**z**	**P>|z|**	**e^b**	**e^bStdX**
1	-2	|	0.053	0.805	0.421	1.05	1.02
1	-0	|	1.77	17.35	0.000	5.90	1.66
2	-1	|	-0.053	-0.805	0.421	0.948	0.985
2	-0	|	1.72	17.73	0.000	5.59	1.63
0	-1	|	-1.77	-17.35	0.000	0.170	0.603
0	-2	|	-1.72	-17.73	0.000	0.179	0.612

Variable: Buckle (sd=.49999786)

Odds comparing Alternative 1 to Alternative 2			**b**	**z**	**P>|z|**	**e^b**	**e^bStdX**
1	-2	|	-0.114	-3.01	0.003	0.893	0.945
1	-0	|	-1.79	-25.93	0.000	0.167	0.409
2	-1	|	0.114	3.01	0.003	1.12	1.06
2	-0	|	-1.68	-25.27	0.000	0.187	0.432
0	-1	|	1.79	25.93	0.000	5.99	2.45
0	-2	|	1.68	25.27	0.000	5.35	2.31

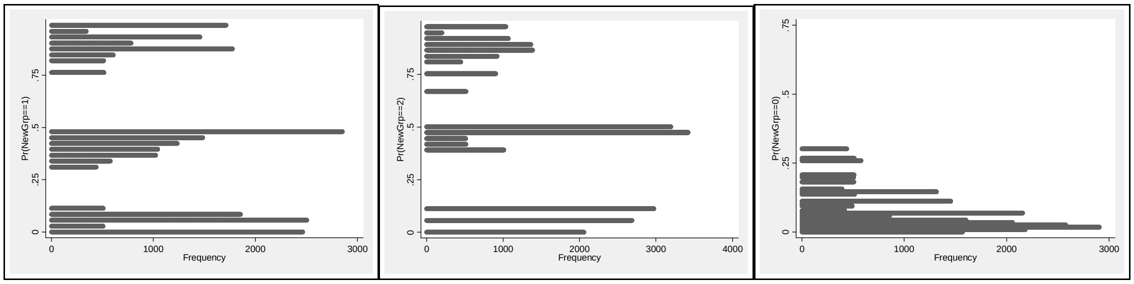
Now the predicted probabilities can be calculated to better understand the impact of group choice trends. Table 6.11 shows that the overall predicted probabilities for GroupID1 and GroupID2 are relatively equal and that the predicted probability for GroupID0 is almost zero. However, analysis of GroupID totals and group emergence clearly indicates that some GroupIDs given their HistID and SPTol means are favored over others.

Table 6.11 Predicted Probabilities for Each GroupID

Variable	Obs	Mean	Std. Dev.	Min	Max
p(GrpID1) |	24215	0.455	0.348	0.005	0.992
p(GrpID2) |	24215	0.469	0.324	0.007	0.984
p(GrpID0) |	24215	0.075	0.075	0.001	0.302

Looking at the frequencies of the probabilities for each GroupID shows grouping within each distribution (Graph 6.25). The majority of the GroupID0 probabilities fall below 25% and most are very low probabilities. The probabilities for GroupID1 and GroupID2 are clustered at low, medium, and high values. This is in contrast with the Identity Salience model version where the frequencies were equally spread out over all the probabilities with tails at the extremes. GroupID2 probabilities mostly occur in the middle values (around 50%) with several high probabilities; it also has few low probabilities. However, GroupID1 has more high probabilities, a wider breadth of middle range values, and more low probabilities than GroupID2.

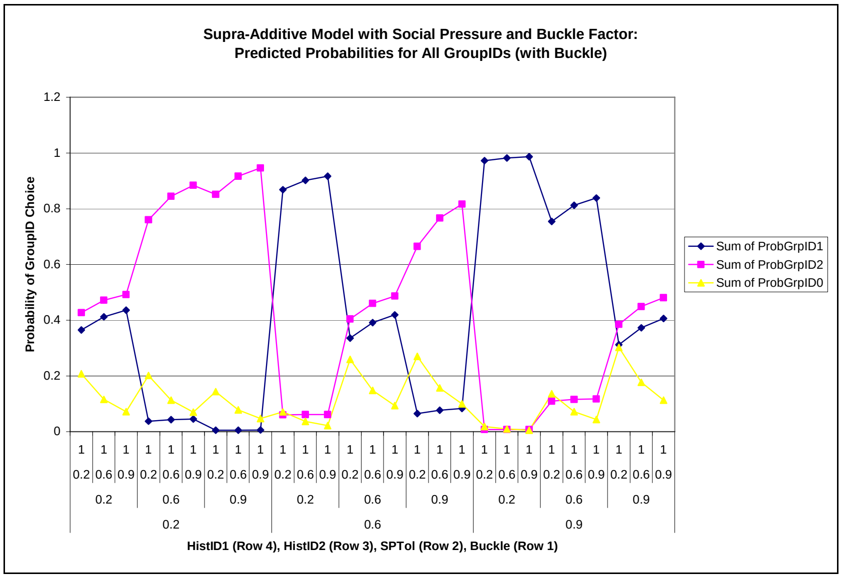
Graph 6.25 Frequencies of Predicted Probabilities



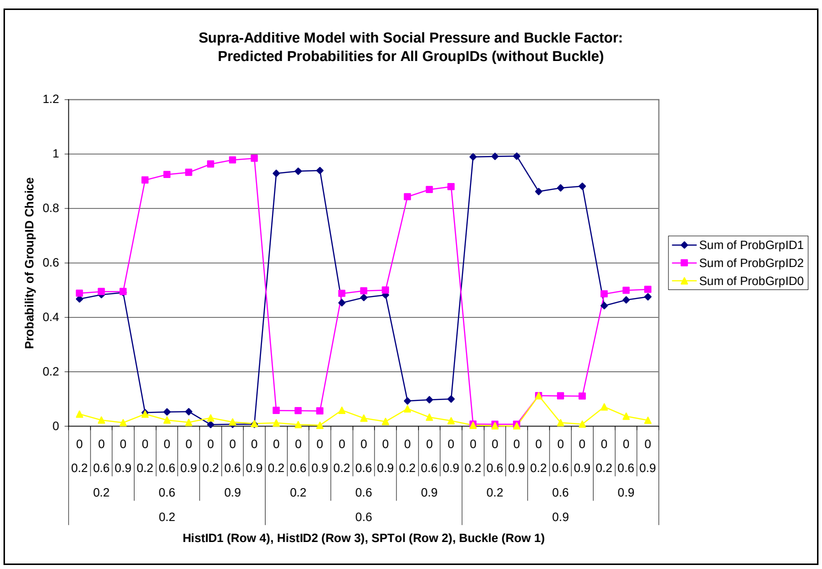
Next, we can compare differences between predicted probabilities with the Buckle Factor and those probabilities without the Buckle Factor. Graphs 6.26-6.27 show the probabilities for low, medium, and high means for HistID1, HistID2, and SPTol. Graph 6.28 shows the difference in probabilities between the two. Positive values indicate that mean combinations without the Buckle Factor are larger; negative values indicate that mean combinations with the Buckle Factor are larger.

It is immediately apparent that the Buckle Factor aids in maintaining GroupID0. All the GroupID0 differences are negative. Not having the Buckle Factor appears to aid in GroupID1 and GroupID2 formation. The higher HistID mean produces a bigger difference. The Buckle Factor does not seem to have much influence on the lower HistID mean; the difference between having the Factor and not having the factor is almost always or essentially zero. When the two HistID means are equal, not having the Buckle Factor boosts the probabilities for GroupID1. Finally, as social pressure tolerance increases, regardless of the HistID mean, the difference between having the Buckle Factor or not decreases.

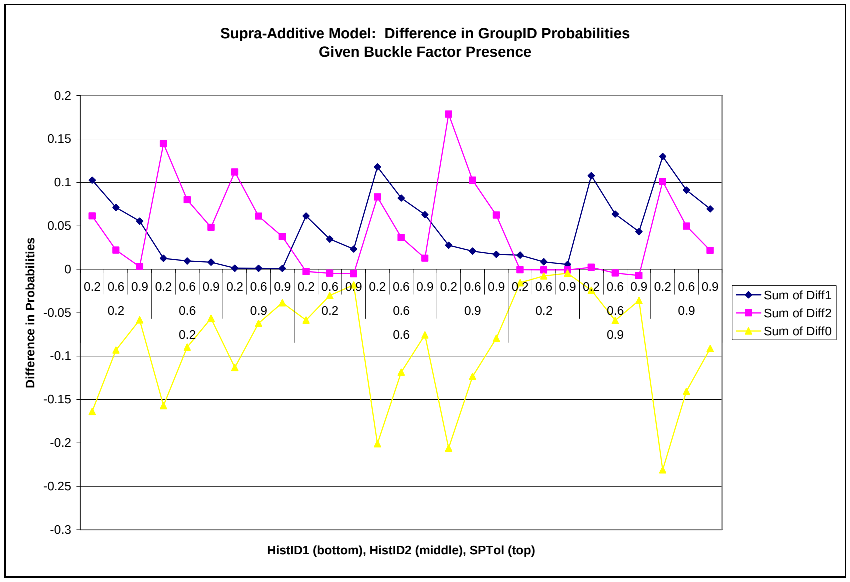
Graph 6.26 Probabilities w/Buckle



Graph 6.27 Probabilities w/o Buckle



Graph 6.28 Difference in Probabilities



However, the average difference in probabilities for GroupID1 (4.61%), GroupID2 (4.42%), and GroupID0 (-8.72) is still relatively small. It is possible, however, that this increase in probabilities for GroupID1 and GroupID2, and decrease in probabilities for GroupID0 are enough to significantly determine group emergence patterns. [43] Substantively, these results make sense given agent interactions. At the start of a model run, all agents have GroupID0. It is therefore more difficult for agents with the Buckle Factor to hold their ground and not be influenced by the surrounding majority. If an agent does not have the Buckle Factor, they will be able to choose either GroupID1 or GroupID2 withstanding their neighbors' pressure to maintain GroupID0.

As the run continues, and more agents have chosen either GroupID1 or GroupID2, not having the Buckle Factor allows group clustering. Agents with the

---

[43] Examining the factor change in odd ratios will help determine which GroupID is most influenced by the Buckle Factor (later in analysis).

Buckle Factor will always be a liability until they agree with their neighbors. What determines which GroupID prevails, especially when the GroupID totals are all-or-nothing in favor of one GroupID, are the HistID1, HistID2, and SPTol mean combinations. Some combinations favor the formation of one GroupID over the other, and the Buckle Factor may help speed up this domination or make group emergence patterns more balanced.

Finally, calculating the discrete change in the probabilities will show the affect each identity variable has on each GroupID choice. Table 6.12 provides changes in the probabilities for each GroupID with one unit change of HistID1, HistID2, SPTol, and as the Buckle Factor goes from zero to one. This information can then be utilized to form plots that clearly indicate how each identity variable influences group choice.

Graph 6.29 shows the discrete change plot of each identity variable. As the HistID1 mean increases one unit, the probability of choosing GroupID1 increases by 0.93. In contrast, the probability of choosing GroupID2 decreases by 0.90. The probability of choosing GroupID0 also decreases with one unit change in the HistID1 mean, albeit negligibly (0.03).

The effect HistID2 has on group choice is just the opposite as the HistID1 mean. With one unit increase in the HistID2 mean, the probability of choosing GroupID2 increases by 0.88. The probability of choosing GroupID1 decreases by 0.94. Finally, the probability of choosing GroupID0 increases by 0.05. Substantively, the effect of the HistID means reflects the preference of choosing the stronger of the two HistIDs in determining group choice decisions.

Table 6.12 Discrete Change and Marginal Effects

HistID1Mean

	Avg|Chg|	1	2	0
Min->Max	0.541	0.811	-0.784	-0.027
-+1/2	0.619	0.928	-0.896	-0.032
-+sd/2	0.289	0.434	-0.415	-0.019
MargEfct	1.10	1.65	-1.58	-0.073

HistID2Mean

	Avg|Chg|	1	2	0
Min->Max	0.557	-0.835	0.775	0.060
-+1/2	0.624	-0.935	0.881	0.055
-+sd/2	0.295	-0.443	0.411	0.032
MargEfct	1.13	-1.69	1.57	0.123

SPTolMean

	Avg|Chg|	1	2	0
Min->Max	0.058	0.048	0.039	-0.087
-+1/2	0.089	0.072	0.059	-0.132
-+sd/2	0.024	0.020	0.016	-0.035
MargEfct	0.082	0.069	0.054	-0.123

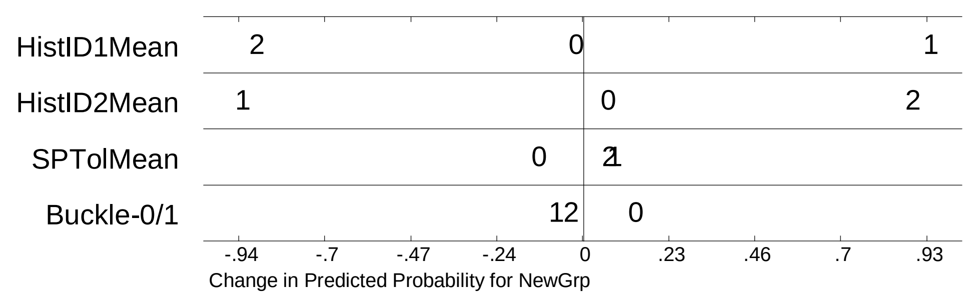
Buckle

	Avg|Chg|	1	2	0
0->1	0.086	-0.085	-0.045	0.130

	1	2	0
Pr(y|x)	0.424	0.500	0.076

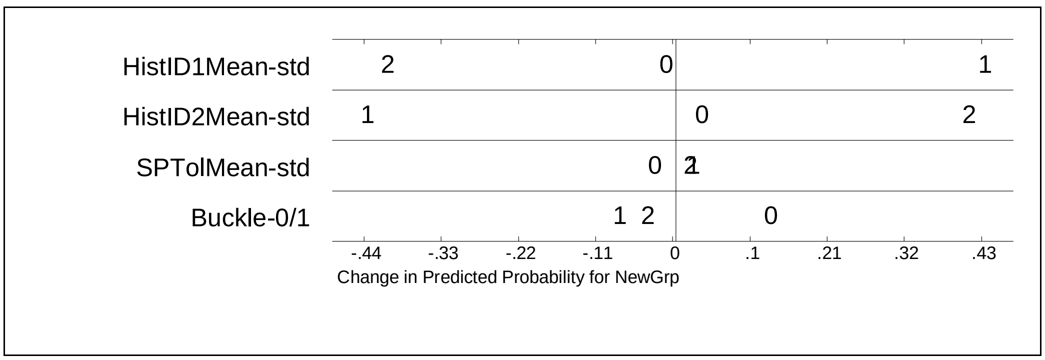
	HistID1	HistID2	SPTol	Buckle
x=	0.574	0.582	0.533	0.504
sd(x)=	0.282	0.282	0.285	0.500

Graph 6.29 Discrete Change in Probability



With one unit change in the SPTol mean, the probabilities of choosing both GroupID1 and GroupID2 slightly increase by 0.07 and 0.06, respectively. This indicates that as social pressure tolerance becomes stronger, it minutely helps in determining group choice. Moreover, the effect on which GroupID is similar. SPTol aids in choosing a different GroupID other than GroupID0, but it does not but either GroupID1 or GroupID2 at a great advantage. The probability of choosing GroupID0 decreases by 0.13 as SPTol increases by one unit.

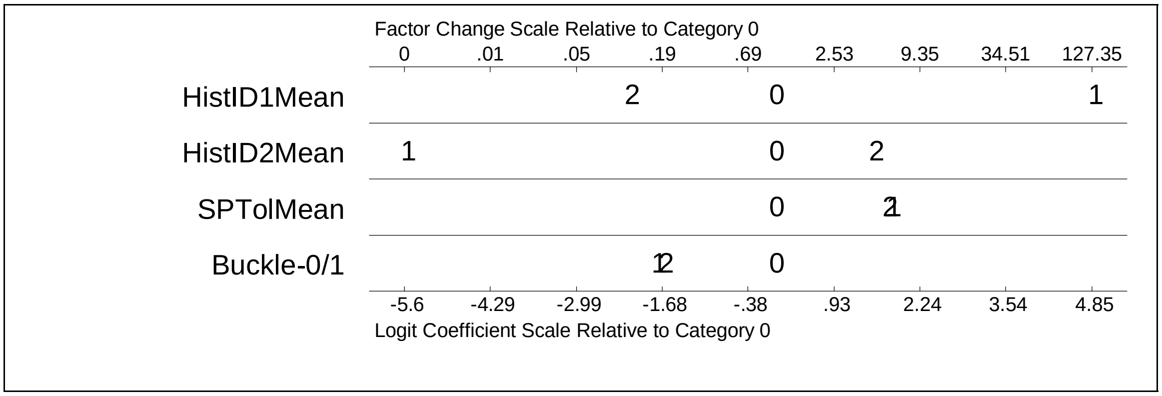
Graph 6.30 Discrete Change, Std. Deviation



To further help verify the influence of discrete change in the probabilities of choosing each GroupID, examining the discrete change with and increase of one standard deviation further shows just how different is each change (Graph 6.30). All HistID1, HistID2, and SPTol means maintain similar discrete change in their probabilities when their means are increased by one standard deviation. However, as the Buckle Factor goes from zero to one, the difference between the probabilities for GroupID1 and GroupID2 are a little big larger when one considers the effect from an increase of one standard deviation. The probabilities for choosing GroupID1 and GroupID2 decreases even more than indicated in Graph 6.29.

Next, plotting the factor change in the odd ratios for each identity variable can illustrate the influence they have on each group choice (Graph 6.31). The distance between each GroupID demonstrates the magnitude of effect from that particular identity variable on each GroupID choice. Each plot has GroupID0 as its base.

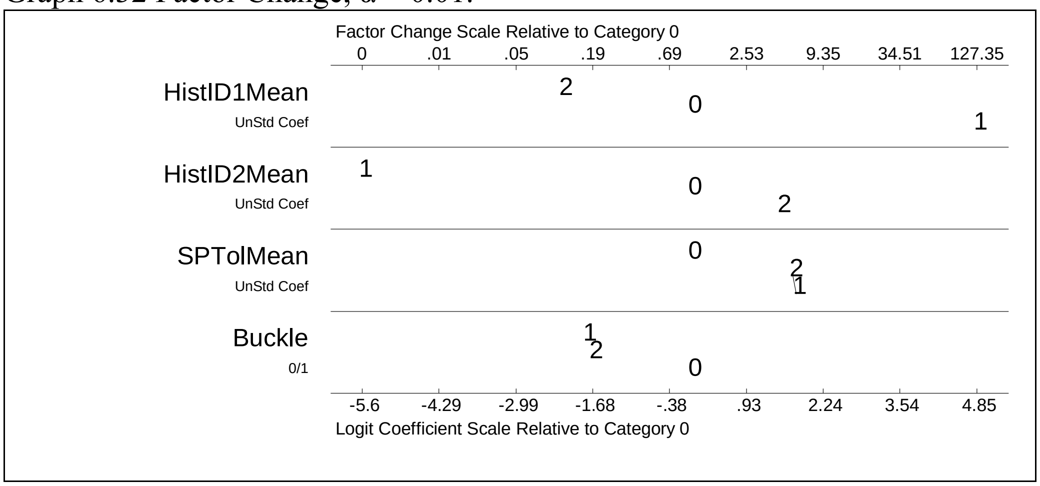
Graph 6.31 Factor Change in Odd Ratios



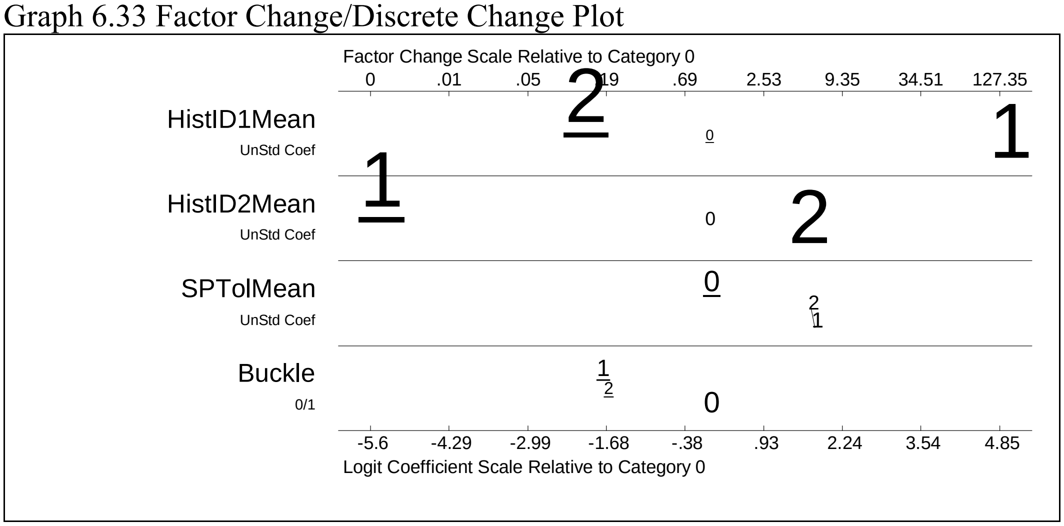
It is clear that the HistID1 mean influences choosing GroupID1 the greatest. With an increase in the HistID1 mean, the odds of choosing GroupID1 increase. In contrast, the HistID2 mean has a larger effect on the GroupID2 choice as HistID2 increases. An increase in the SPTol mean appears to equally increase the odds of choosing GroupID1 and GroupID2. Similarly, as the Buckle Factor goes from zero to one, the odds in *not* choosing both GroupID1 and GroupID2 increase about the same. Overall, HistID1 and HistID2 shape GroupID choice more than SPTol and the Buckle Factor.

Adding significance levels to the odd ratios helps determines which effects on the GroupIDs are statistically significant. Graph 5.29 shows the effects of the identity variables on GroupID choice with an alpha of 0.01. All the identity variables have statistically significant effects on GroupID choice except the SPTol mean. HistID1, HistID2, and the Buckle Factor not only order GroupID choice, but the increase (or decrease) in the odds for each choice is statistically significant. However, while an increase in the SPTol mean increases the odds in choosing GroupID1 and GroupID2 relative to GroupID0, the effect of this increase is not significant. That is, SPTol does not order which group (GroupID1 or GroupID2) is chosen.

Graph 6.32 Factor Change, α = 0.01.



Graph 6.33 Factor Change/Discrete Change Plot



Finally, Graph 6.33 combines the discrete change in probabilities and the factor change in the odd ratios shows a substantive impact on GroupID choice by considering not only the constant change among variables (the factor change) and the change in the current odds as each variable changes values (the discrete change). The area of the GroupID number is proportional the discrete change in the odds of choosing a GroupID. The alpha is again 0.01.

GroupID1 and GroupID2 are mostly determined by the HistID1 and HistID2 means, respectively. Secondly, the SPTol mean affects choosing GroupID1 and GroupID2. An increase in the SPTol mean favors choosing GroupID1 or GroupID2, though the effect on both is still statistically not significant. However, as the Buckle Factor goes from zero to one, the substantive effect in not choosing GroupID1 (slightly more) and GroupID2 is statistically significant.

Finally, an increase in the SPTol mean and when the Buckle Factor is one significantly affects agents maintaining GroupID0. HistID1 and HistiD2 have very little influence on GroupID0. Substantively, the strength of a pre-existing HistID primarily determines choosing a non-neutral GroupID. While social pressure tolerance and whether or not an agent buckles primarily determines if an agent remains neutral.

6.9 Predicted Probabilities of Group Choice: Model Comparison

The probabilities of group choice will be compared using a two-proportion z-test. The hypothesis tested is H_3: predicted probabilities of group choice will be different across comparable HistID mean combinations between the Identity Salience and Supra-

Additive models. Tables 6.13 – 6.15 show the probabilities for each GroupID and the corresponding z-test results. The z-test uses a 95% significance level.

Table 6.13 Z-test Results, GroupID1

			Identity Salience N=8825	Supra-Add N=24215			
HistID1	HistID2	SPTol	Pr(GrpID1) (sd)	Pr(GrpID1) (sd)	Diff (sd)	z	P>|z|
0.2	0.8	0.2	0.038 (0.002)	0.012 (0.001)	0.027 (0.002)	15.88	0.000
0.2	0.8	0.6	0.033 (0.002)	0.012 (0.001)	0.021 (0.002)	12.87	0.000
0.2	0.8	0.9	0.030 (0.002)	0.013 (0.001)	0.018 (0.002)	10.80	0.000
0.6	0.4	0.2	0.721 (0.005)	0.723 (0.003)	-0.005 (0.006)	-0.90	0.368
0.6	0.4	0.6	0.718 (0.005)	0.758 (0.003)	-0.040 (0.006)	-7.42	0.000
0.6	0.4	0.9	0.708 (0.005)	0.773 (0.003)	-0.065 (0.006)	-12.09	0.000
0.9	0.1	0.2	0.954 (0.002)	0.992 (0.001)	-0.038 (0.002)	-22.69	0.000
0.9	0.1	0.6	0.966 (0.002)	0.994 (0.000)	-0.028 (0.002)	-19.73	0.000
0.9	0.1	0.9	0.971 (0.002)	0.995 (0.000)	-0.024 (0.002)	-18.12	0.000

Table 6.14 Z-test Results, GroupID2

			Identity Salience N=8825	Supra-Add N=24215			
HistID1	HistID2	SPTol	Pr(GrpID2) (sd)	Pr(GrpID2) (sd)	Diff (sd)	z	P>|z|
0.2	0.8	0.2	0.947 (0.002)	0.911 (0.002)	0.037 (0.003)	10.88	0.000
0.2	0.8	0.6	0.959 (0.002)	0.947 (0.001)	0.012 (0.001)	4.29	0.000
0.2	0.8	0.9	0.965 (0.002)	0.963 (0.001)	0.002 (0.002)	0.94	0.347
0.6	0.4	0.2	0.205 (0.004)	0.199 (0.003)	0.006 (0.005)	1.23	0.221
0.6	0.4	0.6	0.236 (0.005)	0.204 (0.003)	0.003 (0.005)	6.47	0.000
0.6	0.4	0.9	0.260 (0.005)	0.204 (0.003)	0.056 (0.005)	10.95	0.000
0.9	0.1	0.2	0.010 (0.001)	0.004 (0.000)	0.006 (0.001)	6.15	0.000
0.9	0.1	0.6	0.011 (0.001)	0.004 (0.000)	0.007 (0.001)	7.85	0.000
0.9	0.1	0.9	0.013 (0.001)	0.004 (0.000)	0.009 (0.001)	8.97	0.000

Table 6.15 Z-test Results, GroupID0

			Identity Salience N=8825	Supra-Add N=24215			
HistID1	HistID2	SPTol	Pr(GrpID0) (sd)	Pr(GrpID0) (sd)	Diff (sd)	z	P>|z|
0.2	0.8	0.2	0.014 (0.001)	0.078 (0.001)	-0.063 (0.002)	-21.33	0.000
0.2	0.8	0.6	0.008 (0.001)	0.041 (0.001)	-0.033 (0.002)	-15.02	0.000
0.2	0.8	0.9	0.005 (0.001)	0.025 (0.001)	-0.020 (0.001)	-11.50	0.000
0.6	0.4	0.2	0.074 (0.003)	0.075 (0.002)	-0.001 (0.003)	-0.31	0.760
0.6	0.4	0.6	0.046 (0.002)	0.039 (0.001)	0.007 (0.003)	2.94	0.003
0.6	0.4	0.9	0.032 (0.002)	0.023 (0.001)	0.009 (0.002)	4.35	0.000
0.9	0.1	0.2	0.037 (0.002)	0.005 (0.002)	0.033 (0.002)	22.92	0.000
0.9	0.1	0.6	0.023 (0.002)	0.002 (0.000)	0.021 (0.002)	19.19	0.000
0.9	0.1	0.9	0.016 (0.001)	0.001(0.000)	0.015 (0.001)	16.60	0.000

Most of the mean combinations and resulting probabilities of group choice are significantly different for GroupID1, GroupID2, and GroupID0. For all GroupIDs, the combination of HistID1 = 0.6, HistID2 = 0.4, and SPTol = 0.2, yields probabilities for both the Identity Salience and Supra-Additive models that are not statistically different. This could be because these means provide the largest overlap for GroupID1 and GroupID2 agent totals and formed groups, and either GroupID could be the majority GroupID. There is more possibility of model overlap during this middle part of the HistID means. However, the majority of mean combinations have significantly different predicted probabilities so it is difficult to accept H_3 unequivocally.

Finally, as seen in the Basic Model and the Social Pressure Model, too, the Supra-Additive model's identity variables affect the odds of group choice much greater than in the Identity Salience model. Given this difference is consistent among model versions not only explains why the predicted probabilities are statistically different, but also hints to why the aggregate results are statistically the same. The low standard deviation of the identity variables' distributions tempers this difference. When the population diversity is increased (a higher standard deviation), the increased effects on the odds of group choice in the Supra-Additive model will be intensified (leading to differences in aggregate markers, too).

6.10 Conclusion

The Identity Salience and Supra-Additive model versions in this chapter added the Buckle Factor to provide agents the opportunity to withstand social pressure even if their tolerance levels are lower than their neighbors' and if they disagree with their neighbors' GroupID choice. Does the Buckle Factor influence group choice? If it does, how and when does it influence agent decisions, especially in relationship to HistID1, HistID2, and SPTol? The Buckle Factor does affect agents' decisions to maintain GroupID0—their initially assigned GroupID. The Buckle Factor does not help in choosing GroupID1 or GroupID2. As the Buckle Factor goes from zero to one, the factor change in the odds of choosing GroupID1 and GroupID2 both decrease.

In the Identity Salience model, the Buckle Factor has the largest magnitude of effect on the odds in choosing GroupID0 and is essentially the main determinant of GroupID0. The Buckle Factor's effect on not choosing GroupID2 is second only to HistID1. It has very little influence on not choosing GroupID1. In the Supra-Additive model, the Buckle Factor also is the main determinant for choosing GroupID0. However, this magnitude of effect on GroupID0 is not as large as in the Identity Salience model. Another difference is that the Buckle Factor has smaller effect in not choosing GroupID1 and GroupID2 (with slightly more effect on GroupID1). In the Identity Salience model, the Buckle Factor clearly influences not choosing GroupID2 more than GroupID1.

How and when does the Buckle Factor influence agents' decisions to maintain GroupID0? The Buckle Factor plays a big role at the beginning of each model run when all the agents have GroupID0. For several time steps as agents move around the grid and interact with other agents, GroupID0 is the majority GroupID. An agent surrounded by a majority neighbors with GroupID0 will be pressured to choose GroupID0 unless the agent's social pressure tolerance level is high enough. If the SPTol level is too low, and the agent has the Buckle Factor, the agent will choose GroupID0. The predicted probability of choosing GroupID0 increases in both the Identity Salience and Supra-Additive models when the Buckle Factor is present.

The Buckle Factor also helps in creating political ideologues. That is, agents who do not have the Buckle Factor and have a minority GroupID can keep this GroupID even if their SPTol level is too low to otherwise withstand pressure from the majority GroupID. If there are enough ideologues who can come in contact with agents with low SPTol and the Buckle Factor, it is possible for the minority GroupID to build-up its numbers.

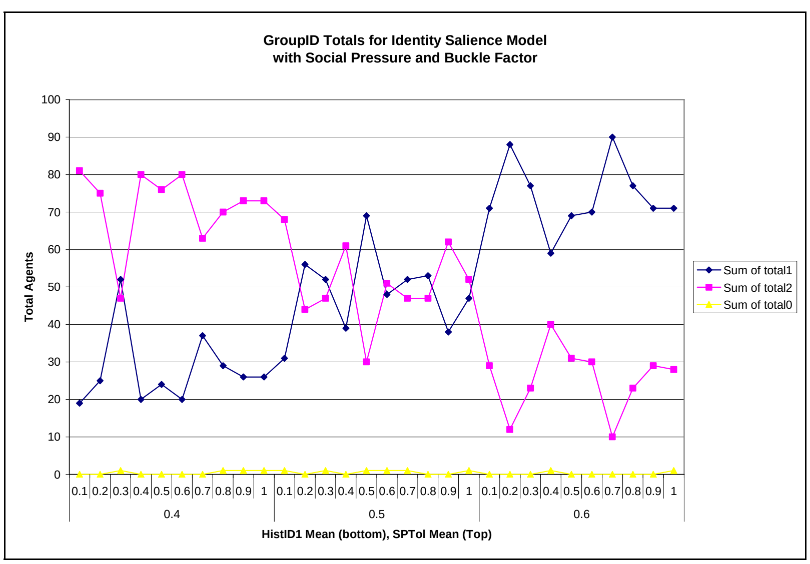
On an aggregate level, GroupID0 does not fare as well. In the Identity Salience model, it does not form at all. In the Supra-Additive model, GroupID0 forms when both HistIDs are low and again when both are high. These few opportunities for formation are also reflected in GroupID0's absence in group emergence. At the aggregate level, GroupID1 and GroupID2 prevail.

Group totals and group emergence for GroupID1 and GroupID2 are overwhelmingly influenced by HistID1 and HistID2 mean levels in both the Identity Salience and Supra-Additive models. SPTol has a secondary influence. Again, having the Buckle Factor does not help agents choose GroupID1 or GroupID2, unless the agent is a political ideologue. However, the agents in each model are affected by HistID1, HistID2, and SPTol differently even though HistID1 and HistID2 fundamentally determine agents' choices.

In the Identity Salience model, as HistID1 increases in strength, the numbers of GroupID1 agents increase. The converse is true for HistID2 (dependently defined by HistID1). As HistID1 and SPTol increase together, diminishing returns occur. SPTol does not help in GroupID1 formation when the HistID1 mean is low. Similarly, SPTol does not help in GroupID2 formation when the HistID1 mean is high. SPTol helps GroupID1 totals for medium HistID1 mean values. A HistID1 mean of 0.6 generates the same number of GroupID1 agents as a mean of 1.0. Diminishing returns occur for GroupID2 totals, too. A low HistID1 mean of 0.3 produces similar GroupID2 totals as does a mean of 0.1. A high HistID1 mean of 0.8 produces the same low GroupID2 numbers as does a mean of 1.0.

The group totals generated in the Supra-Additive model essentially have the same trend for GroupID1 and GroupID2. In general, as HistID1 increases and HistID2 decreases, GroupID1 totals increase. As HistID2 increases and HistID1 decreases, GroupID2 totals increase. There are diminishing returns from SPTol as the difference between the two HistIDs increase (about +/- 0.5 difference). If the value of HistID2 is also considered in the Identity Salience model, this +/- 0.5 difference in the HistIDs is also about the same time SPTol diminishing returns occur, too.

Graph 6.34 GroupID Totals, HistID1 = 0.5



However, social pressure tolerance affects group totals different when the two HistIDs are equal. In the Identity Salience model, there appears to be no stable trend when HistID1 = 0.5 (Graph 6.34). In the Supra-Additive model, as the HistIDs become closer in value, increasing social pressure tolerance helps the lower HistID. This trend is seen when the difference between the two HistIDs is 0.5 or less. When the two HistIDs are equal, increasing SPTol helps to decrease the variation between GroupID1 and GroupID2.

A final difference between the two model versions is that GroupID0 is able to form in the Supra-Additive model and cannot form at all in the Identity Salience model. When HistID1 and HistID2 are close in value, increasing social pressure tolerance does not help GroupID0 totals. However, when the HistIDs are both low (0.1-0.2) and both high (0.8-1.0), GroupID0 agents flourish beyond the few political ideologues. This result is most likely a combination of the Buckle Factor (majority agents influencing agents with low SPTol and the Buckle Factor) and an effect from the neutrality definitions.

Group emergence patterns are similar between the Identity Salience and Supra-Additive models when the HistID1, HistID2, and SPTol values match. The Supra-Additive model adds more possibilities for group emergence with the increased number of HistID1, HistID2, and SPTol combinations. There are also more GroupID0 ideologues overall, and small groups form when the two independent HistIDs are both low and high (there are higher GroupID0 totals). Both models display sensitivity to initially assigned agent characteristics when the HistID means have medium values. There is variation in which GroupID becomes the majority group depending upon which characteristics agents are randomly assigned at the beginning of the model run. This variation in the majority GroupID is also seen in the agent totals when the HistIDs are equal. Overall, the elemental dynamic for group emergence of GroupID1 and GroupID2 is that the higher HistID mean generates higher numbers of its corresponding GroupID.

While group totals and group emergence patterns demonstrate aggregate trends, the dynamics of individual decisions better illustrate the outcomes of potential assumptions in how identity is defined. Table 6.16 shows the magnitude of effects of HistID1, HistID2, SPTol and the Buckle Factor on each GroupID for both models. Variables with positive effects on group choice are in italics. Each model version has similar results; however, the impact of each variable on group choice is always greater in the Supra-Additive model. These are subtle differences between the two versions that are possibly being tempered by the low standard deviations for the HistID and SPTol means (constant at 0.2). Increasing the standard deviation will had more variation within the population and most likely would make the aggregate indicators different, too. This is a plausible explanation as to why there are significant differences between the Identity Salience and Supra-Additive versions at the individual level, but not at the aggregate levels (agent totals and totals of formed groups).

In the Identity Salience model, the HistID1 mean is the major determinant for GroupID1, the Buckle Factor is the major determinant for GroupID0, and SPTol helps determine GroupID2 and GroupID1 (but this effect is not significant). Even though GroupID0 is also aided by the HistID1 mean, the magnitude of effect is so small in comparison to the effect from the Buckle Factor.

Table 6.16 Effects of Identity Variables on GroupIDs

	HistID1	**HistID2**	**SPTol**	**Buckle Factor**
Identity Salience				
GroupID1	*Only Positive Determinant*	N/A	*Positive Effect (small)**	Negative Effect (small)
GroupID2	Negative Effect (large)	N/A	*Positive Effect (small)**	Negative Effect (medium)
GroupID0	Positive Effect (very small)	N/A	Negative Effect (small)	*Positive Effect (large)*
Supra-Additive				
GroupID1	*Positive Effect (large)*	Negative Effect (large)	*Positive Effect (small)**	Negative Effect (small)
GroupID2	Negative Effect (large)	*Positive Effect (large)*	*Positive Effect (small) **	Negative Effect (small)
GroupID0	Positive Effect (very small)	*Positive Effect (small)*	Negative Effect (medium)	*Positive Effect (medium)*

*not significant at the 0.01 level

In the Supra-Additive model, the identity variables work in tandem to help determine group choice. The magnitude of effect from HistID1 on GroupID1 is the greatest and the magnitude of effect from HistID2 on GroupID2 is the greatest. However, SPTol also helps to determine not choosing GroupID0. That is, agents choose either GroupID1 or GroupID2 but the groups are not significantly ordered by SPTol. Agents are still influenced by SPTol nevertheless. GroupID0 is mostly determined by effects from the Buckle Factor, but there is also positive influence from both HistID1 and HistID2. The effect from the Buckle Factor is also not as large as in the Identity Salience model.

In conclusion, examining aggregate level data like the group totals and group emergence patterns show that there is little difference between the models, with the exception that the Supra-Additive model offers more realistic HistID and SPTol mean combinations (and therefore more opportunities for group formation). Both H_1 and H_2 are not rejected. However, individual level decisions show that the biggest difference between the Identity Salience and Supra-Additive models is how and when the identity variables influence the dynamics group choice decisions. Each variable determines its own GroupID in the Identity Salience model. In the Supra-Additive model, all the variables work together to varying degrees to have an effect on group choice. H_3 is rejected.

Chapter Seven

Conclusion

It is important to reconcile different theoretical approaches to the central role multiple identities play in contemporary social movements in developing countries. There is no academic argument against the importance of incorporating identities into social movement and collective action theories. However, the debate seems to lie in how identities influence social movement actors and when these identities are important. A starting point can be questioning assumptions about the differences between theoretical approaches to multiple identities used in this dissertation—identity salience vs. supra-additive conceptions. One goal of this project is to add to this debate by highlighting these assumptions.

The standard approach to multiple identities, identity salience, recognizes that a person operates with many identities that in total "make" that person. However, each identity is recalled or prioritized individually (Stryker 1980; Stryker 2000a; Stryker 2000b). This approach assumes that the various identities do not work in tandem. An alternative conception of multiple identities that race, gender, and ethnic studies utilize is supra-additive identities—identities influence one another and are perceived by individuals simultaneously (i.e. as in multiple oppressions theories). For example, race is a gendered category and vice versa. People view the world with this simultaneous identity lens and experience specific discrimination in this manner, too (Giddings 1984; Collins 1986; Collins 1991; Glenn 1994; Liu 1994).

Fieldwork for this project studied the *No al Club de Golf* movement in Tepoztlán, México. Analysis shows that respondents depended on their Tepozteco and Mexican identities and cultural histories to decide on which side of the movement to join. These pre-existing, multiple identities were fundamental to group formation *before* the social movement even began. Respondents with strong Tepozteco affiliation tended to align themselves with the anti- club movement group. Respondents who strongly identified with a Mexican national identity more often aligned themselves with the pro-club or neutral groups. Those who chose the neutral group were either pro-club but afraid to go public with their true feelings about the club, or they were *Tepoztizos*, foreigners or Mexicans with no family history in Tepoztlán. Respondents, when given the opportunity, self-identified as having simultaneous identities—they were both Tepozteco and Mexican at the same time—but often felt these identities to differing degrees.

Incorporated as part of the simultaneous Tepozteco and Mexican identities are political economic development philosophies. Those with stronger Tepozteco identities tended to believe that certain kinds of development (i.e. development imposed by national or foreign governments) would hurt Mexico, the town, and dilute its cultural traditions. Those with stronger Mexican identities tended to believe that development was desperately needed for Mexico in general, or that Tepozteco cultural change is inevitable regardless of how development would occur.[44]

[44] Respondents were asked about *Pueblos Mágicos*, a development effort spear-headed by the national government. The goal of this plan is to develop traditional towns that draw a lot of tourism, but develop them in a manner that retains the traditional "charm" that attracts tourism in the first place. These towns were consulted first and worked with the national government to develop the project. Anti-club respondents generally felt that *Pueblos Mágicos* is a good example of positive development because it respects their traditions and provides improved infrastructure that the town would utilize (not foreigners).

Fieldwork also discovered that social pressure and social pressure tolerance levels were important in Tepoztecos' decisions to join the anti-, pro-, or neutral-club groups. There was great public pressure to be anti-club. Some respondents agreed with the larger anti-club views given the strength of their Tepozteco identity; social pressure was not a conscious part of their decision to be anti-club. However, the respondents who wanted the club built felt great pressure to be against the club and knew the costs were very high if they went public with their support of the club's construction. Those who did go public as pro-club and stood their ground suffered social isolation and ostracism, felt the need to leave Tepoztlán for their safety (others were kicked out like the local politicians), or were threatened physically or financially (loss of jobs or loss of market stalls). There were two alternative routes pro-club supporters took: 1. claim neutrality; or 2. actually claim to be anti-club (some even participated against the club).

Given fieldwork findings, this dissertation also concentrates on how multiple identities are approached methodologically. The identity salience conception of multiple identities is easier to control or operationalize, and these reasons could be why it is a preferred theory. However, utilizing complex adaptive systems (CAS) ideas and tools, both identity salience and supra-additive conceptions of multiple identities can be examined. CAS and ABM can help not only model interacting agents with multiple identities, but also help identify assumptions about both theoretical approaches. It does not assume easy predictability of behavior between individual and aggregate outcomes.

CAS incorporates "satisficing," interacting agents (Kaplan 1983). These agents interact with and adapt to each other and their environment. This interaction and adaptation leads to a central tenet of CAS, emergence (Holland 1996; Holland 1998). In this case, agents interact with neighboring agents within a limited area and they choose a social movement group to which to belong (i.e. anti-club, pro-club, or neutral). From these individual decisions, each social movement group begins to emerge. However, CAS does not assume that the dynamics of individual decisions (individual level) are the same as the dynamics of group-level outcomes (Schelling 1978; Waldrop 1992; Holland 1996; Wolfram 2002).

The CAS simulations in this dissertation consist of two basic models, Identity Salience and Supra-Additive, representing the two theoretical approaches to multiple identities. For the Basic model, agents' decision calculus includes only identities. In the Identity Salience version, there is only one main identity and another identity dependently defined from the main identity (HistID2 = 1-HistID1). In the Supra-Additive version, there are two independent, interacting identities (HistID1 + HistID2). Gradually making the Basic model more complicated, two more variables are added. Separate experiments include adding Social pressure tolerance (SPTOL), where agents determine if the pressure from its surrounding neighbors is above or below their tolerance threshold, and the Buckle Factor (Buckle), where if present, agents buckle to pressure regardless of tolerance levels. The distributions for HistID1, HistID2, and SPTol all have a standard deviation of 0.2 to not only replicate Tepoztlán's homogeneity in identity strengths, but also to control variation in this first batch of experiments.

7.1 Inter-Model Comparison

Chapters Four through Six presented results for each model version as Social Pressure Tolerance and the Buckle Factor were added to HistID1 and HistID2. The aggregate data—group totals and group emergence patterns—showed that there were *little difference* between the Identity Salience and Supra-Additive models in all versions (Basic, SPTol, and Buckle Factor experiments).[45] GroupID totals were close, with respect to actual agent numbers. Both models generated similar probability curves. Both had diminishing returns from high social pressure tolerance levels when HistID strength was very high or very low. That is, the HistID strength needs to be high enough to reap the benefits of social pressure tolerance, but when the HistID strength becomes very high, social pressure tolerance does not provide any added benefit to group totals. Because of the logistic curve, the Identity Salience models have a transition point where GroupID totals fluctuate depending upon initially assigned agent characteristics. For the Supra-Additive models, this majority group fluctuation occurs when HistID1 and HistID2 are equal or close to being equal. The influence on group choice from the Buckle Factor cannot be seen at the aggregate totals level.

With respect to group emergence, both the Identity Salience models and Supra-Additive models again have similar results. For both, there is no group formation until SPTol and agent interactions are added. The higher HistID always generates larger GroupID totals. When political ideologues are able to maintain their GroupID of choosing, there is the potential of multiple GroupIDs emerging. This occurs primarily when SPTol is high or the HistIDs are close in value. However, it is not until both HistIDs are equal when the majority GroupID can fluctuate depending upon initially assigned agent characteristics. The only difference between the models is that the Supra-

[45] Remember that for this project, the standard deviations are held at 0.2 and are not varied. It is possible that once the standard deviations for each identity variable are changed, more differences would develop.

Additive model has more possibilities for different groups to form because of the additional HistID1/HistID2 combinations.

SPTol affects group emergence because it assists agents in breaking out of the GroupID0 majority at the start up of the simulations (again, all agents are assigned GroupID0 at t=0). SPTol needs to be at least 0.5-0.6 in order for other groups to emerge. The higher HistID generates the larger group formation. When HistID1 and HistID2 are close in value, both GroupID1 and GroupID2, respectively, can form. However, there is always a larger group. When the HistIDs are equal, the majority GroupID can fluctuate because of variation in the initially assigned agent characteristics. The Buckle Factor becomes important in group emergence by creating ideologues (agents without the Buckle Factor) and by creating agents (agents with the Buckle Factor) that can be influenced by the ideologues to change GroupIDs. However, the environment is also an essential variable helping to determine if the political ideologues are able to generate a group. Agents located next to empty spaces on the grid (i.e. having fewer neighbors lowers the percentage necessary to withstand or cave into social pressure), are able to maintain theory minority GroupID and influence neighbors with low social pressure tolerance levels. This environmental factor is central to creating emergence dynamics by introducing potential GroupID cascades. Overall, though, the Buckle Factor aids in maintaining GroupID0.

However, the simulation outcomes generated from individual level agent decisions *are different* between the Identity Salience and Supra-Additive models. The sum does not equal its parts in this case. Each identity variable effects group choice differently between the two conceptions of multiple identities. Decision dynamics are different between each model. The main determining identity variable—HistID1, HistID2, SPTol, or the Buckle Factor—for each GroupID is different when the two models are compared to each other within each chapter. This phenomenon of individual dynamics generating larger effects which take on their own dynamics occurs in complex adaptive systems.

In Chapter Four, the basic models correspond directly with the agent decision rules. This is the only time the way each identity variable effects group choice is similar between the two models, but the probabilities of group choice between each model version are different. The Identity Salience model has almost no effect on GroupID0 decisions. As the HistID1 mean increases, so too do the odds of choosing GroupID1 significantly increase. The odds of choosing GroupID2 significantly decrease. The magnitude of effect of the HistID1 mean in determining GroupID1 and GroupID2 outcomes is large and direct.

In the Supra-Additive basic model, the trend is the same as in the Identity Salience model. As the HistID1 mean increases, the odds of choosing GroupID1 significantly increase as do the odds in not choosing GroupID2. The HistID1 mean has a very small effect on GroupID0. As the HistID2 mean increases, the odds of choosing GroupID2 significantly increase as do the odds in not choosing GroupID1. Fundamentally, each HistID mean directly affects its corresponding GroupID and it increases in identity strength; this corroborates agent decision rules.

` In Chapter Five, social pressure tolerance (SPTol) and agent movement are added to the two models. SPTol levels were the main determinants for GroupID1 and GroupID2 choices. However, in the Identity Salience model, SPTol also significantly orders agent choices for GroupID1 and GroupID2. In the Supra-Additive model, while it is the main determinant for GroupID1 and GroupID2, these outcomes are not statistically significant. SPTol determines that one of the other groups will be chosen, but it *does not significantly determine which* group is chosen. As SPTol increases, the odds of choosing GroupID0 decrease. In contrast, as SPTol increases, the odds of choosing another GroupID (either GroupID1 or GroupID2) increase.

In Chapter Six, the Buckle Factor is added to the Identity Salience and Supra-Additive models. In the Identity Salience model, the HistID1 mean has the greatest magnitude of effect in determining GroupID1 choices. An increase in the SPTol mean does increase the odds of choosing GroupID1 and GroupID2, though the magnitude of effect is small and it is not statistically significant. Finally, the Buckle Factor has the largest effect in determining GroupID0. HistID1, and the Buckle Factor significantly order GroupID choices.

In the Supra-Additive model, the Buckle Factor also has the largest effect on GroupID0, but both HistID1 and HistiD2 have a small effect in determining GroupID0, too. HistID1 and HistID2 also have the largest effect on GroupID1 and GroupID2, respectively. These are the only variable effects that are similar to the Identity Salience model. The Supra-Additive model differs in that SPTol has a small effect on GroupID1 and GroupID2, but the impact does not significantly order agent choices. Overall, GroupID1 and GroupID2 choices are determined by the HistID1, HistID2, and SPTol means, but are only significantly ordered by the HistID1 and HistID2 means.

Substantively, do these differences and similarities matter? The most important information generated by the simulations is that each variable has a different effect on group choice in the final model versions. Our assumptions about how each variable works and how they each determine group choices are challenged as each model version became increasingly complicated.

When the level of population diversity is controlled by holding the standard deviation of the HistID1, HistID2, and SPTol distributions at 0.2, *aggregate* results are similar all around. Individual decision dynamics are very different. However, once the standard deviations for each distribution changes and are varied, it is possible that the aggregate outcomes (i.e. group totals, group emergence and group choice probabilities) will change, too. Given that some mean combinations are sensitive to the initially assigned agent characteristics, it is not unrealistic to think that this sensitivity is carried out through out different distributions and would show up in the aggregate outcomes. These differences could significantly change group emergence patterns. The low standard deviation used for this dissertation in effect tempers the subtle differences between the two model versions.

However, how can this ecological difference be explained? Usually, differences between levels of analysis are attributed to intermediary institutions or social mores that change one-to-one scalability (Kim 1995). It is not that there is a lack of relationship between the aggregate and individual levels, there is not a linear relationship. However, these models do not have any intervening institutions.

Re-examining the aggregate results for agent totals and group emergence shows that the numbers *are* different; they just are not statistically different. An initial though is that this might be a case where potential substantive meaning is more important. Ten more groups might signal to individuals that there are enough people to warrant safe participation or five more groups might increase social pressure enough to influence someone's opinion. Moreover, slight random variation in agent characteristics or increased population variation might increase the difference between the agent and group totals enough to reach statistical significance.

The convergence on similar aggregate patterns may be a function of variable yet to be considered, like spatial distribution in the agents' environment or levels of diversity. Schelling (1978) writes:

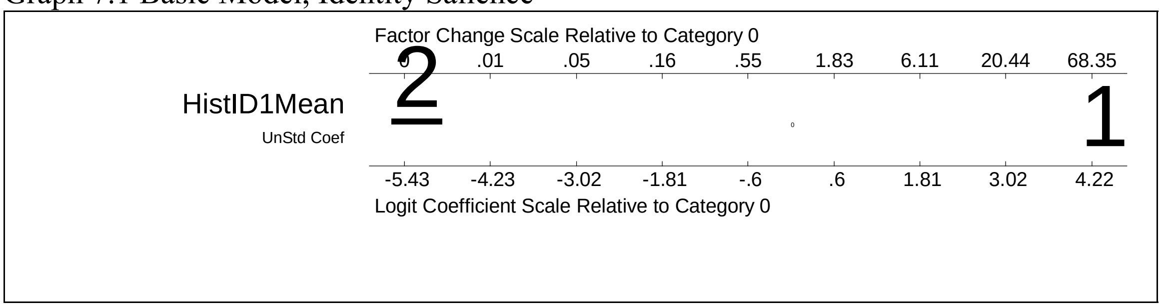
> People are responding to an environment that consists of other people responding to *their* environment, which consists of people responding to an environment of people's responses….These situations, in which people's behavior or people's choices depend on the behavior or the choices of other people are the ones that usually don't permit any simple summation or extrapolation to the aggregates. To make that connection we usually have to look at the *system of interaction* between individuals and their environment, that is, between individuals and other individuals or between individuals and the collectivity (14).

In this case, the agents' system of interaction are not only determined by one another, but also by their environment (i.e. ideologue are able to better influence agents when the agents are located by empty spaces on the grid) and low standard deviation of identity variables. What if the population diversity was higher for HistID1 but lower for HistID2? What if only 10% of population had high SPTol levels? This dissertation shows that the identity variables influence individual agent decisions differently between the Identity Salience and Supra-Additive models; it is therefore not out of the realm of possibility that when variation in these variables or population density change, so too might the lack of statistical difference at the aggregate level.

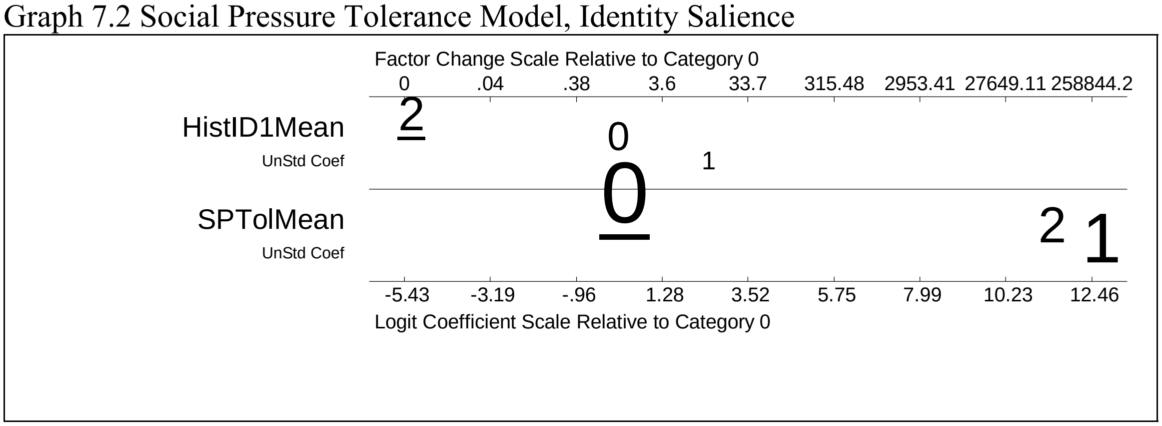
7.2 Intra-Model Comparison: Capturing Individual Decision Dynamics

Next, examining how the Identity Salience and Supra-Additive models individually change as they become more complicated will also help parse out assumptions about defining multiple identities in agent interaction. The graphs below show the combined odd ratio-discrete change graphs for the Identity Salience model. Graph 7.1 presents the results from the basic model that includes just the HistID1 mean. Graph 7.2 presents the results from adding Social Pressure Tolerance and agent interaction to the basic model. Finally, Graph 7.3 presents the results from the fully realized model that combines HistID1, Social Pressure Tolerance, and the Buckle Factor.

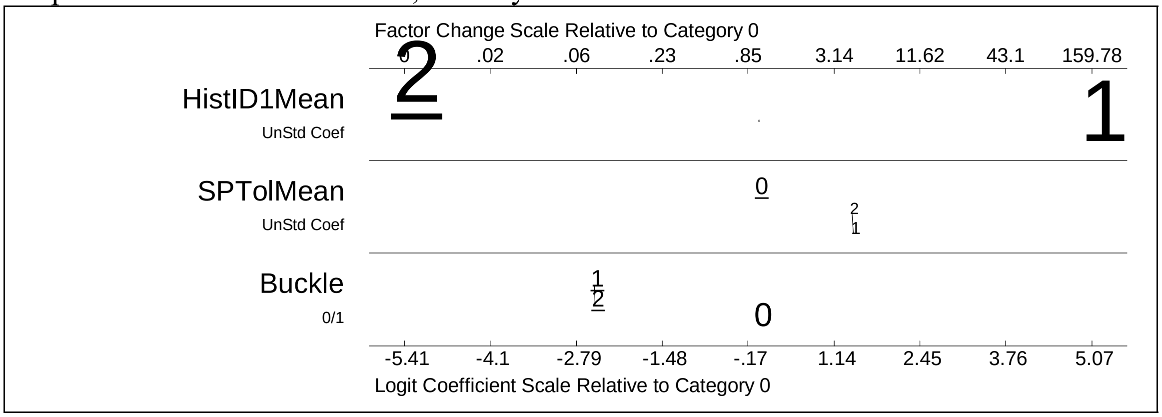
Graph 7.1 Basic Model, Identity Salience



Graph 7.2 Social Pressure Tolerance Model, Identity Salience



Graph 7.3 Buckle Factor Model, Identity Salience



The Basic Identity Salience model in Chapter Four is completely determined by the HistID1 mean (Graph 7.1). As the HistID1 mean increases, the magnitude of effect this increase has on agents choosing GroupID1 is very large. Conversely, the magnitude of effect is large on agents not choosing GroupID2. However, when social interaction and social pressure tolerance levels are added into the agents' decision rules, the determining variable for each GroupID also changes.

Graph 7.2 shows how an agent's Social Pressure Tolerance mean has the greater effect on agents choosing GroupID1 and GroupID2 as tolerance increases. SPTol determines GroupID1 more than GroupID2. However, GroupID1 is also determined by an increasing HistID1 mean, though it does not have as great as an impact as the SPTol mean. Increasing tolerance levels positively assists GroupID2, though low HistID1 mean levels also helps agents choose GroupID2.

Increasing SPTol also decreases GroupID0 choices. Agents are less likely to keep their originally assigned GroupID0 and are more likely to choose either GroupID2 or GroupID1. Agents simply have more tolerance to withstand the GroupID0 majority at the beginning of each run. An increasing HistID1 mean also influences agents maintaining GroupID0. This change occurs when HistID1 increases to about 0.5, making the HistID2 mean 0.5, too. Though the magnitude of effect is medium in comparison to the other effects on GroupID1 and GroupID2, it is still positive.

Finally, when the Buckle Factor is added to the HistID1 and SPTol means, individual decision dynamics change again (Graph 7.3). The Buckle Factor does not influence agents in choosing GroupID1 or GroupID2. As the Buckle Factor goes from zero to one (i.e. the agent will buckle to the neighbors' pressure), the odds increase in favor of choosing GroupID0. This effect implies that the Buckle Factor has the biggest impact on the current odds of choosing GroupID0 when GroupID0 is still the majority GroupID. The odds of choosing GroupID1 and GroupID2 significantly decrease if the agent has the Buckle Factor present.

The effect from the HistID1 mean again becomes the largest effect in determining GroupID1 and GroupID2 outcomes. As the mean increases in strength, the odds of choosing GroupID1 significantly increase; the odds of choosing GroupID2 significantly decrease. The HistID1 mean has almost no effect on the odds of choosing GroupID0, though they slightly increase as the HistID1 mean increases. The Buckle Factor has a larger magnitude of effect on the odds of agents choosing GroupID0.

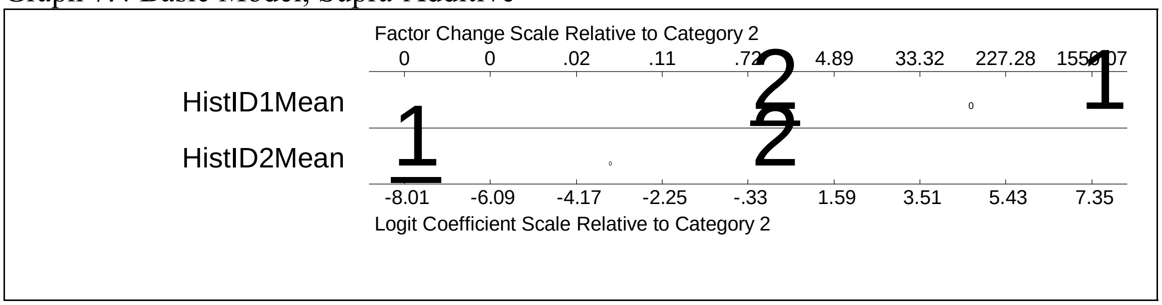
Interestingly, as the Social Pressure Tolerance mean increases, the odds of choosing GroupID1 and GroupID2 increase, too, but this effect does not significantly impact group choice. The odds of choosing GroupID0 decrease. In relation to an increasing HistID1 mean (and, therefore, decreasing HistID2 mean), SPTol is still important for agents not choosing GroupID0 and choosing another GroupID, but which GroupID it is—GroupID1 or GroupID2—is not determined by SPTol.

As each new variable is added to the basic Identity Salience model, how each one influences agents' GroupID decisions changes. Fundamentally, agent decision dynamics change as the variables interact. In the basic model, where the HistID1 mean is the only variable in an agent's decision calculus, it not surprisingly determines GroupID1 and GroupID2 outcomes. It has almost no influence on GroupID0 choices, except for when the two HistID means are equal and there are more agents who are neutral.

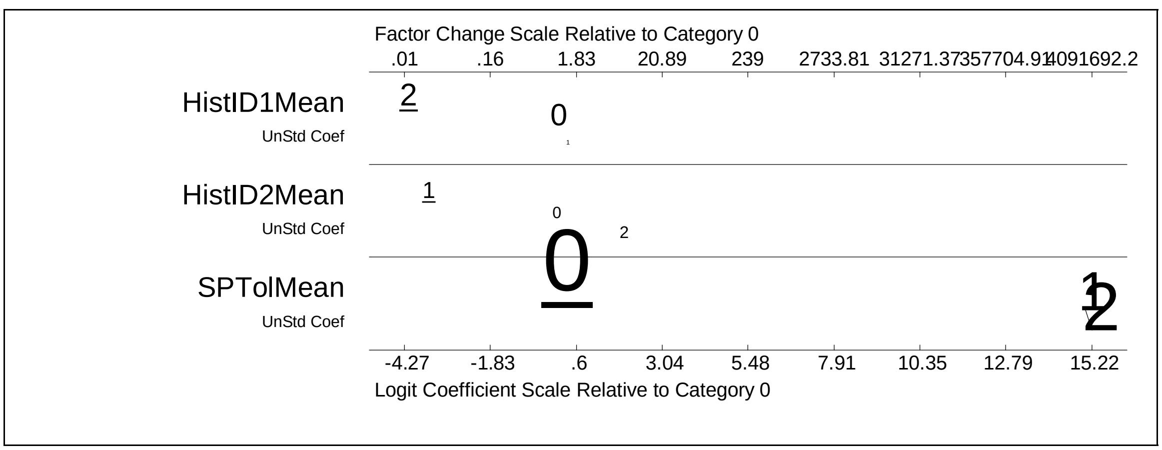
When SPTol is added to this basic model, the odds of choosing GroupID1 and GroupID2 both increase as tolerance increases. Both GroupID1 and GroupID2 are significantly ordered by tolerance levels, too. As tolerance increases, the odds of choosing GroupID0 decrease greatly. The HistID1 mean still influences some GroupID1 choices, but the magnitude of effect on the odds of choosing GroupID1 is not as great as SPTol's influence. Moreover, an increase in the HistID1 mean also increases the odds of choosing GroupID0. Finally, when the Buckle Factor is added, the HistID1 mean again significantly affects GroupID1 choices. However, SPTol does not significantly influence GroupID1 and GroupID2 choices and the Buckle Factor has a large magnitude of effect on GroupID0 choices when agents have the Buckle Factor present. By the final model version, every variable positively increases the odds in choosing a *different* group identity.

Next, comparing decision dynamics within the Supra-Additive model shows changes in how variables determine decision odds, too. In the basic Supra-Additive model, the HistID1 and HistID2 means are defined independently and are the only variables determining an agent's group choice. As the HistID1 mean increases, the odds in choosing GroupID1 significantly increase and the odds in choosing GroupID2 decrease (Graph 7.4). As the HistID2 mean increases, the odds in choosing GroupID2 significantly increase and the odds in choosing GroupID1 decrease. Each mean has very little effect on GroupID0 choices.

Graph 7.4 Basic Model, Supra-Additive

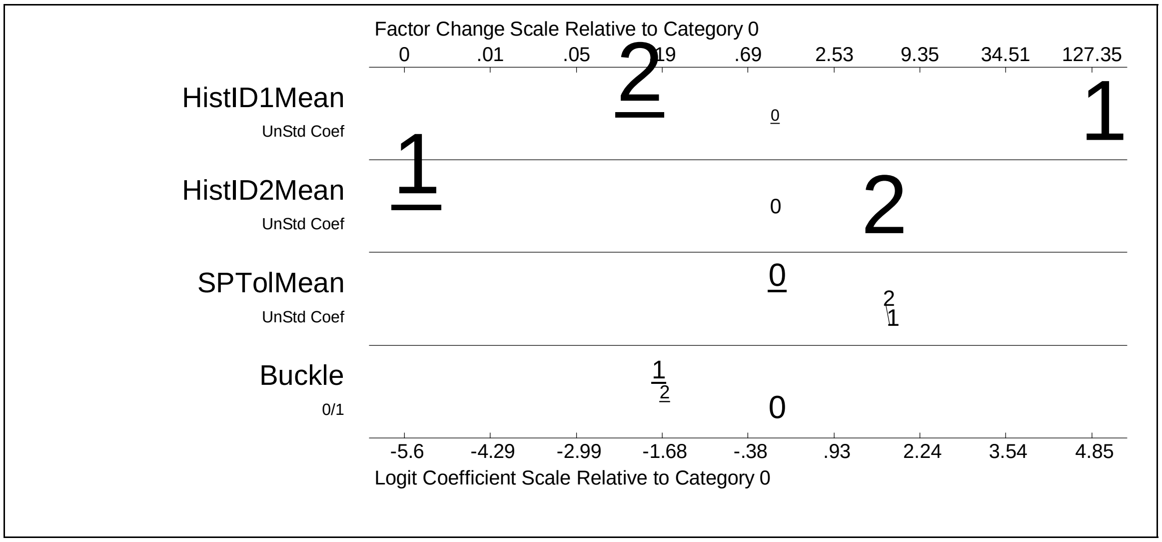


Graph 7.5 Social Pressure Tolerance, Supra-Additive



When Social Pressure Tolerance (SPTol) is added to the two HistID means, decision dynamics greatly change (Graph 7.5). SPTol now has the largest magnitude of effect in determining both GroupID1 and GroupID2. However, which group agents choose is not ordered by SPTol. That is, SPTol increases the odds in choosing another GroupID other than GroupID0 though which GroupID—GroupID1 or GroupID2—is not statistically significant. An increasing SPTol has the largest effect on agent decisions not to choose GroupID0. The odds in choosing GroupID1 only slightly increase as the HistID1 mean increases; the odds in choosing GroupID2 only slightly increases as the HistID2 mean increases. These are very different outcomes that found in the Basic Model. Finally, the odds of choosing GroupID0 are influenced by both HistID1 and HistID2 increasing.

Graph 7.6 Buckle Factor Model, Supra-Additive



When the Buckle Factor is added to SPTol and the two HistID means, the decision dynamics continue to change (Graph 7.6). The HistID1 and HistID2 means revert to having the largest effect on the odds of choosing GroupID1 and GroupID2, respectively. However, SPTol continues to have some positive effect on the odds in choosing GroupID1 and GroupID2. Choosing GroupID1 or GroupID2 remains statistically insignificant. That is, GroupID1 and GroupID2 choices are largely ordered by the HistID1 and HistID2 means. Finally, the Buckle Factor is the main determinant of GroupID0 when an agent has the Buckle Factor present.

The agent-level decision dynamics change in both the Identity Salience and the Supra-Additive models as SPTol and the Buckle Factor are added to the HistID means. The trends in these changes are very similar: 1. the HistID means determine group choice in the basic model; 2. the addition of SPTol shifts decision influence from solely HistID1 and HistID2 to SPTol, and the odds of choosing GroupID0 are slightly improved as the HistID means increase; and 3. the addition of the Buckle Factor makes HistID1 and HistID2 main determinant for GroupID1 and GroupID2, respectively, and it increases the odds of agents choosing GroupID0.

The primary difference between the Identity Salience and Supra-Additive models is evident in the individual level decisions. The overall trends are very similar, but the magnitude of effect on the odds of group choice for each GroupID is always larger in the Supra-Additive model. Even at a low standard deviation of 0.2 for the identity variables' distributions, the predicted probabilities of group choice are significantly different. Most likely, when this standard deviation is increased and the population diversity is increased, the aggregate indicators (agent totals and totals of formed groups) will also be significantly different.

7.3 Methodological and Substantive Implications

Overall, the aggregate data—group totals and group emergence patterns—indicate that there are no real differences between the Identity Salience and Supra-Additive models for this low level of population diversity. Both models even exhibit CAS properties in group emergence patterns around HistID = 0.5. When HistID1 and HistID2 both equal 0.5 (or in the Supra-Additive model's case when both HistIDs also have values close to 0.5), ideologues can influence decision cascades in their favor. The result is that the majority GroupID can change depending upon initially assigned agent characteristics and agents' randomly chosen grid placement. In this case, the "sum does not equal its parts." This also indicates that individual decision dynamics can be different than the larger group dynamics.

Indeed, the local-level data that incorporates individual agents' decisions show that the models do have different dynamics for this low level of population diversity. The most significant differences occur in the influence from Social Pressure Tolerance and its relationship with the HistID and Buckle Factor variables. When SPTol is initially added, it has the most influence on odds of choosing GroupID1 and GroupID2, and in not choosing GroupID0. However, in the Identity Salience model, it is the main determining variable for GroupID1 and GroupID2; in the Supra-Additive model, it is not (the HistID variables are). When the Buckle Factor is added, SPTol positively increases the odds of agents choosing both GroupIDs but the effect is not significant in the Identity Salience model. In the Supra-Additive model, SPTol's relationship to the other variables stays the same except that the overall magnitude of effect on decisions diminishes.

Both levels of data exhibit CAS characteristics. Agent interaction was necessary for group emergence. Group emergence was possible even though agents had limited information and limited vision of their neighbors' GroupID information. Through agent interactions, lone agents or ideologues were able to cause group cascades. The environment also played an important variable, especially for ideologues. Ideologues had the most influence on other agents' group choice when the lone agents were located next to open spaces on the grid.

Another CAS feature seen is the flourishing middle ground when the two HistID strengths are equal or close to being equal. The basic models reached equilibrium points for each run, but the later model versions had constant variation around equilibrium points. Part of the adaptation and variation in the models occurred in the middle ground (inflection point in probability graphs) where the majority GroupID could change depending upon agents' initially assigned characteristics and location on the grid. Agents adapted quickly to their new environments and neighbors' social pressure and this adaptation changed group emergence patterns.

Next, the models' results have several methodological implications. The most important is that fieldwork interviews provided the level of detail needed to identify important variables that were not originally considered vital to participation decisions. A grounded theory fieldwork approach allows a researcher to reevaluate theoretical assumptions and discover other or more important avenues of questioning, in this case the importance for respondents of choosing a social movement side or group before the social movement began in earnest. There was a larger, more complicated story about participation decisions which neither my initial fieldwork plan nor the literature deemed important *but respondents did.* Detailed interviews allowed me to find out that multiple identities were important to group formation and that the group decision was a separate decision from the decision to participate.

Another methodological implication is utilizing CAS theories and simulations to aid in theoretical discovery and in highlighting possible theoretical assumptions. Analysis of the models did not assume that the aggregate results had similar dynamics as the individual agents' decisions dynamics, and indeed they were different for this low level of population diversity. CAS emphasizes that there can be differences between local and global phenomena, and that it is possible that each develop their own characteristics even though one emerged from the other (Schelling 1978; Holland 1996; Holland 1998; De Wolf 2004; Miller 2007). However, it is possible for differences in the aggregate level between the two model versions to be introduced when population diversity of HistID and SPTol means is increased.

More importantly, these differences whenever they do exist, highlight the concern about ecological fallacy and when survey data, for example, lends itself to better predict individual behavior and when it does not. The Identity Salience model is an example of when aggregate data could explain well rather predictive behavior. This is because of how multiple identities are defined—HistID2 is dependent on HistID1 and there is a clear, determined relationship between the two.

However, the Supra-Additive model demonstrates that it is more difficult to predict group choice—especially at the level of individual decisions—when the HistIDs are independent. Survey data would not lend itself to predicting behavior of individual agents or group emergence based on these decisions. Because of this difficulty of predictive outcomes, the Supra-Additive model underscores the utility of CAS and agent-based modeling in parsing out these assumptions and systematically examining complicated behavior.

Methodologically, fieldwork questions or data gathering should consider different causal mechanisms for different parts of a social movement cycle. Different questions might be needed to ask respondents or different variables may be needed to capture these differences at each level of social movement emergence. Moreover, data analysis should remain open that how and when each variable affects the chosen outcome may change depending upon the level of analysis.

Social movement theories should not assume similar dynamics among movement levels either, especially as more theories are developed that want to link the social movement to micromobilization levels. A specific application would be framing or frame theory. While there are several levels of frames identified within a social movement as it develops (Snow 1986; Benford 2000), it should not be assumed that the frames necessary for group creation before movements start and the frames necessary to garner participation, are the same strategies or utilize the same identities. Similarly with collective action theories, group formation might necessitate different incentives than getting that group to participate.

A CAS approach to social movement theory also does not assume completely rational and maximizing agents with perfect information. Agents are “satificing” with limited information (Kaplan 1983). Other research shows, and this project confirms this research, that group formation is still possible given limited information (Brichoux 2002). Future experiments can decrease agents’ vision even further to determine just how little agents can know about their neighbors’ group choices for group formation to still emerge.

A final methodological implication is to regard the environment in which agents find themselves as an important variable. CAS theories incorporate the environment as an independent variable with which agents can interact (Resnick 1994; Epstein 1996; Holland 1996; Axelrod 1997; Cederman 1997; Holland 1998; De Wolf 2004). In this project, agents' decisions were effected by their location on the grid. If they were surrounded by many agents, they had to incorporate their neighbors' group choices in their group decision (via social pressure for a particular GroupID). However, if they were relatively or completely isolated, they had greater opportunity to base their group choice decisions just on the strength of their identities.

Political ideologues (agents with either very high SPTol levels or with no Buckle Factor present) were also able to influence GroupID cascades when they were on the edge of an empty pocket on the grid. Location becomes important especially when social pressure tolerance increases because ideologues would need to rely on those empty pockets to be able to influence agents with lower SPTol levels. If agents find themselves in an environment with high population diversity, it may be more difficult or take longer for group emergence to occur. All experiments for this project utilized a low level of diversity as a control, but also to mimic the Tepozteco population.

Substantively, the implications from the models' results significantly add to social movement and collective action theories. Fieldwork showed not only that multiple identities were important to group formation before the social movement occurred, but also that the decision to choose a side of the movement—and the input into that decision—was different. To assume that getting someone to participate in a movement is just about participation incentives ignores an important step in the process—deciding which side of the movement to join. In the case of Tepoztlán, this group decision was actually more important and had higher social risks than participation decisions. This means that pertinent population characteristics and attitudes (i.e. multiple identities and their environment) given the issue(s) of a movement matter not only for group formation, but also for participation. Moreover, the characteristics and attitudes that are important (or how they are important) may change, too. These different rolls for identities within social movements may make organizers' jobs more difficult in that they should know the targeted population well, especially the social and political consequences of peoples' decisions.

The *No al Club de Golf* movement also shows that group emergence can occur even without an overriding organizing entity or social movement organization. *El C.U.T.* formed as a way to organize participation events and public relations, but respondents did not feel that *El C.U.T.* steered their decisions in any particular way. They felt this way mostly because their decision to choose a side in the movement has already been made. *El C.U.T.* did help organize participation events and disseminate information about these events; in this managerial capacity participation costs were lowered. It perhaps furthered the cultural theme of the movement, too, but the theme of the movement fundamentally emerged during the *asembleas.*

Given the prevalence of resource mobilization theory and centrality it gives to social movement organizations (SMO), focusing on when SMOs become important and in what environments is crucial. They might not be necessary all the time or even present at all. A more organic emergence occurs when there is no SMO industry. As in Piven (1977), not relying on SMOs to steer group formation or movement activities may be a political advantage to some communities (i.e. developing countries).

Understanding when diminishing returns occur in the relationship between identities and social pressure can also help better target resources should an organization exists and be trying to aid group formation. For high social pressure tolerance levels, the data shows that the same amount of agents choose a group when they have medium-level identities as when they have strong identities. Similarly, high social pressure tolerance levels do not aid in group formation for weak-to-medium-level identities. Substantively, increasing incentives or increasing pressure to sway group choice does not work as effectively as understanding why a community identifies strongly with some identities and weakly with others (the identities found important to that community's group formation). With respect to the case of Tepoztlán and the *No al Club de Golf* movement, diminishing returns help to explain why social pressure did not matter or effect decisions to those who already strongly identified as Tepozteco.

A final substantive implication is the need to understand the process of emergence and adaptation as it applies to group formation and larger social movement activity. Social movement organizers would need to take into account that the individual decisions to join a group have different dynamics than that group's behavior (the sum does not equal its parts). The same variables may be present, for example like social pressure and social pressure tolerance, but they may act differently at each level of organization. More importantly, individual decisions to join a group have a different calculus than participation decisions. Most social movement theories already acknowledge that a collective identity does form during a social movement. This dissertation shows that it is possible that different identities, individual or other collective identities, are just as important to developing that larger movement identity before the movement even begins.

This project focused upon the effect of pre-existing identities on group emergence in a homogenous community.[46] The next step in this research agenda is to add to the current model versions experiments that gradually increase population diversity. Other experiments include:

- Varying agent vision.
- Varying population size.
- Increasing the number of identities and groups.
- Varying the percentage of agents that have certain distributions for each variable.
- Social influence.

Finally, variables in conjunction to social pressure tolerance and the Buckle Factor could be added to agents' characteristics and decision parameters. For example, political economic development philosophies also varied among respondents though the philosophies were rooted in their Tepozteco or Mexican identities. Participation decisions, too, could be an overall extension to the group formation models.

7.4 Contributions

The goal of this dissertation is to highlight the importance of pre-existing, multiple identities in group formation *before* social movement participation. The decision to join a group precedes a decision to participation in a movement. These fieldwork discoveries and subsequent computational models contribute to social

[46] Again, the community is homogenous with respect to the diversity of identity strength variation in HistID1 and HistID2, and in social pressure tolerance levels.

movement theories by parsing out differences and similarities between the two major conceptions of multiple identities, Identity Salience and Supra-Additive approaches. How multiple identities, social pressure tolerance levels, and the buckle factor affect group choice at the individual level is different between the two model versions. However, agent and group totals converge at the aggregate level with low population diversity. The main difference between the two model versions is that the Supra-Additive version has a larger magnitude of effect on the odds of choosing each GroupID. This subtle difference will most likely be magnified once population diversity in HistID and SPTol means is increased. Moreover, the Supra-Additive approach yields more agent decisions and behavior outcomes that correspond with fieldwork realities. All groups are able to form in the Supra-Additive models. These realities were found through a grounded theory approach in fieldwork.

The determined nature of the Identity Salience model and the difficulty in predicting outcomes for the Supra-Additive model also implies differences in when aggregate level data is permissible to use to predict individual level behavior. Because of the relationship between HistID1 and HistID2 as defined in the Identity Salience model, outcomes are easier to predict. This model version is an example of when aggregate data like survey data is a more acceptable tool in drawing inferences about individual behavior.

However, the dynamics and outcomes are too complicated in the Supra-Additive model to lend itself easily to prediction. The independence of the two HistIDs coupled with SPTol and the Buckle Factor make outcomes difficult to predict. This in turn does not allow prediction of individual level dynamics. If survey data was used to predict individual level decisions for this complicated behavior, information would not only be lost but predictions would be inaccurate risking ecological fallacy. Agent-based modeling is ideal to examining these types of interactions especially because there is no assumption in a CAS approach that there is one-to-one scalability between individual decisions and aggregate outcomes.

This project also demonstrates that group formation and self-organization is possible without steering from a social movement organization and that there can be different dynamics between local level and aggregate level data. It is possible for agents to self-organize without a SMO. In part, this contribution is because of using a CAS perspective. The utility of CAS is in helping researchers highlight theoretical and methodological assumptions. Finally, this dissertation contributes to social movement theory by demonstrating that understanding some social movement behavior is aided by a CAS approach and agent-based modeling.

Bibliography

Abdelal, Rawi et al (2006). "Identity as a Variable." Perspectives on Politics **4**(4): **695-711**.

Akerlof, George A. and Rachel E. Kranton (2000). "Economics and Identity." The Quarterly Journal on Economics **CXV**(3): 715-753.

Axelrod, Robert (1997). The Complexity of Cooperation: Agent Based Models of Competition and Collaboration. Princeton, Princeton University Press.

Balderrama Vara, Nuvia (n.d.). La Lucha de Tepoztlán en el Contexto Latinoamericano. Tepoztlán.

Benford, Robert D. and David A. Snow (2000). "Framing Processes and Social Movements: An Overview and Assessment." American Review of Sociology **26**: 611-639.

Brichoux, David and Paul E. Johnson (2002). "The Power of Commitment in Cooperative Social Action " Journal of Artificial Societies and Social Simulation **5**(3).

Brown, Elsa Barkley (1989). "Womanist Consciousness: Maggie Lena Walker and the Independent Order of Saint Luke." Signs: Journal of Women in Culture and Society **14**(3): 610-633.

Castells, Manuel (2000). The Rise of the Network Society. Oxford ; Malden, MA, Blackwell Publishers.

Casti, John L. (1997). Would-be Worlds: How Simulation is Changing the Frontiers of Science. Darby, Diane Publishing Co.

Cederman, Lars-Erik (1997). Emergent Actors in World Politics: How States and Nations Develop and Dissolve. Princeton, Princeton University Press.

Chong, Dennis (1991). Collective Action and the Civil Rights Movements. Chicago, The University of Chicago Press.

Collier, George (1999). Basta! Land and the Zapatista Rebellion in Chiapas. Oakland, Food First Books.

Collins, Patricia Hill (1986). "Learning from the Outsider Within: the Sociological Significance of Black Feminist Thought." Social Problems **33**(6): 14-32.

--- (1991). Black Feminist Thought: Knowledge, Consciousness, and the Politics of Empowerment. New York, Routledge.

Corona Caraveo, Yolanda and Carlos Pérez y Zavala (1999). Tradición y Modernidad en Tepoztlán: Historias y Leyendas de un Pueblo en Resistencia. México D.F., Universidad Autonoma Metropolitana Unidad Xochimilco.

Davis, John B. (2007). "Akerlof and Kranton on Identity in Economics: Inverting the Analysis." Cambridge Journal of Economics **31**: 349-362.

De Wolf, Tom and Tom Holvoet (2004). Emergence and Self-Organization: a Statement of Similarities and Differences. Proceedings of the Second International Workshop on Engineering Self-Organising Applications, New York, Springer Verlag.

Demesa Padilla, Gerardo (1998). No Al Club de Golf: Tepoztlán, La Lucha del Pueblo Tepozteco Contra la Imposición un Megaproyecto. Tepoztlán, Gerardo Demesa Padilla.

Ebaugh, Helen Rose Fuchs. (1988). Becoming an Ex: The Process of Role Exit. Chicago, University of Chicago Press.

Eckstein, Susan, ed. (1989). Power and Popular Protest: Latin American Social Movements. Berkeley, University of California Press.

Edelman, Marc (1999). Peasants Against Globalization : Rural Social Movements in Costa Rica. Stanford, Stanford University Press.

Epstein, Joshua and Robert Axtell (1996). Growing Artificial Societies: Social Science From the Bottom Up. Washington D. C. , Brookings Institution Press.

Escobar, Arturo and Sonia E. Alvarez, eds. (1992). The Making of Social Movements in Latin America: Identity, Strategy, and Democracy. Boulder, Westview Press.

Fein, Melvyn (1990). Role Change: A Resocialization Perspective. New York, Praeger.

Ferree, Myra Marx (1992). The Political Context of Rationality: Rational Choice Theory and Resource Mobilization. Frontiers in Social Movement Theory. Morris. New Haven, Yale University Press.

Foweraker, Joe (1995). Theorizing Social Movements. Boulder, Pluto Press.

Friedman, Debra and Dough McAdam (1992). Collective Identity and Activism: Networks, Choices, and the Life of a Social Movement. Frontiers in Social Movement Theory. Morris. New Haven, Yale University Press.

Gamson, William A. (1992). The Social Pyschology of Collective Action Frontiers in Social Movement Theory. Morris. New Haven Yale University Press.

Gecas, Viktor (2000). Value Identities, Self-Motives, and Social Movements. Self, Identity, and Social Movements. Stryker. Minneapolis, University of Minnesota Press.

Giddings, Paula (1984). When and Where I Enter: The Impact of Black Women on Race and Sex in America. New York, Bantam Books.

Gilbert, Nigel and Klaus G. Troitzsch (1999). Simulation for the Social Scientist. Philadelphia, Open University Press.

Glenn, Evelyn Nakano (1994). From Servitude to Service Work: Historical Continuities in the Racial Division of Paid Reproductive Labor. Unequal Sisters: A Multi-Cultural Reader in U.S. Women's History. Ruiz. New York, Routledge.

Guitérrez, Marcela Tostado, ed. (1998). Tepoztlán, Nuestra Historia: Testimonios de los Habitantes de Tepoztlán, Morelos. México, D.F. , Instituto Nacional de Antropología e Historia.

Guzman, Salvador (n.d.). Calendario de Eventos. Tepoztlán.

Hale, Charles R (1994). Resistance and Contradiction: Miskitu Indians and the Nicaraguan State, 1894-1987. Stanford, Stanford University Press.

Holland, John (1996). Hidden Order: How Adapation Builds Complexity. New York, Basic Books.

--- (1998). Emergence: From Chaos to Order. Reading, MA, Perseus Books.

Howard, Judith (2000). "Social Psychology of Identities." Annual Review of Sociology **26**: 367-393.

Hunt, S. A. et al (1994). Identity Fields: Framing Processes and the Social Construction of Movement Identities. New Social Movements: from Ideology to Identity. Larana. Philadelphia, Temple University Press.

Isbester, Katherine (2001). Still Fighting: The Nicaraguan Women's Movement, 1977-2000. Pittsburgh, University of Pittsburgh Press.

Johnston, Hank and Bert Klandermans, eds. (1995). Social Movements and Culture. Minneapolis, University of Minnesota Press.

Kaplan, Stephen and Rachel Kaplan (1983). Cognition and Environment: Functioning in an Uncertain World. Ann Arbor, Ulrich's Bookstore.

Kauffman, Stuart (1995). At Home in the Universe: The Search for Laws of Self-Organization and Complexity. New York, Oxford University Press.

Kelley, Kevin (1995). Out of Control: The New Biology of Machines, Social Systems and the Economic World. New York, Perseus Publishing.

Kiecolt, K. Jill (2000). Self-Change in Social Movements. Self, Identity, and Social Movements. Stryker. Minneapolis, University of Minnesota Press. **13**.

Kim, Uichol (1995). Individualism and Collectivism: A Psychological, Cultural, and Ecological Analysis. Copenhagen, Nordic Institute of Asian Studies Press.

King, Deborah K. (1988). "Multiple Jeopardy, Multiple Consciousness: The Context of a Black Feminist Ideology." Signs **14**(1): 42-72.

Lavrin, Asunción (1995). Women, Feminism, and Social Change in Argentina, Chile, and Uruguay 1890-1940. Lincoln, University of Nebraska Press.

Levine, Dan, Ed. (1993). Constructing Culture and Power in Latin America. Ann Arbor, University of Michigan Press.

Lewis, Oscar (1951). Life in a Mexican Village: Tepoztlán Revisited. Urbana, University of Illinois Press.

--- (1963). Life in a Mexican Village: Tepoztlán Restudied. Urbana, University of Illinois Press.

Lindberg, Staffan and Arni Sverrisson, eds. (1997). Social Movements in Development: The Challenge of Globalization and Democratization. New York, St. Martin's Press, Inc.

Liu, Tessie (1994). Teaching the Differences Among Women from a Historical Perspective: Rethinking Race and Gender as Social Categories. Unequal Sisters: A Multi-Cultural Reader in U.S. Women's History. Ruiz. New York, Routledge.

McAdam, Doug (1982). Political Process and the Development of Black Insurgency, 1930-1970. Chicago, The University of Chicago Press.

McAdam, Doug and Ronnelle Paulsen (1993). "Specifying the Relationship between Social Ties and Activism." American Journal of Sociology **99**: 640-667.

Melucci, Antonio (1985). "The Symbolic Challenge of Contemporary Movements." Social Research **52**: 781-816.

--- (1989). Nomads of the Present: Social Movements and Individual Needs in Contemporary Society. Philadelphia, Temple University Press.

Miller, Francesca (1991). Latin American Women and the Search for Social Justice. Hanover, University Press of New England.

Miller, John H. and Scott E. Page (2007). Complex Adaptive Systems: An Introduction to Computational Models of Social Life. Princeton, Princeton University Press.

Mortimer, Jeylan and Michael Finch and Donald Kumka. (1982). Persistence and Change in Development: The Multidimensional Self-Concept. Life-Span Development and Behavior. Baltes. New York, Academic Press.

Muller, E. and Karl-Dieter Opp (1986). "Rational Choice and Rebellious Collective Action." American Political Science Review(80): 471-486.

Olson, Mancur (1965). The Logic of Collective Action. Cambridge, Harvard University.

Oommen, T.K. (1997). Chapter 3: Social Movements in the Third World. Social Movements in Development. Lindberg. New York, St. Martin's Press**:** 46-66.

Palanco, Héctor Díaz (1997). Indigenous Peoples in Latin America: The Quest for Self-Determination. Boulder, Westview Press.

Paley, Julia (2001). Marketing Democracy: Power and Social Movements in Post-Dictatorship Chile Berkeley, University of California Press.

Pinel, Elizabeth and William B. Swann Jr. (2000). Finding the Self through Others: Self-Verification and Social Movement Participation. Self, Identity, and Social Movements. Stryker. Minneapolis, University of Minnesota Press.

Piven, Frances Fox and Richard A. Cloward (1977). Poor People's Movements: Why They Succeed, How They Fail. New York, Vintage Books.

Randall, Margaret (1981). Sandino's Daughters: Testimonies of Nicaraguan Women in Struggle. . Vancouver, B.C., New Star Books.

Redfield, Robert (1930). Tepoztlan, A Mexican Village: A Study of Folk Life. Chicago, The University of Chicago Press.

Resnick, Mitchell (1994). Turtles, Termites, and Traffic Jams: Explorations in Massively Parallel Microworlds. Cambridge, MA, MIT Press.

Rosas, María (1997). Tepoztlán: Crónica de Desacatos y Resistencia. México, D. F., Ediciones ERA.

Rubin, Jeffrey (1997). Decentering the Regime: Ethnicity, Radicalism, and Democracy in Juchitán, Mexico. . Durham, Duke University Press.

Rupp, Leila and Verta Taylor (1987). Survival in the Doldrums: The American Women's Rights Movement, 1945 to the 1960s. New York, Oxford University Press.

Schelling, T. C (1978). Micromotives and Macrobehavior. New York, W. W. Norton.

Selverton-Scher, Melina (2001). Ethnopolitics in Ecuador : Indigenous Rights and the Strengthening of Democracy. Coral Gables, Fla, North-South Center Press at the University of Miami.

Snow, David A. and Dough McAdam (2000). Identity Work Processes in the Context of Social Movements: Clarifying the Identity/Movement Nexus. Self, Identity, and Social Movements. Stryker. Minneapolis, University of Minnesota Press.

Snow, David A. et al (1986). "Frame Allignment Processes, Micromobilization, and Movement Participation." American Sociological Review(51): 464-481.

Stets, Jan E. and Peter J. Burke (2000). "Identity Theory and Social Identity Theory." Social Psychology Quaterly **63**(3): 224-237.

Stokes, Susan (1995). Cultures in Conflict: Social Movements and the State in Peru. Berkeley, University of California Press.

Stryker, Sheldon (1980). Symbolic Interactionism: A Social Structural Version. Menlo Park, Benjamin-Cummings.

---, Ed. (2000a). Self, Identity, and Social Movements. Minneapolis, University of Minnesota Press.

Stryker, Sheldon and Peter J. Burke (2000b). "The Past, Present, and Future of Identity Theory." Social Psychology Quaterly **63**(4): 284-297.

Tarrow, Sidney (1998). Power in Movement: Social Movements and Contentious Politics. New York, Cambridge University Press.

Taylor, Verta (1989). "Social Movement Continuity: The Women's Movement in Abeyance." American Sociological Review(54): 761-775.

Taylor, Verta and Nancy Whittier (1995). Analytical Approaches to Social Movement Culture: The Culture of the Women's Movement. Social Movements and Culture Klandermans. Minneapolis, University of Minnesota.

Waldrop, M. Mitchell (1992). Complexity: The Emerging Science at the Edge of Order and Chaos. New York, Simon and Shuster.

Watts, Duncan (1999). Small Worlds: The Dynamics of Networks Between Order and Randomness. Princeton, Princeton University Press.

White, Robert W. and Michael R. Fraser (2000). Personal and Collective Identities and Long-Term Social Movement Activism: Republican Sinn Féin. Self, Identity, and Social Movements. Stryker. Minneapolis, University of Minnesota Press.

Wilensky, Uri (1999). Netlogo 3.1 Users Manual. Evanston, Center for Connected Learning and Computer-Based Modeling, Northwestern University.

Wilson, S. Brian. (1997). "The Slippery Slope: U.S. Military Moves into Mexico, Section III "Poverty and Misery-Aggravation by NAFTA."", from http://www.globalexchange.org/countries/americas/mexico/slope/section3.html.

Wolfram, Stephen (2002). A New Kind of Science: . Champaign, Wolfram Media, Inc.

Womack, John Jr. (1999). Rebellion in Chiapas: A Historical Reader. . New York, New Press.

Zald, Mayer N. (1992). "Looking Backward to Look Foward: Reflections on the Past and Future of the Resource Mobilization Research Program." Chapter 14. Frontiers in Social Movement Theory. Morris. New Haven, Yale University Press.

Zald, Mayer N. and John D. McCarthy, Ed. (1987). Social Movements in an Organizational Society. New Brunswick, Transaction Books.

Zinn, Maxine Baca and Bonnie Thornton Dill (1997). Theorizing Difference from Multiracial Feminism. **Through the Prism of Difference: A Sex and Gender Reader**. Zinn. Boston, Allyn and Bacon.