THE ROLE OF EDUCATIONAL EXPECTATIONS, FRIENDSHIP NETWORKS, AND MORAL CODES IN THE MENTAL HEALTH OF ADOLESCENTS

by

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(Under the Direction of Dawn T. Robinson)

ABSTRACT

This dissertation identifies structural properties at the individual, dyadic, and cultural level that generate health and social behavior disparities in the lives of adolescents and young adults. The three studies of this dissertation clarify causal mechanisms underlying sociological theories of structure and health by examining how perceptions of parental educational expectations, structural arrangements within friendship networks, and societal norms about moral codes impact individuals' health outcome. More specifically, these studies address three specific aims: (1) to explore the extent to which perceived malleability in parental educational expectations influence the long-term socio-emotional consequences of adolescents, (2) to track and model the coevolution of adolescents' friendship networks and their depression by studying depression homogeneity among boys and girls, and (3) to assess the role that culturally embedded moral principles play in shaping young adults' impressions and reactions to transgression.

This dissertation explores three markedly divergent conceptions of social structure: the psychological processes are principally concerned with the intrapersonal communication among

selves; the network perspectives give priority to interpersonal relationships among peers; and the cultural models highlights the normative beliefs that guide social actions. Yet these different approaches to the sociological study of structure and health are complementary rather than contradictory. By taking a pluralistic structural approach, this dissertation integrates seemingly disparate literature through the studies of adolescents' and young adults' social relations, be it at the individual, group, or societal level; by delving into the psychological, social, and cultural challenges in the lives of adolescents and young adults, this work gains thorough understandings of the multiple pathways through which health disparities are realized.

INDEX WORDS: Educational expectations, depression trajectory, transition to adulthood, gendered networks, depression contagion, affect control theory, morality

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DEDICATION

To my dad, mom, and my sister.

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CHAPTER 1

DISSERTATION INTRODUCTION

"Everything in social life can be viewed with a focus on social structure as well as from a socio-psychological perspective. ... The ultimate objective [of structural approach] is to advance by means of such sociological explanations our knowledge about society, how it changes, and how it can be changed."

—program statement of the 69th meetings of the American Sociological Association, Montreal 1974

Few words do sociologists use more often than "structure," especially in the phrase "social structure." It has been conceived as "one of the most important and most elusive terms in social science." (Sewell 1992:1) Social structure is powerful and pervasive in individuals' life that not only does it shape social actions, it also dominates and reproduces patterns of relations. Indeed, the term "structure" often implies empowerment in its nominative sense. Whatever aspect of social life we designate as structure it is posited as "structuring" some other aspects of social existence. For instance, considerable research demonstrates that class background shapes parents' educational expectations for their children (e.g., Sewell, Haller, and Portes 1969), gender system structures interactional styles (e.g., Ridgeway and Smith-Lovin 1999), and racial biases constrain employment opportunities for minorities (e.g., Pager, Western, and Bonikowski 2009).

Research on how individuals' social standings affect their life outcomes has explored a wide range of biographic consequences. Among all types of "life chances" (Weber 1968) affected by social structure, the most poignant may be the most literal: individual's health (Lutfey and Freese 2005). That is, how one's basic social conditions impact their chances for staying alive and healthy instead of dying. The concerns among sociologists about the link between structure and health are so fundamental that, for any sociological investigation focused on explaining health disparities, it is nearly impossible to ignore the social structures in which individuals embedded.

Despite the widely recognized importance of social structure, sociology is characterized not by a single comprehensive theory of social structure but by a diverse conceptual schemes and theoretical viewpoints. Broadly speaking, scholarship has conceptualized social structures as cultural schemas (Sewell 1992), patterns of interaction (Homans 1950), forms of association (Simmel 1950), rules and resources (Giddens 1984), functional interdependence (Parsons 1951), or combinations of these and other factors. As general as these theoretical paradigms tend to be, they represent different perspectives on how scholars discern the pattern, observe the regularities, and detect the configurations of social structure.

Hence, there is a need to distinguish the characters and dynamics of different sorts of social structures, in order to articulate mechanisms operating at different levels. The goal of such distinctions, however, is neither to choose a perspective with the most utility, nor construct a single comprehensive theory of social structure. On the contrary, sociologists need to, as Merton (1968) proposed, analyze social structure in a pluralistic way, in order to satisfactorily deal with diverse problems at different analytic levels and the connections between them. According to Merton, different conceptualizations of social structure may be opposed to one another, but their

oppositions are "in about the same sense as ham is opposed to eggs: they are perceptibly different but mutually enriching." (Merton 1975:39)

Following Merton's call for a holistic examination of social structure, this dissertation identifies structural properties at three—the individual, dyadic, and cultural— levels that generate health and social behavior disparities in the lives of adolescents and young adults. The three studies of this dissertation clarify causal mechanisms underlying sociological theories of structure and health by examining how psychological processes of forming expectations, structural arrangements within friendship networks, and cultural norms about moral principles impact adolescents' and young adults' health outcomes. In studying individuals' developmental trajectories of depressive symptoms, depression homogeneity, and responses to transgression, I rely on three conceptualizations of social structure to provide this dissertation with a suitable theoretic framework.

The first social structure examined in this dissertation refers to the psychological processes of individuals' behaviors. From Homans's (1950) and Coleman's (1998) perspectives, social structures are rooted in the psychological make-up of the individuals whose social behaviors and relations compose the structure. Because explanations of social structure must start with psychological explanations of individuals' behaviors, I begin my dissertation by analyzing the psychological consequences of perceiving different types of educational expectations, a critical aspect that has not been investigated by health researchers. However, instead of focusing on the rational choices individuals made in seeking to maximize expected rewards or utilities, I am primarily concerned with the *intrapersonal* communication among selves, as I investigate the evolving relationships between adolescents' actual selves and their perceived *ought* selves from parents with regard to academic achievement.

The second configuration of social structure prioritizes social processes that shape *interpersonal* relations and give rise to relational networks in groups. The idea of viewing social structure as a set of relationship arrangements owns its intellectual insights to Georg Simmel (Farganis 1993). Setting apart from the classical sociologists such as Marx and Durkheim, Simmel (1903) maintains that it is ultimately the patterns and forms of association at the individual and small group level that make up society. Given that the simplest structure of any groups is achieved when individuals move from dyad to triad, study 2 in this dissertation focuses on adolescents' friendship networks to assess the impact of gendered social structure on individuals' health and well-being.

The last conceptualization of social structure highlights the normative beliefs guiding social actions. The cultural explanations of social structure can be traced back to Parson's viewpoints on cultural systems (Parson 1951). According to Parson, abstract system of meanings and beliefs comprises the culture, and characteristics of the culture determine the characteristics of the social structure. As an exogenous determinants of the social structure, culture controls the social systems and individuals' behaviors by attaching meanings to values and norms. The last study in this dissertation will adopt this framework by investigating how affective meanings young adults attached to roles, identities, and behaviors influence their perceptions of and responses to social transgression, and by examining if differences in moral orientation are systematic at the cultural level.

While it may be up for a debate about whether to refer the first conceptualization as micro-, the second as meso-, and the last as macro- sociological perspective on social structure, as Blau (1977) would insist based on his mapping of structural orientations, it is clear that these three views of social structure are complementary rather than contradictory. They do diverge in

substantive focus, as the psychological processes are principally concerned with the intrapersonal communication among selves, the network perspectives give priority to interpersonal relationships among peers, and the cultural models highlights the normative beliefs and meanings. But they are also indispensable to our understandings of social structure in that only through the studies of social relations, be it at the individual, dyadic, or societal level, do researchers find expression in individuals' behaviors at multiple levels of analysis.

Practically, conceptualizing social structure as a three-level configuration is useful for this dissertation as it provides a general framework to organize the three studies: all of them explore mechanisms that generate and preserve associations between one's social standings and health and behavior differentials. By delving into the psychological, social, and cultural challenges in the lives of adolescents and young adults, this dissertation gains a thorough understanding of the multiple pathways through which health disparities are realized. Theoretically, viewing social structure as culturally persistent but locally evolving ensures that we can study accumulative impact of social structures on individual's health outcome without losing human agency and the possible changes of society. Although the enduring (i.e., cumulative) (Adkins, Wang, and Elder 2009) and dual (i.e. dynamic) nature (Giddens 1984; Sewell 1992) of social structure has long been discussed in sociological literature, such premises have not been fully emphasized in empirical studies. This dissertation hence imbeds its claims in the life course framework and explores the development and the diffusion of depressive symptoms. Applying structural approach, the three studies in this dissertation examines the long-term impact of conflicted selves on depression trajectories, the importance of network configuration in spreading depression, and the affective meanings of morality and justice in the lives of adolescents and young adults.

In the following section, I will provide a brief overview of the three studies constituting this dissertation. Because each study has its own literature review with seemly disparate scholarship, I opt to review theories and perspectives related to each study in their respective chapter. I conclude the introduction chapter by offering an overview of three data sources from which data for the empirical studies were drawn, to prepare the reader for the chapters to come.

OVERVIEW OF THE THREE STUDIES

The first study in this dissertation investigates perceived expectation malleability and their impact on adolescents' psychological well-being. Although advances have been made in elucidating the course and causes of depressive symptoms across adolescence, little is known, however, about the influence of perceived parents' educational expectations on adolescents' development of depressive symptoms. In this article, I conceptualize the formation of educational expectations as a decision-making process whereby *changes* in parents' college expectations for their child may or may not correspond to co-occurring *changes* in adolescents' school performance.

Drawing insights from status attainment theory and Bayesian learning theory, I present two models of educational expectations with various degree of expectation malleability (Andrew and Hauser 2011; Bozick et al. 2010; Haller 1982; Morgan 2005; Sewell et al. 1969). By evaluating expectations dynamically as opposed to statically, I explore the extent to which adolescents perceive parents recalibrating their expectations. Furthermore, I assess whether perceived adaptive expectations, or lack thereof, are associated with normative trajectories of depressive symptoms. The literature to date provides little empirical evidence as to the socio-emotional consequences of responsive, adaptive expectations versus non-responsive, rigid expectations. Hence, this study adds to the literature by explicating mechanisms through which

perceived expectations benefit or compromise adolescent's long-term health and well-being from a social psychological and life course perspective.

The second study in this dissertation shifts its focus from micro-level psychological processes to network configuration. Drawing upon literature on emotion contagion and gendered network dynamics, study 2 investigates gendered pathways to depression homophily. Given that depression is the barriers to social integration (Schaefer, Kornienko, and Fox 2011) and the subject to social contagion (Rosenquist et al. 2011), I investigate the extent to which the processes of depression contagion, selection, and isolation are gendered. The second study takes a contextualized view by examining the interactional processes that give rise to network depression homophily for boys and girls. Based on prior research suggesting girls' high levels of social exclusion, I expect depressed girls to withdraw from their friendship networks more readily than non-depressed girls. Yet, depressed girls' tendencies to withdraw also result in compartmentalized networks that effectively insulate the rest of the network from depression contagion. In contrast, boys' friendship networks are characterized by their larger peer size and higher tolerance to network intransitivity. These features, while offering boys more opportunities to stay in the groups, also expose them to depressed others. To the extent that boys' friendship networks are more structured and loosely connected, I hypothesize that depression contagion will be more likely to occur among boys' friendship networks.

The third study builds on research on how affective sentiments organize social life through social interaction. Following a growing scholarly interests on the relationship between culture and action (Miles 2015; Vaisey 2009; Vaisey and Lizardo 2010), this study examines how cultural beliefs, perceptual schemas, and predispositions influence individuals' social behaviors. In particular, I examine a core component of a classic social psychological theory—

affect control theory (Heise 1979, 2010)—by modeling the cognitive process of impression formation. Prior work elucidating these processes has focused almost exclusively on western cultures such as the United States, Canada, and Germany (Britt and Heise 1992; MacKinnon 1985/1988/1998; Schröder 2010; Smith-Lovin and Heise 1988; for exceptions, see Smith, Matsuno, and Umino 1994; and Smith, Matsuno, and Ike 2001). I argue that affect control theory's propositions about the cognitive processes and the control principles need to be tested in a broader context where various social and psychological processes in interpreting events may be influenced by a given culture. In this paper, I ask the critical question about how social events systematically shift around normative sentiments about cultural concepts among Chinese, and to what extent these cognitive processes of Chinese are similar to or different from those of Americans.

OVERVIEW OF THE DATA SOURCE

Study 1 Data: National Longitudinal Study of Adolescent Health

The first data in this dissertation comes from the National Longitudinal Study of Adolescent Health (Add Health), a school-based survey of health and health-related behaviors of adolescents in Grades 7 through 12 (Udry 2003). The sampling frame included all high schools in the United States. A stratified, random sample from 80 clusters of schools was selected from this group. Over 90,000 students completed the in-school survey during 1994-95 school year. Of those, a baseline sample of 20,745 adolescents (age: 12-19 years) was first interviewed at home between April and December 1995 (Wave 1, N = 20,745) and then re-interviewed in 1995-1996 (Wave 2, N = 14,738, only grades 7-11 were re-interviewed; age: 12-21 years), in 2001-2002 (Wave 3, N = 15,197; age: 18-27 years), and with most recent data collection in 2008 (Wave 4, N = 15,701; age: 24-33 years).

The overall sample was representative of United States school with respect to region of the country, urbanity, school type (e.g., public, parochial, private nonreligious, military), ethnicity, and school size. Non-response analysis indicates no significant bias to Add Health estimates from attrition across waves (Brownstein et al. 2014). Details regard the survey design and sampling frame can be found on Add Health website (http://www.cpc.unc.edu/addhealth).

The final analytic sample in the current study consists of 7,253 Whites, 2,939 Blacks, and 894 Asians who contributed at least one time for longitudinal analyses (N = 11,086). Native American, Hispanic, and multiracial youth were excluded from analyses owing to their smaller sample size, heterogeneous ethnic composition, and ambiguous race-ethnic classification, respectively.

Study 2 Data: Friendship Network Data

The second dataset comes from "The Impacts of School Contexts and Friendship Network upon High School Students' Physical and Psychological Development and Learning Achievement" project (therefore refer to "Friendship Network Data"). The Friendship Network Data is a multi-site, longitudinal study conducted by Academia Sinica, Taiwan, from fall 2006 to spring 2009. Respondents were selected from 11th grade students who, in August 2006, were enrolled in public high schools in Taipei, Taiwan.

A central goal of the Friendship Network project was to capture the impact of classroom context within which adolescents form their friendships. Hence, a multistage sampling method was used to randomly select six high schools and then 14 classes within these six schools. Among the six high schools sampled, four are coed schools including both mixed-gender and unisex classrooms. The other two schools are single sex high schools—one is all-girl and the other is all-boy high school; Among the 14 classes selected from the six schools, there were four

all-boy classes and four all-girl classes each and the remaining six classes were mixed-gender.

Upon recruitment, the first wave of data collection began in the fall of 2006 (N = 470). Follow-up surveys were conducted about every six months thereafter, with the last wave of data being collected in spring 2009 (Wave 5, N = 232). There were two types of questionnaires, measuring friendship nominations and demographic information respectively. The long versions of the survey collected adolescents' demographic information, adjustment to school life, perception of school performance, stressful life events, and most importantly, depressive symptoms. At each assessment, students, their caregivers (father and mother), and the school teachers were asked to complete questionnaires.[1] Student questionnaires were administrated by researchers and teachers in classes whereas parents questionnaires were filled out by caregivers at home without the presence of researchers and were returned by their children to school teachers.

Students also completed network surveys by checking off names of their best friend from class rosters. To measure friendship compositions at various stages (e.g., initiation, stabilize, change, etc.), respondents were asked to nominate their friends multiple times within each wave, especially at earlier stage of the study (Wave 1: 4-7 times; Wave 2: 3 times; Wave 3: 1-2 times; Wave 4: twice; and Wave 5: once). There was no limitation on how many friends students can nominate. In total, there were 10-15 friendship networks per respondent and each network represents a full social network of the class.

Students join and leave the study at different time points during data collection. To account for that, missing values due to structural reasons (both behavioral and network) are specified in the data and are taken into account in all models. In total, there were 592 adolescents who have participated at least one wave of the study.

Study 3 Data: Archived Affect Control Theory Data

Study 3 uses archived affect control data from China and the United States. The Chinese data was collected by researchers from University of Wisconsin-Milwaukee and participants were all undergraduate students at Fudan University, Shanghai, China in 1999.

There were two steps involved in the data collection process. Initially, researchers translated 467 Identities, 350 Behaviors, 99 Emotions, 199 Traits, and 179 Settings for 1294 common words in the American versions of affect control theory semantic lexicons. These common words are representative of cultural concepts. Next, to insure use of words that are reasonably equivalent in denotative meanings to the American semantic dictionaries, items that are likely to evoke ambiguous meanings or several meanings (e.g., stimuli with single or clear denotative translations in English may have multiple denotative meanings in Chinese) were taken out.

To estimate impression equations, both individual stimuli (words) and phrases (events) are included in data collection. Because Chinese follows the English language case-grammar in "actor-behave-object (ABO)" fashion, of which affect control theory operationalizes its definitions of situations, all events were constructed in such way (e.g., "salesman serves schoolgirl"). The final list of stimuli includes 450 Identities, 300 Behaviors, 99 Emotions, 150 Traits, 150 Settings, and 258 Events for the most common words or phrases. They come from the American stimuli, but are not a word for word translation of the American semantic dictionaries. Ratings for individual stimuli of words are designated as "fundamental sentiments", whereas EPA ratings for identities and behaviors consisting of events are deemed as "transient sentiments" or impressions. EPA ratings on both in-context and out-of-context stimuli were aggregated from individual level data.

It is worth noting that the 258 events that I used for impression formation estimation are not full factorial events design (see below for details). However, most impression-formation studies limit their events between the numbers of 100 to 214 to economize data collection. Empirical results from a smaller sample of event sentences have shown good external validity in terms of representing normative views of a given culture (MacKinnon 1985/1988/1998; Schröder 2011; Smith et al. 1994). In addition, for specifications that appear in both equations estimated from large and small sample, coefficients are reasonably close (Heise 2012).

Data were collected using applied techniques and instructions from prior studies to ensure standardized procedure. A Chinese version of standard data collection program ATTITUDE (Heise and Lewis 1988) was employed, resulting 1150 lexicon entry produced from 380 undergraduate respondents at Fudan University. The program presented stimuli randomly to participants and asked them to make ratings on three semantic differential scales (*Evaluation*: good vs. bad; *Potency*: powerful vs. powerless; *Activity*: lively, young, noise vs. slow, old, quite). Scores were assigned to scales that are anchored with the following adverbs: slightly =1 or –1; quiet = 2 or –2; extremely = 3 or –3; infinitely = 4 or –4; and neural = 0, right in the middle.

To ameliorate fatigue and other instrumentation biases, the study protocol restricts participants to rate an upper limit of 150 stimuli. For participants rating more than one dataset, a 15 minutes rest was required before participants proceed to the next scaling task. Compared to traditional paper-and-pencil questionnaire, studies show that this survey method leads to fewer errors (Heise 1997).

For the U.S. culture, I draw data from the North Carolina 1978 dataset. EPA ratings of 721 Identities, 600 Behaviors, 440 Modifiers, and 345 Settings were obtained from 1,225 North Carolina undergraduates (Smith-Lovin and Heise 1988). In addition, it includes a total of 515

event sentences that were composed to reflect a full factorial design. The 512 events were included to exhaust all possible ± EPA profiles of actors, behaviors, and objects with each other (2^3 x 2^3 x 2^3) along with three additional events representing all-neutral sentences for administration purpose.

SUMMARY

Taken together, the three studies of this dissertation suggest that adopting a pluralistic structural approach to examine health and social behavior inequalities opens up new and exciting avenues of inquiry. Study 1 points to the psychological nuances in perceiving educational expectations that might help to explain variations in educational expectation benefits. It also addresses the limitations of existing research in understanding long-term socio-emotional consequences related to expectations. Study 2 identifies the precise structure and contents of social networks that either inhibit or assist depression contagion among adolescent boys and girls. In doing so, it provides a rigid test of the multiple, and largely gendered, pathways to depression homophily. Study 3 questions affect control theorists' earlier assumption of the universal impression formation processes by examining how cultural beliefs and schemas influence young adults' responses in moral situations. The next three chapters of this dissertation report original empirical research that illustrate the three structural approaches to the study of health and social behavior inequalities. The lines of inquiry pursued in these studies not only offer a fuller evaluation of the relationship between structure and health in the context of adolescents and young adults but also provide insight into the classic sociological debate on the link between structure and agency.

NOTES:

1. One class dropped out the study after the first wave of data collection, so the total number of classes dropped to thirteen after Wave 1. At Wave 1, respondents were 11th grade. By the time of our last survey (Wave 5), they were college freshman in their first semester.

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CHAPTER 2

STUDY 1: TOUGH LOVE? EDUCATIONAL EXPECTATION RECALIBRATION AND TRAJECTORIES OF DEPRESSIVE SYMPTOMS[1]

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ABSTRACT

Despite the well-documented effects of educational expectations on attainment, researchers debate how individuals form expectations about their future. Scholars disagree on the extent to which people recalibrate their expectations in light of adolescents' academic performance. Questions also remain concerning the long-term mental health consequences for adolescents who perceive responsive, adaptive expectations from their parents, compared to those who perceive nonresponsive, rigid parental expectations. Using national longitudinal data from the National Longitudinal Study of Adolescent Health (Wave I-IV: 1994-2009), this paper examines (1) the interplay between perceived educational expectations from parents and adolescents' academic performance, and (2) the impact of different configurations of educational expectation on adolescents' development of depressive symptoms. Latent class growth analyses and multinomial logistic regression analyses provide support for the theoretical prediction that perceived rigid expectations are associated with experiences of non-normative trajectories of depressive symptoms during adolescents' transition to adulthood. However, results also reveal that adolescents who perceived their parents being flexible in their expectations are no better off than those adolescents who reported perceptions of rigid expectations. Both groups are associated with heightened risks of experiencing disruptive pathways of depression trajectories. To account for these findings, I discuss perceived rigid and adaptive expectations related to parenting styles where authoritarian and permissive parenting are posited to be detrimental for adolescents. This paper contributes to the literature by moving beyond the traditional approach of examining static expectations and by linking long-term mental health consequences to perceived expectation malleability.

INTRODUCTION

Adolescence marks a critical period in studying individual's social, physical, and psychological developments over the life course. A substantial body of research suggests that depressive symptoms rise through early and middle adolescence, peak in late adolescence, and decline in early adulthood (Clarke and Wheaton 2005; Ge, Natsuaki, and Conger. 2006; Hankin et al. 1998; Mirowsky and Ross 1992). Past research also identifies socioeconomic status (SES), gender, and race/ethnicity as the primary risk factors of depressive symptoms, emphasizing the importance of the structural underpinnings of individual's mental health and well-being (Adkins, Wang, and Elder 2010; Gore and Aseltine 2003; Hankin et al. 1998; Miech and Shanahan 2000). While advances have been made in elucidating the course and causes of depressive symptoms across adolescence, little is known, however, about the influence of parents' educational expectations on adolescents' development of depressive symptoms. This is rather unfortunate because school-related stressor are some of the most frequent stressors adolescents report (de Anda et al. 2000), and they can take emotional tolls on young people (Carter et al. 2006).

Parents' educational expectations matter. It is well established in the literature that parental beliefs about the educational future of their children significantly boost students' academic achievement (for a review, see Yamamoto and Holloway 2010). Considerable research also demonstrates that young people's educational attainment helps them to obtain higher socioeconomic status (SES) which, in turn, is predictive of better health later in life (Goldman and Smith 2011; Goyette and Xie 1999; Yamamoto and Holloway 2010).

Expectations can also be a source of social stress. In fact, investigations on the mental health outcomes of both minorities (Adkin et al. 2009; Hsina and Xie 2014; Mickelson 1990) and non-minority youth (Agliata and Renk 2009; Luthar and Becker 2002) have found a negative

association between high expectations and psychological well-being, suggesting the potential downsides to shooting for the stars.

In this paper, I take a dynamic approach to examine parents' educational expectation malleability and to investigate the impact of adolescents' perceptions of such malleability on their psychological well-being. Rarely do researchers evaluate the dynamics of educational expectations. That is, when we think of expectation formation related to education as a decision making process, do parents recalibrate their educational expectations in response to changes in their children's academic performances? Or do they fix their expectations at levels that are comparable to their social background?

While research on status attainment and Bayesian learning has presented models of educational expectations with various degree of expectation adaptability (Andrew and Hauser 2011; Bozick et al. 2010; Haller 1982; Morgan 2005; Sewell, Haller, and Portes 1969), the literature to date provides little empirical evidence as to the socio-emotional consequences of responsive, adaptive expectations versus non-responsive, rigid expectations. From a social psychological perspective, the focus on "static," "self-reported" educational expectations from parents does not answer the question of whether adolescents' perception of rigid expectations have negative psychological effects, such as depression. Although suspected by past research that "tiger mom parenting" (Chua 2011), while providing strength and motivations to Asian American children, also takes psychological costs (Hsina and Xie 2014), research has not yet linked the rigidity of parental expectations to adolescents' long-term health and well-beings.

To address questions raised above, this study is designed to capture the development of educational expectations by focusing specifically on the evolving relationships between educational expectations from parents and adolescents' actual academic performance. In

particular, I examine whether parents are perceived to adapt their educational expectations over time based on new information about their child's potential educational success. Adaption occurs when parents recalibrate their expectations downwardly or upwardly in response to changes in adolescents' academic performance. Alternatively, parents may hold their expectations constant in spite of ups and downs in child's school performance. I refer to the first configuration as responsive, adaptive expectations and the second one as non-responsive, rigid expectations.

In this paper I ask whether perceived *changes* in parents' college expectations for their child respond to co-occurring *changes* in adolescents' school performance. To answer this, I evaluate parents' educational expectations from adolescents' point of view and measure these perceptions in multiple assessments. In addition, I ask whether perceived adaptive expectations, or lack thereof, are associated with normative as opposed to disruptive depressive symptoms trajectories. To date, no nationally representative study has examined the mental health consequences of varying expectations. This study thus adds to the literature by specifying conditions under which expectations benefit or compromise adolescent's long-term health and well-being. My statistical analysis draws from the National Longitudinal Study of Adolescent Health (Add Health). To preview my findings, results indicate that adolescents' perceptions of non-responsive, rigid expectations are associated with higher risks of experiencing non-normative trajectories of depressive symptoms, as self-discrepancy theory (Higgs 1987) and social stress theory predicted. Yet, results also reveal that adolescents who believed their parents to readily adjust their expectations are no better off than those adolescents who perceived rigid and unbending parental expectations. In both cases, adolescents are more likely to experience trajectories of depressive symptoms that lead to poorer health outcomes in the long run.

LITERATURE REVIEW

The Malleability of Educational Expectation: The Processes of Adaptability?

Parents' educational expectations refer to realistic predictions that parents have regarding youth's future academic outcomes, such as their highest levels of educational attainment (Yamamoto and Holloway 2010). A large body of research documents the importance of parental expectations on adolescents' academic achievement (Zhang et al. 2011; Bates and Anderson 2014). Students with high parental expectations tend to be more motivated and engaged at school, earn higher grades, and attain more education than their counterparts with low parental expectations (Benner and Mistry 2007; Yamamoto and Holloway 2010; Zhang et al. 2011). Although scholars usually agree upon the primary determinants of educational expectations (e.g., family socioeconomic status (SES), academic performance, etc.), researchers disagree on the malleability of educational expectations. That is, when think of educational expectation formation as a decision making process, extant theoretical perspectives diverge on the extent to which individuals modify their educational expectations in the face of new information about adolescents' academic abilities (Andrew and Hauser 2011; Bozick et al. 2010; Morgan 2005).

On the one hand, the Wisconsin status attainment model, a classic model studying individual's social mobility and its economic, social, and psychological determinants (Haller 1982; Sewell et al. 1969), have long demonstrated that parents' educational expectations are determined by social origins with status destinations. Decades of empirical research have shown that expectations are higher in high socioeconomic strata than in low socioeconomic strata (Davis-Kean 2005; Lippman et al. 2008), and expectations among parents of racial minorities are higher than those among parents of Whites (Dandy and Nettelbeck 2002; Hao and Bonstead-Bruns 1998; Goyette and Xie 1999; Strand 2011).

With regard to expectation malleability, researchers working under this tradition tend to view expectations as a stable mental state that ossifies in adolescence (Haller 1982). Although the model includes adolescent' academic performance as a determinant of parents' expectations, empirical investigation on the changes of educational expectations over time provides strong evidence to the stability assumption. For example, research finds that during grade school, a year of expected education in the prior period is equivalent to .90 to .97 years of expected education in the following period (Andrew and Hauser 2011), and the expectations adolescents held in high school mostly persist long after youths move beyond high school (Alexander, Bozick, and Entwisle 2008). More importantly, the higher the family SES, the more stable the aspirations or expectations (Bozick et al. 2010; Kao and Tienda 1994). Thus, high SES family hold firmer to their intentions over the years regarding educational expectations. For those with initially high expectations, that means greater stability.

The view that educational expectations are a static mental state is in stark contrast to the arguments based on Bayesian learning theory (Morgan 2005). Framed as an alternative and complimentary approach to the status attainment model, the Bayesian learning perspective highlights the evolving relationship between expectations and academic performance. In particular, the theory emphasizes individuals' agency in adapting expectations on the basis of new and pertinent information (e.g., test scores, grade point average (GPA), etc.), and argues that adaption "is the primary controlling guide for forward-looking behavior…" (Morgan 2005:176). According to this perspective, parents' and adolescents' educational plan about future are malleable and responsive to changes in academic feedback.

While theoretically plausible, findings on adaptive expectations are somewhat inconsistent. Parents' expectations do fluctuate based on child's school performance

(Goldenberg et al. 2001), suggesting that parents take actual performance indicators from their children into account when forming expectations (Alexander, Entwisle, and Bedinger 1994). Yet, individuals only adjust their educational expectations modestly and in response to very large changes in school performance (Andrew and Hauser 2011). Moreover, the strength of the causal relationship between performance and expectations varies by subgroups. For instance, the expectations of middle- and low-SES youth are more volatile than that of high-SES adolescents (Bozick et al. 2010). Parents of European Americans appeared to be more willing to adjust their expectations to their child's (lower) actual achievement than were ethnic minority parents (Zhang et al. 2011). In particular, Asian American parents believe school performance is a function of hard work and motivation (Okagaki and Frensch 1998; Yamamot and Holloway 2010). Because Asian parents attribute future attainment primarily to students' effort rather than their academic ability or intelligence, research has found a weak relationship between past performance and parental expectations among minority groups and high-SES families, indicating a diluted power of performance in steering parents' expectations (Yamamot and Holloway 2010).

Taken together, prior research on educational expectations holds different views on how malleable expectations are. While status attainment tradition advocates stable (and often high) expectations (Andrew and Hauser 2011; Haller 1982), the Bayesian learning theory highlights the malleability of expectation formation (Morgan 2005). The issue of expectations malleability also raises interesting questions over mental health consequences of the (de)coupling relationship between performance and expectations. If parents are not attentive to the feedback from school in constructing their expectations, what do their educational expectations portend for adolescents?

Theories Predicting that Perceived Rigid Expectations will Increase Depressive Symptoms

From social psychological perspectives, the most common prognosis of confronting discordance between expectations and performance, or a fallout in fulfilling parents' expectations, is the experience of stress, anxiety, self-doubt, and depression. In fact, research discovers that despite Black and Asian American adolescents' high educational aspiration and expectations, both groups are less psychologically well-adjusted and socially engaged in school than their white peers (Ge et al. 2006; Lee and Zhou 2015; Qin, Way, and Mukherjee 2008). Asian American adolescents, in particular, are suspected to expose strict expectations that may have boosted their academic achievement at the cost of psychological well-being (Hsin and Xie 2014).

There are theoretical reasons for predicting the detrimental effect of non-responsive expectations on depressive symptoms. Sociologists and social psychologists have long been concerned with the potential downsides of psychological dissonance. Two theoretical perspectives, in particular, predict that perceiving non-responsive expectations from parents will adversely affect adolescents' mental health. The decoupling relationship between parents' expectations and students' achievement is conceptualized as (1) a discrepancy between *ought* selves perceived from parents and *actual* selves, and (2) a non-event stressor. Although these perspectives originate in different academic disciplines, they share the premise that perceptions of non-responsive expectations lead to psychological distress.

Self-discrepancy theory, developed by Higgins (1987, 1989), explains the complex mental health consequences that results from the dissonance individuals experience between a variety of aspects of the self (i.e., ideal selves, ought selves, and actual selves). Closely related to

the current study are the concept of ought selves and actual selves, whereby the former refers to what others (often significant others such as parents and spouse) believe a person should or ought to be and the latter refers to the kind of person an individual believes he or she actually is. The theory predicts that individuals experience a set of negative emotions, such as sadness, dissatisfaction, and depression, when they hold conflicting or incompatible beliefs. Empirical evidence have been found in the social psychology literature to support the claims that tensions between one's actual self-concept and one's ought self-guide induce higher levels of negative emotions (Higgins et al. 1986; Higgins, Klein, and Strauman 1985; Scott and O'Hara 1993; Strauman 1988).

Applied to the present study, perceived expectations from parents represents the *ought* selves whereas students' school performance reflects adolescents' *actual* selves. Based on Higgins's theory (1987, 1989), it is posited that a *concordance* between perceived changes in parents' expectations and changes in adolescents' school performance will lead to better psychological well-being whereas *discordance* contributes to stress. If parents who were optimistic about their children's academic prospect become less so in light of mounting academic difficulties, it indicates that parents are responsive and efforts are made to minimize discrepancy. In contrast, discordance between changes in parents' educational expectations and changes in adolescent's own academic performance suggests parents' disregard to relevant information. It is predicted that perceived unwillingness from parents to adjust their expectations will increase depressive symptoms of adolescents. While previous research finds that students' academic performance declined when perceived parents' expectations exceeded students' own expectations (Wang and Benner 2014), this study focuses on the impact of misaligned changes

between expectation perception and adolescents' performance on youth's psychological well-being.

The second social psychological theory, social stress theory, also presumes that failing to achieve an expected status is a source of distress. According to this perspective, tensions between perceived expectations and misaligned performance may ignite intense feelings among adolescents who wish to reconcile the discordance. To the extent that adolescents believe that their parents are obdurate in expectations, they are likely to experience a non-event stressor that provokes psychological distress. Studies show that students perceiving themselves as falling short on their parents' expectations reported higher levels of negative emotions and worse school performance (Agliata and Renk 2008; Wang and Benner 2014). Thus expectations may negatively influence youths if expectations are unrealized and thus constantly serve as a social stressor (Hanson 1994).

In short, social psychological perspectives on self-discrepancy and non-event stressors predict that adolescents who perceive a lack of adjustment in parents' educational expectations (e.g., non-responsive, rigid expectations) will report higher levels of psychological distress than will individuals who experience responsive, adaptive expectations from their parents.

Reasons to Predict No Consequences: Alternative Interpretations of Perceived Rigid Expectations

Although the psychological hazards associated with perceptions of non-responsive expectations are theoretically plausible and supported by many empirical analyses, there is also considerable body of research contradicting this proposition. In the era of "college for all" (Goyette 2008), students from different racial/ethnic and socio-economic backgrounds are likely

to develop high educational expectations that are unrelated to their present performance (Mickelson 1990; Hanson 1994; Kao and Tienda 1994). Consequently, misalliance between expectations and achievement may be more common than we think. It is thus possible that rigid expectations will *not* undermine long term psychological well-being among youths.

Several studies provide evidence to support the alternative prediction. Bozick and colleagues (2010), for example, have shown that retaining consistent expectations, alongside adolescents' overall declines in Grade Point Average (GPA), has an overall positive impact on students' school achievement. In a similar vein, Bastes and Anderson (2014) have argued that a more optimistic, rather than realistic, view of the parents about their students' capacities helps propel the underachievers into long-term academic success. With regard to psychological well-being, results from Reynolds and Baird (2010) fail to link unrealized educational expectations to long-term psychological cost (i.e., depression). To account for their findings, the authors in that study maintain that students are adaptively resilient in dealing with educational expectation failures, therefore society should not dissuade unpromising students from dreams of college. It is worth noting that in all the above studies, educational expectations were measured by self-report from parents. It thus leaves the question regarding how perceived malleability of expectations influences long-term mental health of adolescents unanswered.

THE CURRENT STUDY

The foregoing discussion provides competing positions in terms of expectation malleability. While status attainment model emphasizes educational expectations as a static mental construct, Bayesian learning theory highlights the adaptation process of expectation formation. Hence, I start this paper by investigating whether parents are perceived to recalibrate

their educational expectations in the face of their child's school performance. In examining the interplay between parents' educational expectations and adolescents' academic performance, I construct a typology of educational expectation based on expectation malleability and performance consistency. Parents can vary on the rigidity of their expectations. They can be either stable or malleable over time. Students could also have a consistent or volatile school performance. Figure 2.1 shows the conceptual typology based on these two dimensions. In total, I distinguish four types of educational expectations: (1) a *non-responsive, rigid* expectation (i.e., this is when parents hold their expectations consistent even as adolescents experience ups and downs in their school performance); (2) a *responsive, adaptive* expectations (i.e., parents adjust their expectations upwardly or downwardly to be consistent with changes in adolescents' school performance); (3) a *responsive, maladaptive* expectations (i.e., parents modify their expectations but they are inconsistent with changes in students' school performance); and (4) *sustained expectations* (i.e., parents' expectations are steady and students' school performance stay consistent across time).

Although literature reviewed above addresses potential mental health risks related to the first and the second type of expectations (i.e., perceptions of rigid and adaptive expectations), parents' expectations could be malleable in a way that do not accurately reflect changes in students' academic performance. I refer this group as having maladaptive expectations.[1] I expect the sustained group will experience the best psychological well-being given their stable expectations and consistent academic performance whereas the maladapted group will have the worst outcome given their disadvantages on both dimensions. For the other two groups, while the education literature originated in status attainment tradition predicts educational and

psychological benefits associated with rigid, yet stable, expectations, social psychological perspectives claim health and well-being hazards under perceptions of parents' non-responsive, rigid expectations.

Upon establishing these configurations of expectations, I proceed to investigate mental health consequences associated with perceived expectation adjustment, or lack thereof. That is, to what extent do parents' rigid versus responsive expectations contribute to group disparities in depressive symptoms? I focus on adolescents' developmental pathway of depressive symptoms as my outcome variable of interest. From the life course perspective (Elder 1998), a trajectory model helps scholars to delineate the pathways of depressive symptoms in both its initial levels and subsequent rates of change. Trajectories revealed in the data allow scholars to discover long-term consequences by identifying psychological problems faced by adolescents at early stage (Ge, Conger, and Elder 2001). Using longitudinal data, prior studies have discovered four major classes of pathway of depressive symptoms experienced by children and adolescents: chronic high, high-to-decreasing, moderate-to-decreasing, and stably low (Hao and Woo 2012; Stoolmiller, Kim, and Capaldi 2003). I thus expect to identify similar numbers of classes, as well similar trajectories of depressive symptoms, in my data.

METHOD

Data

Data for this paper come from the National Longitudinal Study of Adolescent Health (Add Health), a school-based survey of health and health-related behaviors of adolescents in Grades 7 through 12 (Udry 2003).[2] The sampling frame included all high schools in the United States. A stratified, random sample from 80 clusters of schools was selected from this group.

Over 90,000 students completed the in-school survey in 1994. Of those, a baseline sample of 20,745 adolescents (age: 12-19 years) was first interviewed at home between April and December 1995 (Wave 1, N = 20,745), and then re-interviewed in 1995-1996 (Wave 2, N = 14,738, only grades 7-11 were re-interviewed; age: 12-21 years), in 2001-2002 (Wave 3, N = 15,197; age: 18-27 years), and with most recent data collection in 2008 (Wave 4, N = 15,701; age: 24-33 years). The overall sample was representative of United States schools with respect to region of the country, urbanity, school type (e.g., public, parochial, private nonreligious, military), ethnicity, and school size. Non-response analysis indicates no significant bias to Add Health estimates from attrition across waves (Brownstein et al. 2014). Details regard the survey design and sampling frame can be found on Add Health website (http://www.cpc.unc.edu/addhealth).

The final analytic sample in the current study consists of 7,253 Whites, 2,939 Blacks, and 894 Asians who contributed at least one time for longitudinal analyses (N = 11,086). Native American, Hispanic, and multiracial youth were excluded from analyses owing to their smaller sample size, heterogeneous ethnic composition, and ambiguous race-ethnic classification, respectively.

Information from all respondents in the final sample were used to identify trajectories of depressive symptoms in latent class growth analysis (LCGA) (Bollen and Curran 2006). Individuals who had missing values for academic achievement, parental educational expectations, gender, or racial/ethnic group were excluded, resulting in a final sample of 8,243 in my multinomial logistic regression model.

Measures

Depressive symptoms were measured using a variation of the Center for Epidemiological Studies Depression Scale. The original CES-D instrument contains 20 questions on a number of physical and psychological symptoms of depression. They cluster into four factors: Somatic-Retarded Activity, Depressed Affect, Positive Affect, and Interpersonal Relations (Ensel 1996; Radloff 1977). Because Wave 3 survey was limited to nine items of the CES-D scale given the acceptable psychometric properties from the composite measure of these items, I use these nine items commonly collected in three data waves for my analyses.

Individual items were coded on a four-point scale, from *never or rarely* (0) to *most or all of the time* (3), and refer to feelings the respondent had in the past week (maximum scale score = 27). The CES-D nine items were summed and have a high internal consistency across three waves (Wave 1: $\alpha = .78$; Wave 2, $\alpha = .76$; and Wave 3, $\alpha = .80$). The repeated, continuous measures of this variable were used to establish developmental pathways of depressive symptoms.

Perceived Educational Expectations from Parents were assessed by asking adolescents at Wave 1 and Wave 2 "how disappointed would your mom (dad) feel if you did not graduate from college?" (1 = *not at all*, 5 = *very much*) (Pearson correlation $r = .38$; $p = .000$) Responses from both parents were summed and averaged at each wave to indicate perceived educational expectations from parents at each time point. If a respondent had only one parent/guardian, then that person's educational expectation was used.

Grade Point Average (GPA): At Wave 1 and Wave 2, adolescents reported recent grades in Mathematics, English, History, and Science classes at school. Letter grades reported in Wave

1 and Wave 2 interviews were transformed into a 4-point numerical scale (i.e., A = 4, B = 3, C = 2, D = 1) and summed and averaged to construct a measure of academic performance. If respondent had only taken classes in some but not all subjects, only grades on the classes that they have taken were included in the calculation.

Expectation Configurations: Based on my typology in Figure 3.1, I first subtracted perceived expectations at Wave 1 from expectations at Wave 2 to create three categories of expectation changes. A positive score indicates an increase in parents' expectations at Wave 2 (*"Increased"*) whereas a negative score signifies a lowered expectation at Wave 2 (*"decreased"*). Both changes show malleability in parents' educational expectations. A score of zero suggests that educational expectations had remain unchanged across two waves (*"stable"*). In a similar vein, I created three categories of GPA changes, corresponding to *improved*, *declined,* and *unchanged* school performance. From there, I match changes in performance that are consistent or inconsistent with stable versus malleable expectations, resulting in four configurations: rigid, adaptive, maladaptive, and sustained expectations.

Parents' Education. At Wave 1, students reported the education levels of their parents. The format of the responses ranges from 0 (never went to school) to 9 (professional training beyond four-year college or university). I summed and averaged father's and mother's educational level as the average parents' education. Maternal education was taken as the parental education index in families that were headed by a single female. Paternal education was taken as the parental education index in families that were headed by a single male.

Depression Diagnosis was measured at Wave 4 by asking respondent "has a doctor, nurse, or other health provider ever told you that you have or had depression?" (1 = yes, 0 = no)

Educational Achievement. At Wave 4 (2008), participants reported the highest levels of education that they had achieved. By this year, all respondents were older than the typical age required to complete college (age: 24-33 years). Ordinal levels of young adults' education were created ranging from 1 (less than grade 8 completed) to8 (beyond college degree).

Adult Income. At Wave 4, respondents reported their personal earnings before taxes. Ordinal levels of young adults income were created (1 = less than 5,000; 11 = 100,000 to 149,000).

Race-ethnicity was measure with two dummy coded categories by dichotomizing the presence of non-Hispanic Blacks and non-Hispanic Asian Americans racial or ethnic statuses, with non-Hispanic Whites as the reference group.

Age-based Trajectory Approach

While developmental theory posits age as the appropriate metric in the study of longitudinal change and it is well known that the development of adolescents' depressive symptoms has a strong age-related component, the Add Health data is not organized by age, but by wave. Given the substantial age variation at the beginning of Add Health data collection, I first reconstruct my wave-based data into age-based data following prior procedures to predict baseline and subsequent rates of change for depressive symptoms (Wickrama, Noh, and Elder 2009).

In this approach, rather than merging data by wave, information was restructured based on the chronological age of respondents (i.e., 13, 14, …, 23 years). For example, because respondents who were 13 to 18 years of age in 1995 (Wave 1) became 14 to 19 years of age in 1996 (Wave 2), and 19 to 23 years in 2001 (Wave 3), information of 13 years of age in 1995,

1996, and 2001 was combined regardless of the year of data collection. Similarly, information of 14, 15, 16, …, 23 years of age was combined based on the chronological age. In doing so, researchers combine cross-sectional and longitudinal data to produce a data set spanning a longer developmental period from the age of 13 to 23 years (Duncan et al. 1999). Designed to approximate a longitudinal study of different cohorts, data structure with age-at-testing, as opposed to wave-of-testing or year-of-testing, not only entails substantive interpretations of trajectories as having distinct developmental segments, it also has important statistical advantages. Models with age-at-testing data structure estimate statistics using all available information from every person, so they do not suffer from statistical problems of pair-wise estimates based on different sample size. Although this approach produces massive amounts of missing data, the missingness is not related to other variables. It would be missing completely at random (MCAR) (Rubin 1976).

Similar to Wickrama et al. (2009), my restructuring of depressive symptoms across three waves yielded a cohort data design ranging from 13 to 24 years of age, at an interval of 2-years to increase analytic power. An important assumption of the age-at-testing restructuring approach is to postulate the same developmental trend occurs in each cohort, despite having limited longitudinal data from different birth cohorts. Previous studies based on such designs provided findings comparable to those obtained from true longitudinal cohort designs when estimating growth curves for depression (Duncan et al. 1999).

Plan of Data Analysis

The analyses for the current study are threefold. The first step is to measure expectation malleability. That is, how prevalent each of the expectation configuration is in Add Health data. I

then identify developmental trajectories of depressive symptoms from early adolescence to young adulthood using Latent Class Growth Analysis (Muthén and Muthén 2009). The Latent Class Growth Analysis focuses on the relationships among individuals. The goal is to group individuals into class membership, with each class representing a distinct pattern of trajectory (Jung and Wickrama 2008; Muthén 2004). Hence, individuals within each category are homogeneous in terms of their stage of progression and shape of growth, and groups of individuals are heterogeneous across categories. Finally, I examined how the probability of membership in each trajectory subgroup is distinguished by expectation configurations using multinomial logistic regression analyses. All analyses were conducted in Mplus 7.4 software (Muthén and Muthén 2014) in conjunction with Stata 14.0 (StataCorp 2015).

RESULTS

Descriptive Patterns of Expectation and GPA changes: Identifying Expectation Plasticity

Table 2.1 presents the descriptive statistics for all variables used in the current study. With regard to these variables, two patterns are noteworthy. First, when looking at depressive symptoms across waves, levels of depressive symptoms decrease as respondents get older (Wave 1: M = 5.77, Wave 2: M = 5.75, Wave 3: M = 4.50). In addition, on average, while perceived college expectations from parents stay unchanged across time, respondents' reported GPAs decline significantly (Wave 1: M = 2.81, Wave 2: M = 2.71, $p < .05$). Both findings are consistent with previous research showing improvement in depressive symptoms toward young adulthood and the overall drops of adolescents' academic performance in transition to high school (Ge et al. 1994; Wickrama et al. 2009).

How did adolescents fare in terms of facing rigid versus adaptive educational expectations from their parents? Table 2.2 presents means of expectations and GPA scores in two waves by configurations of expectations, along with the total number of respondents within each category. Table 2.2 shows that despite the overall declines in adolescents' GPA over time, about 8.8 percent of the respondents (N = 725) was able to maintain a consistent school performance. Because no new information was provided for parents to update their expectations, adolescents in this group reported a "*sustained expectation*" from their parents. While almost 60 percent of parents were malleable, to at least perceived to be, in their expectations, only a third of them adjusted expectations in light of new evidence about their child's academic abilities (N = 1994, 24.2%), with the other two thirds maladapted. Results also show that a substantial proportion of parents did not recalibrate their expectations in spite of changes in students' GPA (N = 2687, 32.6%). These, nevertheless, suggest that parents' educational expectations are both stable and dynamic.

Pairwise *t-tests* comparing variable means between groups in Table 2.2 reveal that all but two pairs are significant at $p < .05$ level. Overall, descriptive statistics indicate that adolescents with sustained expectations fare the best, followed by adolescents with rigid expectations. Compared to the rest of the adolescents, adolescents with sustained expectations score the highest on their GPA (M = 3.19) and reported the highest educational expectations (M = 4.55) and parental education (M = 6.40). This pattern is in line with findings from Bozick et al. (2010) that expectations and performance tend to be more stable among high-SES youth. Interestingly, groups with perceived flexible expectations, be it adaptive or maladaptive, fare the worst when it comes to educational expectations, academic performance, and parents' education.

How do different configurations of expectations link to long-term mental health outcome? To answer this question, I next move to the second step of my analyses by identifying distinct trajectories of depressive symptoms from early adolescence to young adulthood.

Trajectories of Depressive Symptoms: Identifying Distinct Classes of Trajectories

Tables 2.3 presents the means and standard deviations for depressive symptoms in the form of age-at-testing, along with the numbers of respondents who provided data for each cell. Overall, depressive symptoms experienced a curvilinear change from early adolescence to young adulthood, with depression peaking around the age of 17-18 years old (M = 6.11, SD = 4.13) and gradually declining and reaching its lowest point by age 24 (M = 4.47, SD = 4.00).

Prior studies suggest that the trajectories of depressive symptoms are different for Asian and Black adolescents than that for White adolescents (Ge et al. 2006). To address this concern, Figure 2.2 plots the descriptive depressive symptoms by three racial/ethnic groups. As can be seen from Figure 2.2, although Asian and Black Americans experience higher levels of depressive symptoms than that of Whites across the entire age range, the convex shape of trajectories was found in all three racial/ethnic groups. Thus my latent class growth analysis combined three groups together to estimate distinct classes of trajectories.

Building on previous research documenting the developmental course of depressive symptoms (Clarke and Wheaton 2005; Ge et al. 2006; Hankin et al. 1998; Mirowsky and Ross 1992) and confirmed by descriptive means presented in Table 3.3, I specified a growth trajectory of depressive symptoms in two distinct segments. Figure 2.3 presents the conceptual model for my latent class growth curve model, with the first segment corresponds to early/middle adolescence (age 13-18) and the second segment models linear changes in depressive symptoms

during late adolescence/young adulthood (age 19-24) (Raudenbush and Bryk 2002). This is also called piecewise growth curve model (Bollen and Curran 2006). There are three parameters for each class of trajectory to be identified in the latent growth curve analysis, the intercept (initial level), slope 1, and slope 2.

I used three indexes to determine the optimal numbers of latent classes: Bayesian Information Criteria (BIC), Entropy, and the Lo, Mendell, and Rubin test (Lo, Mendell, and Rubin 2001). The BIC value balances two components, maximizing the likelihood and keeping the model parsimonious, with a low BIC value indicates a well-fitting model (Nylund, Asparouhov, and Muthén 2007). Entropy ranges from 0 to 1, with high values of entropy (> .80) indicate that individuals are classified with confidence and there is adequate separation between the latent classes (see Muthén 2004). I also examined the likelihood ratio test (LMR-LRT) of Lo et al. (2001) that compares the *k* and the *k*-1 class model. A significant LMR p-value indicates the current model is better than model with one less class. As recommended, classes were added until the BIC started increasing, and then the model that minimized the BIC was chose.

Table 2.4 presents the maximum likelihood values, the BIC, the entropy, the LMR likelihood ratio tests and the proportion of individuals in each class for each of the increasingly complex membership classification. The BIC decreased steadily for one through four-class solution (146408.93, 145122.17, 144093.10, and 143495.14, respectively) and LMR tests were all significant. Thus models with more classes fit better than models with fewer classes. Although the BIC values continued to diminish as classes increase, the proportion of individuals in one class failed to pass five percent minimum requirement from four-class model onwards. Hence, the three-class growth curve model provided the best fit for the observed data.

My latent class growth analyses created three distinctive groups that accommodate all respondents and with large enough group size to yield stable estimates. Parameter estimates for each class are shown in Table 2.5, along with mean levels of education, socioeconomic attainment and rates of depression diagnosis at Wave 4 when respondents were adult. Their fitted trajectories are shown in Figure 2.4.

Not all groups of adolescents experience the same rates of change or follow the normative developmental pathway in depressive symptoms. Of the three classes identified by the latent class growth analyses, Table 2.5 shows that only the first class (*consistent-low,* prevalence 74.8%) is characterized by a normative development of depressive symptoms: self-reported depressive symptoms slightly escalate in the mid-adolescence and decline during early adulthood ($slope_1$ = .188 and $slope_2$ = –.476; p = .000). It shows that throughout the study years, the first class had a chronic low level of depressive symptoms. In contrast, respondents in class 2 (*high-decreasing*, prevalence 16.5%) have considerably higher initial levels of depressive symptoms (Intercept = 11.540; p = .000) but experienced gradual declines during the first segment of adolescence (Slope 1 = –.077; p = .000). Severe depressive symptoms reported by respondents in class 2 faded with their transition to adulthood, as indicated by a sharp decline in depressive symptoms after the age of 18 years old (Slope 2 = –2.247; p = .000). Finally class 3 (*moderate-increasing*, prevalence 8.6%) consists of individuals who experienced steep gains in depressive symptoms throughout the age range ($Slope_1$ = 1.758; $Slope_2$ = 1.562; p = .000). Despite their relatively low initial level of depressive symptoms (Intercept = 5.417; p = .000), individuals in group 3 are projected to have the highest levels of depressive symptoms compared to the other two groups.

My findings on adolescents' distinct depressive symptom pathways are consistent with past studies revealing similar trajectories of depressive affect. In both Capaldi (2003) and Hao and Woo (2012)'s studies, the authors identified three to four classes of depressive mood that were similar to classes presented in the current study. Another way to validate the trajectory classification is to examine depression diagnoses, educational attainment, and personal earnings reported at Wave 4 (ages 24-32 years).

Table 2.5 indicates that only 12 percent of adolescents in the consistent-low group were diagnosed with depression, compared to 27-31 percent of diagnosis rate of respondents in class 2 and 3. Class 1 also reported the highest educational attainment and personal earning in adult years. These differences are highly significant among class memberships (Depression diagnosis: $\chi^2 = 345.50$, $df = 2$, $p < .00$; Education attainment: $\chi^2 = 352.13$, $df = 20$, $p < .00$; Income: $\chi^2 = 247.77$, $df = 20$, $p < .00$), with class 1 being the most advantageous group.

Are Perceived Rigid Expectations Detrimental to Adolescents' Psychological Well-being?

Finally, I estimated the likelihood of falling into each of the three trajectories of depressive symptoms using multinomial logistic regression analyses. I chose the consistent-low class as my reference category in the multivariate analyses because it represents the normative development of depressive symptoms (Ge et al. 2006) and was associated with the best psychological, educational, and economic outcomes in adulthood. For ease of interpretation, I present odds ratios in my models. A ratio of 1 represents equal odds that the student falls into the comparison category or the reference category. A ratio greater than 1 represents increased odds, while a ratio less than 1 represents decreased odds of falling into the comparison category rather than the reference category.

In examining how traditional markers of structural inequalities influence memberships in the three trajectory class, results from Model 1 in Table 2.6 suggest that being White, male, having highly educated parents all significantly lower the odds of falling in two disruptive trajectories (*Moderate-increasing* and *High-decreasing*) compared to the odds of staying in normative, *consistent-low* class. Specifically, the risks of Black and Asian American adolescents staying in a high-decreasing (vs. consistent-low) class are 1.32 and 2.75 times as high as the odds for White American adolescents; the odds for minority groups to experience a moderate-decreasing (vs. consistent-low) trajectory are 1.74 times than the odds for White adolescents. Results from Model 1 in Table 2. 6 also corroborate findings from prior studies by demonstrating the health benefits derived from higher parental expectations (Goldman and Smith 2011; Marmot 2000; Yamamoto and Holloway 2010). Compared to adolescents who perceived lower parental expectations, adolescents with higher parents' expectations are significant less likely to experience either moderate-increasing (odds = .968; p = .000) or high-decreasing (odds = .904; p = .000) pathways of depressive symptoms.

Model 2 in Table 2.6 added three dummy variables that compare adolescents with rigid, adaptive, or maladaptive parental expectations to those with sustained expectations (the reference group), while controlling for baseline GPA and educational expectations. Consistent with self-discrepancy and social stress theories' predictions, perceiving non-responsive, rigid parental expectations is associated with heightened risks of experiencing high levels of depressive symptoms during early/middle adolescence. It seems that for adolescents whose parents failed to recalibrate their expectations when objective indicators had changed, they are more likely to report high levels of psychological stress.

To further probe whether rigid expectations are more prevalent among subgroups of adolescents, as believed by pundits and general populations (Chua 2011), I conduced additional analyses to check if my Asian American sample reports higher rates of rigid expectations and whether the detrimental effect is more pronounced among Asian Americans. I do not find support for either of the propositions.

Are Adaptive Expectations Beneficial to Adolescents' Psychological Well-being?

Do adolescents with perceived responsive, adaptive expectations then fare better, as self-discrepancy and social stress theory predict? The answer is also no. Results from Model 2 in Table 2.6 show that adaptive expectations significantly contribute to higher risk of staying in the high-decreasing trajectory. Their adverse effect exists even when I controlled for baseline GPA and parents' educational expectations. The apparent differences in depressive symptoms trajectories between young adults who enjoys sustained expectations versus those with adaptive expectations were not explained away by GPA or expectations themselves. The net effect for adaptive expectation in Model 2 indicate that, regardless of academic ability and parents' beliefs about their children, adolescents in this group were psychologically troubled, much like their counterparts in the rigid group.

That fact that adolescents with adaptive expectation are no better off than those with rigid expectations is somewhat surprising. Results suggest that both groups are associated higher likelihood to fall into high-decreasing pathway of depressive symptoms. Remember, self-discrepancy theory and social stress theory predict a positive relationship between responsive expectations and better mental health. Although adolescents' depressive symptoms in high-decreasing class eventually faded during their transition to adulthood, analyses suggest that they

are still more likely to be diagnosed with depression, less likely to obtain higher education level, and less likely to attain higher occupational status when they are adult.

Lastly, in comparing risks of falling into *moderate-increasing* versus *consistent-low* trajectories, results fail to support the claim that adolescents with rigid or adaptive expectations will experience increased depressive symptoms. Being responsive or not in parents' educational expectations matters little in predicting the risks of experiencing an accelerated pathway of depressive symptoms (all *p*s >.05).

DISCUSSION

The central goal for the current paper is to determine whether emotional costs, particularly depression, stem from perceiving various types of expectation from parents. Prior studies on social mobility have advanced our understanding of educational expectations, but they lack an adequate account of whether different forms of expectation matter for adolescents' psychological well-being. Drawing upon perspectives from life course and social psychological theories, I propose a dynamic approach to study different types of educational expectations and to examine their impact on young Americans' psychological well-being during the transition to adulthood. Using nationally representative data of 11,086 adolescents from the National Longitudinal Study of Adolescent Health, this study extends prior research in several important ways. First, I examine different configurations of expectation formation to determine how malleable parent's educational expectations perceived to be. Second, I provide greater analytic leverage than prior research by identifying classes of depression trajectories with distinct long-term consequences. Third, I investigate whether expectations, rigid and adaptive expectations in particular, are predictive of trajectories of depressive symptoms for young Americans.

On the whole, I find a good deal of population heterogeneity in the dynamics of educational expectation. Although a substantial proportion of parents were seen as recalibrating their expectations when circumstances prompt them to do so, as suggested by Bayesian learning theory (Morgan 2005), the more typical response was to hold expectations steady across time. The strategies of remaining consistent in their children's long term goals versus being flexible in expectations was found to be significantly related to parents' education levels. This corroborates earlier claims that expectations are rather stable (Alexander et al. 2008; Haller 1982) and the lack of malleability in expectations is more salient among high-SES families (Andrew and Hauser 2011; Bozick et al. 2010; Kao and Tienda 1994). It seems that for many parents, especially those with high socioeconomic status, once their educational beliefs are established, it becomes a static mental state and will not easily bend to changes in reality.

With regard to developmental pathway of depression, my results show that for most young people in the United States the trajectories of their depressive symptoms are rather stable (consistently-low) and congruent with the trajectories that are the most typical in the stage of their life course (i.e., inverted U-shape). Yet, the results also show quite a clear division between adolescents in the non-normative, disruptive trajectories versus normative trajectory in terms of long-term health and socioeconomic outcomes. To measure the risk factors and protective factors in predicting these distinctive trajectories, I find strong evidence supporting predictions that perceiving strict, unbending expectations leads to psychological distress. Parents' insistence on their college expectations would mostly likely result in a fallout in fulfilling these expectations, putting adolescents at higher risks of experiencing severe depressive symptoms. It is worth noting that I did not find evidence to corroborate the stereotypes that strict parenting is a trait of

Asian culture. Nor do I find the adverse effects of rigid expectations are more pronounced for Asian American adolescents. In other words, Asian American youths are just as likely as everyone else to experience rigid expectations, and the detrimental effect of having a strict expectation on mental health are just as hard for Asian American youths as for others in the sample.

On the other hand, I also hypothesized health benefits resulted from adaptive expectations. I did not find any instance of this. Instead, adolescents with adaptive parents have worse academic performance and lower expectations compared to their counterparts with sustained and rigid expectations. Their psychological wellbeing are no better off than adolescents who lack expectation plasticity at all, even after controlling performance and expectations.

What explains my failure to find empirical support for the premise in the social psychology of self? The lack of positive emotional consequences of responsive, adaptive expectations is in line with the educational psychology literature, which assumes greater benefits from strict, not lenient, parenting. Among the major parenting styles defined by Maccoby and colleagues (1983), the permissive style refers to parenting behaviors that are high on warmth but low on demandingness. It is postulated that children raised in this parenting will perform less well academically than children of parents who are high on both dimensions (Maccoby and Martin 1983). It is difficult to map adaptive expectations onto a specific parenting style, but the ideas of parents being flexible and willing to adjust their expectations whenever needed are coincident with the low demandingness represented by permissive parenting style. Perhaps, in a life phase where dramatic changes in adolescents' social, psychological, and physiological processes occur, cultivating a more stabilized expectation outweighs the benefits of providing

flexibility in parental guidance. In fact, studies have found that adolescents who perceived their parents as being more permissive were more likely than their peers to attribute achievement outcomes to external causes or to low ability (Glasgow et al. 1997). Given respondents identified with adaptive expectations also had the worst performance in two waves, it is possible that the adaptive expectations contribute to adolescents' dysfunctional attributions made for academic failure, which in turns, cause psychological stress.

Although this study provides important insights into expectation dynamics and its impact on youth's long term psychological well-being, it has limitations. First, the scope of this article is limited to *perceived* parents' expectations that were reported by youths. Although from social psychological perspectives, it is the perceived expectations, rather than actual expectations, matter when examining the implications of expectations on individual's mental health, additional research is necessary to investigate whether study patterns hold if actual expectations from parents were used. Second is the issues of causality between educational expectations and school performance among adaptive parents. It is plausible that parents are attentive to their child's academic standing when formulating a plan for the future, it is equally plausible that those who perceive declining interest of their parents in college graduation let their grade slip, in which case measures of malleability would capture the influence of expectation on academic performance, rather the reverse. Although prior studies do find reciprocal relationship between parents' expectations and adolescents' achievement (Zhang et al. 2011), such circles of causality are hard to disentangle in the current data set. In a similar vein, one could also argue a reversed causal relationship between configurations of expectation and depression trajectories that, students with high levels of depressive symptoms (class 2) were unable to maintain consistent academic performance. It is thus

possible that the emotional well-beings of adolescents predict perceived malleability of educational expectations via its influence on adolescents' academic performance. Future research is warranted to tease out the direction of causality.

In closing, educational expectations have long been used to explain social stratification in the realms of education and occupation. In most research, the focus is on the link between static expectations and educational and professional achievement. When these effects are large and significant, as they often are, it is easy to simply conclude that expectations are, without any doubt, positive and beneficial. But when the yield from high goals advantages some youths than for others, we must consider more generally what else is required to make expectations "work." That is, we need to understand more clearly the relevant dynamics of expectation and how these either impede or facilitate successful outcomes. Steady expectations can help to bring about the desired psychological well-being only when they match with consistent performance. Projecting "rigid expectations" does not serve the mental health interests of youth. Does it follow that parents should readily deflate their inflated goals? Because high expectations are associated with long-term benefits such as high educational and occupational attainment, this probably is not advisable. In the extreme case, it makes little sense to infuse children the sense that they are failures. This would not be healthy at any time. Future research is warranted to make concrete suggestions on the most effective approach. Knowing when expectations are advantageous versus disadvantageous could help educators and health specialists better identify adolescents at risk and provide intervention programs in the early stages.

NOTES:

1. I refer all changes in parents' expectations that were not based on school performance as maladaptive. This does not necessarily mean that parents miscalculated their expectations and formed unrealistic expectations. In fact, these changes still could be realistic if they were based on other information (finances, health, career plan, etc.).
2. The Institutional Review Board at University of Georgia approved the public use of Add Health data of the author for the current study (IRB ID: MOD00003183).

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Figure 2.1. Conceptual Typology of the Educational Expectations

	Perceived *Stable* Expectations	Perceived *Malleable* Expectations
Performance *Inconsistency*	(1) Rigid	(3) Maladaptive
Performance *Consistency*	(4) Sustained	(2) Adaptive

Note. Stable Expectation = parents hold their educational expectations constant across time; Malleable Expectations = parents change their educational expectations over time; Performance Consistency = co-occurring changes in adolescents' school performance are consistent with dynamics of parents' educational expectations; Performance Inconsistency = co-occurring changes in adolescents' school performance are contradicted with patterns of parents' educational expectations;

Table 2.1. Descriptive Statistics for Study Variables

	Scale	Mean	SD
Depressive Symptoms (Wave 1)	0 (never or rarely) to 3 (most or all the time)	5.777	4.241
Depressive Symptoms (Wave 2)		5.747	4.053
Depressive Symptoms (Wave 3)		4.503[a]	4.020
Parents' Expectations (Wave 1)	1 (low) to 5 (high)	4.030	1.185
Parents' Expectations (Wave 2)		4.008	1.214
GPA (Wave 1)	1 = D or lower to 4 = A	2.814	.794
GPA (Wave 2)		2.709[b]	.888
Parents' Education (Wave 1)	0 (no school) to 9 (4-year college +)	5.709	2.121
Male	1 = Male	.467	.499
Depression Diagnosis (Wave 4)	1 = Yes 0 = No	.159	.366
Education Achievement (Wave 4)	1= less than 8th grade to 8 > college degree	5.635	1.819
Adult Income (Wave 4)	1 = less than 5,000 to 11 = 100,000 to 149,000	6.229	2.991
Race - White	1 = Yes	.663	
Black		.259	
Asian		.079	

Note: standard deviations are in the parentheses.

a: *t*-test in comparison of means for depressive symptoms at Wave 3 vs. depressive symptoms at Wave 1 is significant at .05 level.

b: *t*-test in comparison of means for GPA at Wave 2 vs. GPA at Wave 1 is significant at .05 level.

Table 2.2. Educational Expectations and GPA at Two Waves by Expectations Configurations

	Rigid	Adaptive	Maladaptive	Sustained
Expectations at Wave 1	4.477[a] (.998)	3.739 (1.199)	3.650 (1.194)	4.548 (.927)
Expectations at Wave 2		3.595 (1.264)	3.741 (1.207)	
GPA at Wave 1	2.849 (.743)	2.710 (.739)	2.727 (.764)	3.191 (.843)
GPA at Wave 2	2.739 (.819)	2.576 (.881)	2.650 (.856)	
Parent's Education	5.954 (2.115)	5.518 (2.090)	5.547 (2.071)	6.404 (2.064)
N	2687	1994	2831	725
%	32.6	24.2	34.3	8.8

Note: a: All pairwise *t*-tests comparing means between groups are significant at .05 level, except for the mean comparisons between adaptive group vs. maladaptive groups on adolescents' GPA at Wave 1 and parents' education.

Table 2.3. Descriptive Statistics of Depressive Symptoms, Parental College Expectation, and GPA by age

Age (years)		13-14	15-16	17-18	19-20	21-22	23-24
Depressive Symptoms	Mean	4.95	5.61	6.11	5.22	4.58	4.47
	SD	(3.73)	(4.02)	(4.13)	(4.23)	(4.04)	(4.00)
	N	2520	5248	4000	4162	3964	4887

Note: standard deviations are in the parentheses.

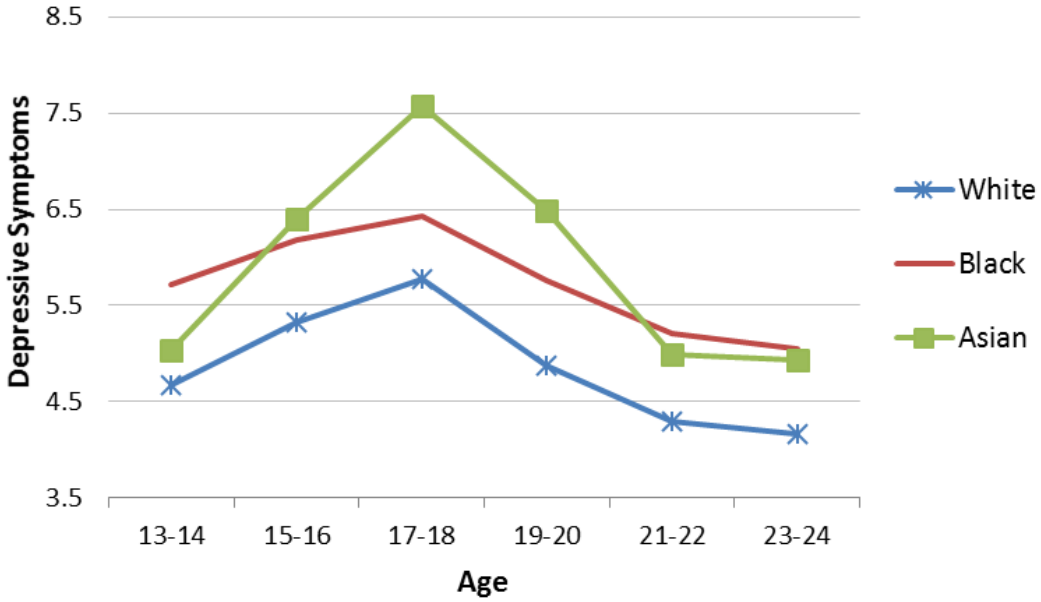

Figure 2.2. Trajectories of Depressive Symptoms by Three Racial Groups

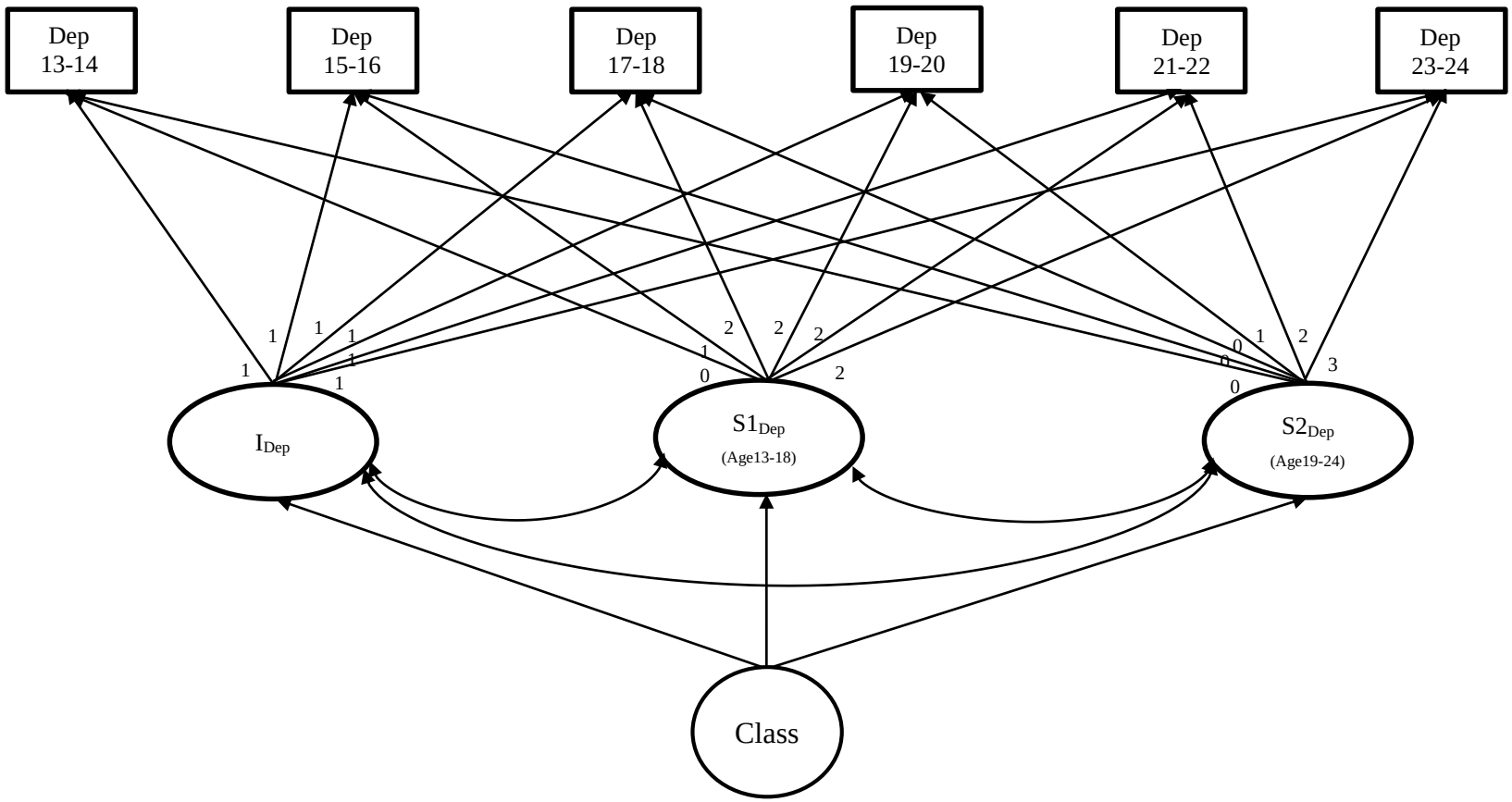

Figure 2.3. Conceptual Model for the Latent Class Growth Analysis of Depressive Symptoms from Early Adolescence to Young Adulthood

Table 2.4. Parameters of fit of latent class growth analysis (LCGA) (N = 11,354)

Class	Maximum Likelihood	BIC	Entropy	LMR test		Proportion of individuals in class				
				2LL	P	1	2	3	4	5
1										
2	-73143.774	146408.93[a]	.759	4224.401	.000	.206	.793			
3	-72481.721	145122.17	.784	1324.106	.000	.086	.748	.165		
4	-71948.508	144093.10	.746	1066.426	.000	.609	.271	.047	.071	
5	-71630.855	143495.14	.744	635.305	.000	.045	.116	.570	.240	.027

Note: BIC = Bayesian Information Criterion; LMR = Lo–Mendell–Rubin; LL = log likelihood.
a: Intercept variance and slope variance were fixed at zero in each class.

Table 2.5. Parameters for Depressive Symptoms Trajectories and Wave 4 Outcomes by Class Membership

	% [a]	Baseline	Slope 1 (13-18 yrs)	Slope 2 (19-24 yrs)	Outcome at Wave 4		
					Depression Diagnosis	Adult Income	Educational Achievement
Class 1: Consistent-Low	74.8	3.976***[b]	.188***	-.476***	.12 (.33)	6.39 (2.91)	5.97 (2.07)
Class 2: High-Decreasing	16.5	11.540***	-.077***	-2.047***	.27 (.44)	5.57 (3.18)	5.23 (2.08)
Class 3: Moderate-Increasing	8.6	5.417***	1.758***	1.562***	.31 (.46)	5.42 (3.25)	5.15 (2.03)

Note: a: Proportions for the latent classes based on estimated probabilities.

b: Significance means that there is a significant variation in mean levels of intercept (or slopes) within each class.

*$p < .05$; **$p < .01$; ***$p < .001$ (two-tailed tests)

Figure 2.4. Fitted Mean Trajectories of Depressive Symptoms for Three Classes

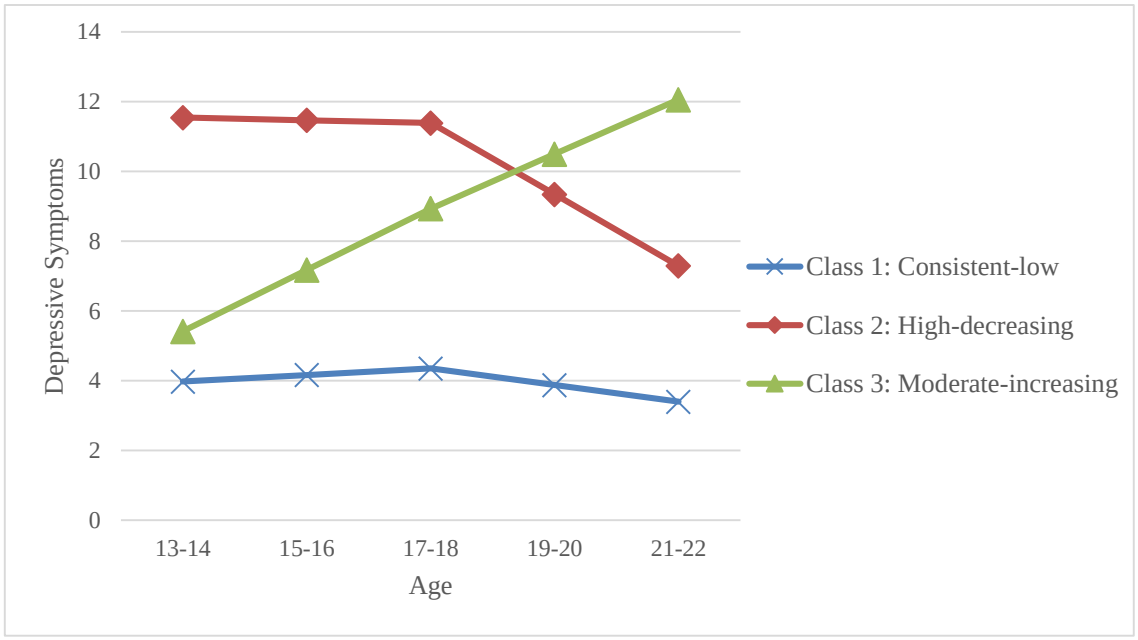

Table 2.6. Odds Ratios from Multinomial Logistic Regression Predicting Trajectory Classification of Depressive Symptoms (N = 8,032)

reference: Consistent-Low	High-Decreasing		Moderate-Increasing	
	Model 1	Model 2	Model 1	Model 2
GPA (wave 1)	.594*** (.025)	.600*** (.025)	.606*** (.035)	.609*** (.036)
Expectations (wave 1)	.904*** (.025)	.916** (.025)	.968 (.036)	.991 (.039)
Expectations Configurations (vs. sustained)				
Non-responsive, rigid		1.333* (.189)		1.052 (.196)
Responsive, adaptive		1.490** (.218)		1.224 (.235)
Responsive, maladaptive		1.358* (.193)		1.283 (.237)
Controls				
Black (vs. white)	1.315*** (.098)	1.321*** (.097)	1.735*** (.166)	1.755** (.171)
Asian (vs. white)	2.749*** (.307)	2.766*** (.309)	1.736** (.302)	1.754*** (.310)
Male (vs. female)	.387*** (.027)	.387*** (.027)	.471*** (.044)	.471*** (.044)
Parents' Education (wave 1)	.943*** (.016)	.944*** (.014)	.953* (.020)	.954* (.020)
Intercept	2.067*** (.324)	2.010*** (.267)	.590* (.129)	.615** (.111)

Note: Consistent-Low is reference category.
*$p < .05$; **$p < .01$; ***$p < .001$ (two-tailed tests)

CHAPTER 3

STUDY 2: ISOLATION, REJECTION, OR CONTAGION? GENDERED PATHWAYS TO DEPRESSION HOMOPHILY[2]

[2] Zhao, Jun, Dawn T. Robinson, and Chi-yi Wu. To be submitted to the *American Journal of Sociology*.

ABSTRACT

Recent research documents both the influence of social networks on adolescent depression and the influence of depression on the structure of adolescent friendship networks. Considerable research also documents gender differences on fundamental network processes. The present research examines the somewhat surprising implications of this classic gendered pattern of friendship structures for studying depression homogeneity among boys and girls. I propose that in girls' friendship networks, where the network is compartmentalized into micro-structures, the tendency of depressed adolescents to withdraw from interaction, which effectively insulates the rest of the group from contagion, also isolates depressed girls from potential social support. In contrast, boys' denser and more inclusive friendship networks may offer more opportunities for depression transmission through peer influence, resulting in contagion-based homophily. Using stochastic actor-based models for 421 adolescents from mixed-gender, all-girl, and all-boy classrooms in six Taiwanese high schools, I find predicted friendship network structures in girls' and boys' classrooms. Moreover, when controlling for the reciprocal effects of network dynamics and depression change, results suggest that social withdrawal of depressed girls explains depression homophily in both single-gender and mixed-gender classrooms whereas peer influence predicts depression homophily in all-boy classrooms.

Keywords

Gender, networks, depression, homophily, adolescents

Adolescent depression is both common and consequential. Friends matter when it comes to adolescent depression. Existing literature on depression demonstrates that relationships can protect individuals from, or make individuals vulnerable to, the experience of depression. Moreover, relationships can form, thrive, and fade in response to mental health.

Less research examines how gendered networks might influence the processes of depression isolation, rejection, and contagion through friendship networks. Gender plays an important role in structuring adolescent friendships. In this paper I develop novel arguments about the consequences of this gendered structuring for social contagion. Specifically, I propose that one consequence of the regularly observed differences between boys' and girls' friendship networks is to promote more depression contagion within boys' networks than within girls' networks. To elaborate my proposal, I re-examine the relationship between social networks and adolescent depression, paying close attention to how these networks are shaped by gender. I use a unique longitudinal sociometric dataset from six Taiwanese high schools containing both single gender and co-ed classrooms. I use these data to examine the questions about how gendered network structure affect depression contagion and isolation. I tease out the complex relationship between depression and social relations by addressing three questions: (1) what are the mechanisms that account for depression homophily among adolescents; (2) are there differences between boys and girls in terms of depression diffusion and withdrawal; (3) does classroom gender composition influence these contagion processes? My analyses provide greater nuance to the important discussion in the social network and health literatures. Moreover, my Taiwan context allows me to demonstrate the broader applicability of social network and gender theory in an important international setting.

THEORETICAL BACKGROUND

Depression and Adolescents' Mental Health

Depression may fall and rise over the life course, but adolescence is a period of high vulnerability. Rates of depression spike during adolescence when significant physiological and psychological changes occur, decrease over time as individuals progress to marriage, employment, and higher economic status, and then rise again when their physiological health starts to decline (see Mirowsky and Ross 1992; Sutin et al. 2013, for review). Prior research finds that depression appears to follow an inverted U-shape trajectory from adolescence to early adulthood, with highest in early adolescence and either plateau or drop somewhat in late adolescence/early adulthood (Ge et al. 1994; Ge, Natsuaki, and Conger 2006).

These findings fit well with extant theory. As a phase of development bridging childhood and adulthood, adolescence is a period when the widening array of social stressors, coupled with pubertal transition, places individuals at heightened risks for emotional distress. Not only are levels of adolescent depression higher than that of childhood and adulthood, depression is among the top mental health challenges faced by this age group (Campas, Ey, and Grant 1993). Estimates of depression prevalence vary somewhat across studies and research populations, but most U.S. research finds that 30-40 percent of adolescents suffer from depression at subclinical levels and estimates that 15 percent of adolescents suffer from major depression (Avenevoli et al. 2008; Compass et al. 1993; Rushton, Forcier, and Schectman 2002). Moreover, adolescent depression is one of the strongest predictors of adolescent suicide (Kandel, Raveis, and Davies 1991) and predicts depression later in life as well (Belsher and Costello 1988; Kovacs et al.1984).

The relationship between social relations and depression is complex. Depression affects gregariousness, or level of involvement in social relationships. Specifically, depression leads to withdrawal from social relationships (Schaefer, Kornienko, and Fox 2011) and inhibits in particular the formation of bridging ties (Cornwell 2009). Albeit that, numerous studies find a tendency toward depression-based homophily (Hogue and Steinberg 1995; Merikangas 1984; Rosenblatt and Greenberg 1988, 1991; Shaefer et al. 2011; Wenzlaff and Prohaska 1989). That is, relationships develop more often and faster between individuals with similar depression states. On the other hand, research suggests that social relationships can be protective in insulating individuals from depression (Baumeister and Leary 1995; Cohen and Wills 1985; Cornwell 2003; Cornwell and Waite 2009) and promoting adolescents' mental health when indivdiuals are integrated into larger networks (Ueno 2004). Given that depression is an aspect of well-being that is both the *source* and the *outcome* of social relationships, it seems critical to examine more carefully the role of network dynamics on the spread and containment of depression within friendship networks.

Depression and Social Networks

Studies of network homophily suggest multiple pathways to explain why "birds of feather flock together" (McPherson, Smith-Lovin, and Cook 2001). Specifically, sociologists turn to three classes of explanations to understand processes involved in drawing similar individuals together– *selection*-based explanations, *influence*-based explanations, and *structural/epi-phenomenal* explanations. Below I consider each of these explanations for contributing to our understandings of depression homophily.

Selection-based homophily is often conceptualized as choice-based or preference-based homophily (McPherson et al. 2001) because of its focus on individuals' attraction to similar others. The tendency for non-depressed others to be mutually attracted seems obvious. However, there are also arguments for why friendships among the depressed could be reciprocated. Schachter proposed that individuals in stressful situations prefer spending time with others who are facing similar threats, concluding that "misery doesn't love just any kind of company, it loves only miserable company." (1959:24) Attraction to similar others might also be motived by the social and emotional support provided from experientially similar network ties in stressful situations (Suitor, Keeton, and Pillemer 1995; Suitor and Pillemer 2000). Since the alters also experienced similar circumstances in the past, he or she could provide relevant information that helps alleviate uncertainty of the depressed ego (Kulik and Mahler 2000).

Recent work by Schaefer et al. (2011) describes two additional selection mechanisms that could lead to outcome homophily without requiring differential preference. The first one is *ego-withdrawal*. Part of the clinical definition of depression includes experiencing lower energy, higher levels of fatigue, less engagement with the world, and less interest in what and who is around. Such experiences may cause individuals to pull out of social networks entirely, creating higher levels of overall homophily indirectly through clustering of social ties among non-depressed individuals. Another selection mechanism proposed as an alternative to choice-homophily is *alter-avoidance*. Depressed individuals dwell on the negatives, have less energy, and display poorer coping skills. These manifestations of depression could make depressed individuals less attractive as potential new friends and be less rewarding to existing friends – causing the relationships to wane or falter.[1] In fact, Coyne and associates (Coyne 1976, 1984;

Joiner and Coyne 1999) developed the concept of "interpersonal depression" to describe depressive symptoms that arise from interacting with depressed others. The primary point I take from their theory is that depressives induce negative emotions in significant others. These negative affects, in return, elicit rejection from others. As with ego-withdrawal, social relationships driven by alter-avoidance inevitably force depressed adolescents to befriend with other social outcasts, including depressed ones. In their dynamic analyses of adolescent networks using the National Longitudinal Study of Adolescent Health, Shaefer and colleagues (2011) find evidence for the ego-withdrawal mechanism, but not for the alter-avoidance mechanism. They argue that depressed individuals come to occupy more marginalized network positions where they have less access to peers and are more likely to have friendships outside of normative network processes.

Influence-based explanations for observed homophily include both normative influences such as socialization, sanctioning, observational learning, as well as social contagion through automatic recognition of facial expression or body postures adjustments (de Gelder et al. 2004). Affect is often seen as a crucial component of depression – and considerable research suggests that both positive emotions (e.g., happiness) and negative emotions (e.g., fear, depression, and loneliness) can be transferred to others via emotional contagion (see Christakis and Fowler 2013 and Hatfield, Cacioppo, and Rapson 1994, for review). The spread of emotions occurs not only between dating partners and college roommates with whom individual may share similar experience in common social interaction (Anderson, Keltner, and John 2003; Joiner 1994), emotional convergence can also be achieved through social media (e.g., Facebook) (Coviello et al. 2014; Fowler and Christakis 2008; Kramer, Guillory, and Hancock 2014). The latter of which

underscores the power of "peer effects" even in the absence of direct interaction. Intriguingly, one longitudinal study of U.S. adolescents has found evidence of choice homophily for adolescents' depression, as well as a gendered tendency toward depression contagion (Hogue and Steinberg 1995). The authors found that boys, but not girls, became more similar in depression to their peer groups over time.

Both of the abovementioned agency-based perspectives hold that relational phenomena are found in individual's goals, personalities, or traits. In contrast, structural, or epi-phenomenal, explanations describe how homophily is produced as a second order consequence of the opportunity structures for social interaction. Most notably, notions of the baseline homophily (Blau 1977) and focus theory (Feld 1981) put the spotlight on structural aspects that produce systematic patterns in networks, stressing the foundational structural conditions in which social relations form. According to this line of work, connected clusters of ties could arise from joint activities occurring within foci (e.g., families, city neighborhoods, voluntary groups) or emerge out of fundamental network processes (Schaefer et al. 2010). For instance, the traditional wisdom about "friends of my friends are my friends" speaks about the structural forces that act upon actors (i.e., tendency toward transitivity: when there is a tie from *i* to *j*, and also from *j* to *h*, then it is more likely to observe a tie from *i* to *h*).

Given the crucial roles several epi-phenomenal principles may play in structuring social networks and influencing health behaviors, I control endogenous structural forces in the data by simultaneously examining behavioral change and network change within high school classrooms (thus restrict actors to the same foci) and by including principal processes of network formation in all our models.

Gender and Social Networks

Despite the intriguing finding from Hogue and Steinberg (1995) that depression might be more contagious among boys than among girls, not much additional attention has been paid to this possibility. Could social networks play a role? A long tradition of research in social science documents the differences in the structure of boys' and girls' friendship (see review in Smith-Lovin and McPherson 1993). Although the origin and nature of gender differences in network structures is debatable (see Maccoby 1998 versus West and Zimmerman 1987), I focus on the *consequence* of structural differences between boys' and girls' friendship networks in the current study. In addition to the ubiquitous pattern of gender homophily in children's play (Maccoby 1988), extant research also documents several gender-specific ways in which friendships are structured. Frist, comparing the numbers of friendship ties girls and boys maintained, studies have found that boys tend to operate within larger play groups whereas girls more often have the company of a single friend (Benenson 1990; Lever 1978; Thorne 1993).

Moreover, observational data suggests that boys tend to form social groups with interrelated friendship structure. Girls, in contrast, lean more toward dyadic than interrelated friendships (Markovits, Benenson, and Dolenszky 2001). This is consistent with the idea that girls are more exclusive than boys in their friendship choice and that when intransitivity occurs in their relationships, girls tend to strategically resume network balance by dropping intransitive ties than adding one, as boys may be more apt to do (Eder and Hallinan 1978). Differences on how boys and girls decide to remove intransitivity have great implications to group structure: while the deletion of choices will lead to a more disjointed social network, the addition of ties creates a more densely connected, cohesive network. Due to distinctions in how boys and girls

manage their friendship network, research finds greater membership stability among boys' friendship networks as the network crystallized (Baines and Blatchford 2009).

To sum up, prior studies suggest distinctive patterns and network dynamics for boys and girls: girls tend toward greater selectivity and play in smaller groups and boys tend toward greater inclusion and playing in larger, more stable groups. Building on these patterns, I predict that the processes of selection and contagion will explain depression homophily for girls and boys, respectively. In particular, depressed girls are more likely to withdraw or be excluded from cliques because (1) they are less likely to extend or receive friendship ties (Smith-Lovin and McPherson 1993), and (2) their exit and exile of local cliques are more likely to go unnoticed due to higher flux among the whole network. Such selection of friendships creates homophily indirectly by limiting friendship partners available to girls. In contrast, boys build friendship intimacy through shared activities such as team sports. Boys' socially structured networks afford them greater stability in friendships but also expose young boys to greater peer influence. In this light, I predict that social contagion (or influence) of depression will explain depression homogenity among boys.

HYPOTHESES

Figure 3.1 illustrates how I expect gendered network dynamics to shape depression contagion over time. The top three panels in Figure 3.1 depict an idealized representation of an all-girl classroom. At time 1, girls are assigned to a classroom where no prior relationships are assumed. In time 2, the girls have formed dyadic and triadic relationships, with two of the girls exhibiting depressive symptoms (the lighter shade). At time 3, several ties have severed, representing depressed individuals' withdrawals of from local cliques.

In sharp contrast, boys' friendship networks, depicted in the bottom panel of Figure 3.1, are organized into larger, denser peer groups that remain relatively stable over time. It is posited that girls' friendship networks may serve to "quarantine" depressed girls, allowing non-depressed girls to be insulated from exposure to depression when depressed girls either withdraw from the social networks or get excluded by their peers. Boys, on the contrary, have reduced access to the social strategy of withdrawal. By consequence, non-depressed boys remain at somewhat higher risks of exposure to the depression diffusion across the peer groups. Of course, the implications for the depressed individuals are somewhat in contrast to these diffusion effects. The more isolated girls will lack the social support to combat depression. In the boys' groups, the relative effects of social support and social contagion may counter one another, helping the depressed individuals, but hurting his (many) alters.

I articulate these expectations as general propositions about the relative weight of network selection versus behavior influence during the coevolutionary processes of friendship network and behavior contagion for girls and boys. A more general version of the arguments developed above should apply to any context in which (1) the social system is structured by gender in the ways described in the research on children and adolescents' friendships – with girls operating in smaller, less stable friendship groups and boys operating within larger, more stable friendship groups; (2) there exists a feature of individuals that is transmittable or inhibiting across network ties – through contagion or social influence; and (3) that feature also has an effect (positive or negative) on the likelihood of either sending or receiving a friendship tie. Based on previous research I expect that high school friendships should exhibit the pattern described in (1), and that depression meets the criteria of (2) being transmittable and (3) affecting the

likelihood of withdrawal. Testing these arguments would require a dataset in which I can clearly examine the gendered structure of friendships, where I can observe whole (sociometric) networks changing over time, and in which I have information about individual level depression as it changes over time.

I begin my evaluation on adolescents' friendship networks by examining and comparing three fundamental network-based endogenous processes of friendship networks: *network density*, *reciprocity*, and *transitive triplets*. I expect that as network evolves these core structural features will characterize both boys' and girls' networks but that there will be disparity in the magnitude of these effects.

Hypothesis 1a: adolescent girls are less likely than adolescent boys to form network ties (i.e., friendship networks will be denser in boys' network than in girls' network).

Hypothesis 1b: adolescent girls are more likely than adolescent boys to form reciprocated ties (i.e., the tendency toward mutuality will be stronger among girls than boys).

Hypothesis 1c: adolescent boys are more likely than adolescent girls to choose friends of friends as friends than to choose other classmates as friends (i.e., the tendency toward triad closure will be stronger among boys than girls).

Upon establishing gendered patterns of network structure, I proceed to test gendered contagion of depression in the following hypotheses:

Hypothesis 2: depressed girls are more likely to withdraw from their networks than less-depressed girls.

Hypothesis 3: depression contagion is expected only among boys' networks.

METHOD

Data

Assessing the relative merits of each hypothesis requires data with several important properties. Of primary importance is that the data include the depressive symptoms of all students, including their pre-friendship and post-friendship depression across multiple years. Second, to test my gendered pathway to depression homophily hypothesis, friendship networks should ideally be measured across different gender settings where both unisex (all-boy and all-girls) and mixed-gender classes are included in the data. Third, to minimize problems of network boundary introducing bias into estimates of peer effects, a student's peers should be accurately defined as those who they interact on a daily basis.

My analysis uses a dataset that possesses these properties. The data used in the present study were from a Taiwanese longitudinal study entitled "The Impact of School Contexts and Friendship Network upon Adolescents' Physical and Psychological Development and Learning Achievement." It was conducted by Institute of Sociology Academia Sinica. Respondents were selected from 11th grade students who, in August 2006, were enrolled in public high schools in Taipei, Taiwan. Hence the first step in the multistage sampling was deployed to randomly select six schools from all high schools in Taipei. Fourteen classes were then randomly located from six schools and all of the students in the selected classes were included in the survey.

This data includes both single-gender as well as mixed-gender classes. In Taipei, it is a commonly held view that mixing the sexes in school will have a detrimental effect on academic achievement due to romantic distraction in adolescence. So while primary schools put boys and girls together in the same classroom, junior and high schools often opt for single-sex classrooms

(Wu 1991). Although the trend toward mixed education at the school level has already begun, several coeducation schools still have single-sex classroom as well as mixed-gender classrooms within the schools. Among the 14 classes, four of them were all-boy classes, four classes were all-girl classes, and the remaining six classes were mixed-gender. Having a whole set of classes provides researchers a rare opportunity to reveal insights about gendered social processes in isolation before moving to the more complex mixed-gender context. Since gender composition in classrooms should be seen as a context that generates gender differences (Perry and Pauletti 2011), I argue that this is an ideal data set for testing our proposition that there are gendered pathways to depression homophily. Though I did not specify any hypotheses for social relations in mixed-gender classes, I speculate that the magnitude of structural tendencies in this context will lie somewhat in between all-boy and all-girl networks. As a result, I might still observe depression withdrawal and contagion, but only among subgroups of girls and boys or to a lesser extent.

Five waves of demographic survey were collected during the study window from fall 2006 to spring 2009 with an interval about six months. In addition, students completed network survey of their friendships at multiple time points over two-year period, with a higher frequency of friendship nomination at the beginning of the project (see endnote 2 and 3 for detailed description of the study design).

In total, there were 592 adolescents who at least have participated one wave of the study, representing 14 classes from six schools in Taipei City. Respondents were age 17 and 18 with a mean of 17.64 (SD = .47) at wave 1. By the time of last survey (Wave 5), some of them have made it to college.

Sample

The present study employed data from Wave 1 and Wave 3. All information about the variables used in the subsequent analyses emerged from the students' self-report survey.[4] One class (an all-girl class) dropped out of the study after the first collection of data, resulting the total number of classes retained in the sample as thirteen with an average class size of 32 students (SD = 4.87). Within the thirteen classes 470 adolescents participated in the first wave of data collection. I excluded 18 students who transferred out into other schools after Wave 1 (thus were ineligible for follow-up), leaving 452 students in the sample. Another 31 cases were excluded from the final data for missing behavioral data at Wave 3, leaving the final sample of 421 adolescents.[5]

I dealt with missing data by constraining our analysis to respondents who provided full information on friendship networks and behavioral data on both waves for two reasons: (1) various imputation techniques discussed in the literature (Stork and Richards 1992) often assume cases missing at random which is not the case here (see endnote 5); and (2) previous simulation studies have found that biased parameter estimates still exist even after imputation techniques were applied (Huisman and Steglich 2008). I also consider our approach for restricting analysis to completely observed cases to be more conservative because of the hypothesized withdrawal for depressed girls.

Measures

Friendships. Friend nominations were collected in a short questionnaire:--"*please list all your good friends in this class, ranking them according to closeness (not including your boyfriend or girlfriend).* There are no limits on how many friends you can nominate." Each

network (a class) is formally represented by an adjacency matrix with 1 representing directed ties and 0 representing the absence of a relationship. Since there are multiple network data collections within each wave, I chose the ones with the closest date to students' behavior survey. I used class-wide peer nominations because in Taiwan, adolescents usually stay with the same group of classmates and teachers throughout high school (see Tsai 2004 for the details of the education system in Taiwan). Therefore, adolescents have more opportunities to form friendship with peers within the classroom instead of outside the classroom.

Depression. Depressive symptoms were measured at each wave using scale from the Center for Epidemiological Studies Depression (CES-D), a widely used instrument for measuring the prevalence of depressive symptoms among the general population. It contains 20 items asking how many days respondents experienced a number of physical and psychological symptoms of depression during the previous week. Individual items are coded on a 4-point scale, from 0 = less than one day to 3 = 5-6 days.

The CES-D has been translated into and validated in many languages including Chinese (Gupta and Yick 2001), and has shown good structural validity and reliability when administered to Chinese adolescents (Chen et al. 2009). The alpha index was high for both waves ($\alpha = .89$, Wave 1; $\alpha = .91$, Wave 3; correlation between waves = .59, $p < .000$), indicating good internal validity. Confirmatory factor analyses (CFA) also revealed that the CES-D scale in our sample has a three-factor structure, similar to previously identified pattern in the literature (Fountoulakis et al. 2001; Ghubash et al. 2000; Ying 1988).[6] Individual items were scrutinized to address concerns for potential gender-biased items of the scale but results suggested that the full 20-item scale could be adopted in our analysis.[7]

I summed the CES-D 20 items and created four categories of depression based on cutoffs suggested in the literature.[8] A score of 16 has been used extensively as the cut-off point for high depressive symptoms on this scale (Radloff 1977), so it was employed as the first cutoff. Respondents scored 15 and lower on the CES-D scale were coded 1 ("no risk group") (N_{W1} = 189; N_{W3} = 185; about 45%).

Although the cutoff of 16 is commonly used among Caucasian samples in the United States, several researchers have suggested a higher cut off point for Asians given their higher rates of reported depressive symptoms (Cheng and Chan 2005; Cho and Kim 1998; Ghubash et al. 2000; Yang et al. 2004). Hence, a CES-D score between 16 to 21 was coded 2, representing "possible risk of depression" (N_{W1} = 87; N_{W3} = 84; about 20%); a CES-D score between 22 to 28 was coded 3, indicating "probable risk of depression" (N_{W1} = 76; N_{W3} = 91; about 18% and 21%). Finally it is posited that a CES-D score greater than 29 may significantly increase individual's likelihood for being diagnosed with major depressive disorder (MDD). Thus I coded respondents to be at "high risk of depression" when their depressive symptom scores were over 29 (N_{W1} = 68; N_{W3} = 61; about 16% and 14%).

Control variable.

Stressful Life Event (SLE). I modified the negative life event scale (Simons et al. 1993) to indicate stressful life events that might happen to adolescents. Respondents were asked to indicate whether they had experienced 43 stressful events during the previous 12 months at Wave 1. The events included incidents such as being suspended from school, parents' divorce, broke up with boyfriend (girlfriend), had a fight with schoolmates, etc. (See Appendix A for full scale.) The raw stressful life event in our sample ranged from 9 to 22 (M = 3.54, SD = 3.23). I

categorized respondents into one of the four groups based on their raw score. Of the 421 students, 12% did not experience any negative life events (coded 0), about 34% had encountered 1-2 incidents, 27% had experienced 3-4 negative events, and about 27% students reported that they have had at least 5 stressful life events that happened to them or to their family in the past year (coded 3).[8]

Academic Ranking. I controlled student's academic performance at Wave 1 by asking their rank in their most recent exam. Answers from students were also verified by teacher's record. I transformed their numerical rank into percentiles within their class and later created categorical ranks from 1 to 4, with higher numbers indicating better academic performance.

Gender. I controlled gender in mixed-gender classes (0 = female; 1 = male). Two additional interaction effects between male and depression were included in models within mixed-gender classes to investigate: (1) if depressed girls will significantly less likely to extend ties compared to their male counterparts; and (2) if depression diffusion only exist among boys in mixed-gender classes.

Model Overview

This section presents a non-technical account of the model for the coevolution of network and behavior in groups. I reply primarily on stochastic actor based (SAB) models to analyze the data. For the mathematical details, I refer the reader to Snijder (2001) and Steglich et al. (2010).

The SAB model estimates peer influence on behavior as well as the processes that produce ties between actors. According to this approach, actors make individual decisions while being embedded in their social networks, but their embeddedness is changing as a result of what they themselves and the other actors do. It assumes that network change occurs through a series

of micro-steps in which actors are given the opportunity to modify their ties, either by extending a tie to a new partner or dissolve an old tie. Because the model is stochastic in nature and it is formulated in terms of changes made by the actor in his/her outgoing ties and his/her behavior, it accurately defines a mutual dependence between social relations and individual behaviors. In other words, behavior can be used as a criterion for friendship formation/loss and can simultaneously be influenced by one's friendship relations.

Each model considers two functions simultaneously: one is to estimate changes in the network (friendship selection) and the other is to estimate changes in behavior (e.g., depression). The network evolutionary part models the likelihood of a tie between adolescents by examining effects of attribute similarity, such as individual characteristic (e.g. gender) or behavior (depression). For each attribute, the network function includes the ego, alter, and similarity effect of the attribute on degree, which represents whether a person with certain characteristics are more likely to have ties. For instance, the negative ego depression parameter would suggest that depressed adolescents *nominate* fewer friends than their less depressed counterparts, a "withdrawal" mechanism abovementioned. Alternatively, a positive alter effect on academic ranking parameter would indicate that good students are more likely to *be nominated* as a friend (more popular); and a positive similarity effect indicates that ties tend to occur more often between actors with similar values on certain attribute (e.g., gender homophily).

Noticeably, the network function also controls for endogenous structural effects that help to form ties. While effects depending on externally given attributes are called *covariate or exogenous effects* in SAB model, *endogenous structural effects* are effects of the network on itself, expressing that the network acts as an opportunity set as well as a constraint on friendship

formation (Steglich et al. 2010). I included five network effects in all models: outdegree (or the selectivity of the friendship relationship), reciprocity, transitive triplet, transitive ties, and 3-cycle.

It is often expected that the outdegree parameter is negative, implying that friendship networks will be rather sparse and that the creation and maintenance of friendship ties to arbitrary others will be avoided. Reciprocity captures the tendency of an actor to reciprocate friendship choice made by others. So a positive sign would indicate that adolescents were more likely to select peers who had previously selected them.

I specified two indicators, *transitive triplets* and *transitive ties*, in my models as they capture tendencies toward triad closure: *Transitive triplets* measures the likelihood of a transitive tie based on the number of triads that can be made transitive, that is, the number of *j*s that *i* nominates as friends, while these *j*s nominate *k* as a friend; *Transitive ties* measures the likelihood of a transitive tie based on the existence of at least one friend of a friend, that is, whether there exists at least one *j* nominated by *i* who nominates *k* (Ripley and Snijders 2010). By including both variables and calculating their combined effects, I will obtain the correct interpretation of the total effect of closure indicating the extent to which an individual's playmates also interact with one another. Finally the effect of 3-cycle is the likelihood that *j* nominates *i* as a friend when *i* nominates *k* as a friend and *k* nominates *j* as a friend. Such a 3-cycle is intransitive and it indicates local hierarchy in friendship networks.

The second component of the SAB model is the behavior evolutionary function, which captures the influence from alter's behavior on ego's behavior, in various ways. These elements contain the hypothesized determinants of the probabilities of changes toward other values of the

behavior variable. Theories about social influence or contagion suggest that focal individual's behavior depends on the behavior of his or her friends. To model the overall tendency for adolescents to adopt a level of depression that brings them closer to the depression level of their friends, I use a measure of *total similarity* on depression. This measure is a function of the difference between ego's depression level and ego's friends' depression level, weighted by the total number of friends.

Analytic Plan

I start by documenting whether we observe depression homophily in the data. I estimate Pearson correlations between ego's depressive symptoms and his or her friends' average depression levels in same time period at two waves. I then estimate a series of SAB models in R software program (RSiena package version 1.1-232) (Ripley et al. 2014) to explain mechanisms leading to friendship networks homogeneity. I perform preliminary analyses separately for each class. Each model is identically specified to simultaneously estimate the relative contributions of homophilic selection and social influence on depressive symptoms, while controlling for various network and individual effects. Specifically, each model includes parameters representing structural effects, homophilic selection effects based on gender (in mixed-gender class), depression, stressful life events, and academic ranking. Parameters predicting changes in depressive behavior include linear and quadratic tendencies and behaviors of their friends.

I fit the SAB models for each of the 13 classes separately and combine the results through a multiple-group meta-analysis in which the original SAB estimates in classes within the same gender composition are summed and averaged (Snijders and Baerveldt 2003). The meta-analysis approach has been a popular method to combine results from multiple network models and has

been incorporated in network analysis software that will be used for this study. The coefficients reflect the average effect of the parameters in the networks and are tested on the basis of *t*-ratios defined as estimate divided by standard error.

RESULTS

Depression Homophily among Adolescent Boys and Girls

Table 3.1 shows descriptive statistics, including means, standard deviations, and correlation matrix among all study variables. Correlations for all-boy classes are presented above the diagonal, and correlations for all-girl classes are presented below the diagonal (Table for mix-gender class is omitted due to space limitation, but available upon request). Most of the zero-order correlations are consistent with the literature. For instance, stressful life event was positively associated with depressive symptoms ($r_{girl\ at\ t1}$= .281, $p < .01$; $r_{girl\ at\ t2}$= .561, $p < .00$) and it was negatively associated with academic performance (r_{girl}= -.187, $p < .05$).

My Pearson correlations suggest that the levels of ego's depressive symptoms were positively associated with the average levels of depressive symptoms of ego's friends, at least for the later wave (for boys, r_{t2} = .23 p = .01; for girls, r_{t2} = .24, p = .01; *p values* at time 1 > .05). The significant correlation between depression of egos and alters at time 2 provides a preliminary evidence to suggest depression homophily among both boys and girls.

Gendered Pattern of Network Dynamics

Table 3.2 shows network composition and transitions between observation moments by class. On average, student nominated 3-4 friends in each wave, though the average degree for most networks decreased over time. That is, fewer nominations were made at later waves. The Jaccard index, which express quantitatively whether the data collection points are too close

together or too far apart, was also applied to the network variables. The Jaccard score indicates how similar the two networks are (0 = completely dissimilarity; 1= complete overlap).[9] Snijder et al. (2010) recommend that Jaccard values between consecutive waves should be at least .20 and, preferably, above .30. In my case, the Jaccard scores were all above the .20 threshold, suggesting enough network tie changes between waves to be analyzed. Table 3.2 also shows modest change on students' behaviors across waves, with fair amount of increases as well as decreases in adolescents' depressive symptoms during the 12-month period.

Table 3. 3 shows results from multi-group meta-analysis of SAB model for all-girl, all-boy, and mixed-gender classes. The coefficients interpretation is the same as that for coefficients in logistic regression (Ripley et al. 2014). Results for the network evolution part of the model are reported in the upper part of Table 3.3. In discussing these results, I first review effects of endogenous structures that give us insights into the gendered patterns of friendship selection.

Across all three groups, structural network principles played prominent roles in forming friendship ties. As reflected in the negative *outdegree* parameter, networks became less dense over time. That is, adolescents were less inclined to nominate random classmates as friends. Instead, they favored mutual friendship (positive reciprocity effect) and made friends with the friends of their friends (positive *transitive triplets* and *transitive ties* effect). Because creation and maintenance of social relations require time and energy, it is understandable that students withheld their ties to preexisted relationship instead of extending them to random classmates. Despite that, it became more difficult to nominate friends overtime. In addition, effects of 3-cycles (actor $i \rightarrow j$, $j \rightarrow k$, $k \rightarrow i$) were negative and significant, suggesting rejections to intransitive triads and preferences to local hierarchies.

To address my first inquiry of differentiated network structures (hypothesis H1a through H1c), I performed multiple *t*-tests to determine whether fundamental structural processes differ by gender.[10] Results suggest that all proposed structural coefficients were statistically different between girls in all-girl classes and boys in all-boy classes. In particular, in a single-gender context, girls were less likely than boys to extend new ties to other actors. Substantively, this means that girls have a lower propensity than boys to make arbitrary friends ($t = 1.97$, $p < .05$). Instead, their friendship is driven by needs of reciprocity ($t = 3.52$, $p < .00$). Hypotheses (H1a) and (H1b) are therefore supported.

Regarding the tendency for network closure, the effect of transitive ties ($b = .734$, $p < .00$) and the effect of transitive triplets ($b = .222$, $p < .00$) for the all-boy classes are significant. When an adolescent boy has at least one indirect tie with a friend of friend compared to no friends' friends, the odds of him nominating this classmate increases by 160% ($\exp^{.222+.734} = 2.06$). In contrast, the odds of an adolescent girl making friends with friends of friends, if there is one friend of a friend, only increases by 77% ($\exp^{.426+.146} = 1.77$). The *t*-test shows that the combined effects of triad closure was larger for all-boys groups than for all-girls groups, with *t*-ratio approaching to statistical significance ($t = 1.78$, $p = .07$). Hypothesis (1c) that adolescent boys are more likely than adolescent girls to choose friends of friends as friends than to choose other classmates as friends is partially supported.

Additional analyses were performed to compare the parameters from single-gender classes to mixed-gender classes. No clear pattern emerged in relation to fundamental structural principles. Reciprocity in mixed-gender classes was lower than that in all-girl classes ($t = 2.74$, $p = .00$) but outdegree was larger than all-boy classes ($t = 2.04$, $p = .04$).

In general, results across three gendered settings confirm propositions from several studies by showing the significant contribution from reciprocity, transitivity, and local hierarchy to network tie creation. More importantly, findings also provide strong evidence to suggest structural differentials between boys' and girls' networks: while networks among girls are disjointed into micro-structures, friendship networks among boys are denser and more inclusive.

Depression and Network Selection

Model 1 through 3 in Table 3.3 estimated ego withdrawal, alter avoidance, and preference for depression similarity on friendship likelihood, while controlling confounding factors *and* peer influence in three groups. Coefficients for control variables (stressful life events and academic ranking) are omitted in Table 3.3 but they were included in all models. As predicted, I observed a negative and significant depression ego effect in all-girl classes (b = -.184, $s.e$ = .078, $p < .05$). Recall that the friendship evolution model predicts who selects whom as a friend. Results from Model 1 thus indicate that the odds of a *depressed* girl in selecting a friend is 17% lower than the odds of *less-depressed* girl in nominating a friend ($\exp^{-.163} = .832$). In other words, depressed girls gradually disengaged from their social relations by making fewer friends over time. Hypothesis (H2) is thus supported.

Depression and Peer Influence

Results for the peer influence model are reported in the lower part of Table 3.3. Consistent with my hypothesis, Model 2 in Table 3.3 (all-boy classes) reveals a positive "total similarity" effect on depression (b = .825, $s.e$ = .399, $p < .05$). Adolescent boys, but not girls, adopted depressive symptoms that were similar to their friends' depression over time. Hence, I find support for depression convergence within all-boy's friendships.[11]

Mixed-gender Classes and Depression Homophily

Finally, the SAB model was replicated for mixed-gender classes. Model 3 in Table 3.3 indicates a strong tendency toward gender homophily, confirming gender homophily presented among adolescents (b = .659, $s.e$ = .093, p < .00). The interaction effect in the network dynamic function was also significant (b = .172, $s.e$ = .100, p = .08). To probe this interaction term, I calculated the log odds of friendship formation following the approach suggested in Rulison et al. (2013). Each calculated log odds is based on ego's and alter's gender and their depression status (all else being equal). A positive value indicates an increase in the log odds of a friendship tie whereas a negative value indicates a decrease in the log odds of friendship tie.

Figure 3.2 displays the likelihood of (a) *same-gender* and (b) *cross-gender* friendship based on ego's gender and their depressive symptoms. All but one values from panel (a) were positive, reflecting a strong preference for same-gender interaction. Notably, compared to low depressed girls *and* high depressed boys, highly depressed girls (the second set of bars) were particularly less likely to befriend anyone, regardless of the gender of the alters and the mental health status of the alters. In contrast, depressed boys had modest odds of making friend either with same-gender or cross-gender classmates. Although adolescents generally do not prefer other gender peers, as can be seen from the negative values in figure 3.2 (b), highly depressed boys actually had a slightly positive likelihood to make friends with low depressed girls.

Similarly, I examined whether boys were more susceptible to peer influence than were girls in mix-gender classes. I did not find a significant interaction effect. Thus, boys in mixed-gender classrooms were no more or less likely than girls to spread depression, nor were they more or less susceptible than boys to depression in this context.

A Closer Look at the Depressed Boys and Girls

The current data offers limited means to test whether depression convergence is caused by the contagion of depression or the spreading of well-being (see endnote 11). One way to check this indirectly is to calculate the percentages of students who changed their depression categories during survey years. Based on values reported from Table 3.2 (the last three columns), it is clear that students in the mixed-gender classes experienced the highest rate of mental health improvement (50/(50+44+101) = .256), followed by girls in all-girls classes where 23.5% of girls reported improved psychological well-being by Wave 3. That a higher proportion of students in mixed-gender and all-girl classes recover from depression lends some support to the argument that compartmentalized social networks facilitate friendship withdrawal, thus insulate the rest of the networks from contagion of depressed girls.

To further explore what happened to the "most depressed" boys and girls, I checked the depression trajectory of the "high risk" groups. Table 3.4 presents students' depression scores across waves ranked by their original depression category at Wave 1. Students who were considered to be at "no risk" (group 1) of depression at the beginning of study years remain to be the healthiest group later on. There was also a greater improvement of psychological well-beings among high-risk boys (group 4) than among their counterpart girls ($\Delta_{boys} = 9.88$; $\Delta_{mixed} = 6.33$; $\Delta_{girls} = 5.29$). It appears that in the gender segregated contexts, subgroup of girls with the greatest mental health challenges are not improving at the same rate as their male counterparts. I suggest readers to interpret these descriptive cautiously. Still, considering girls' overall amelioration in depression and the most depressed ones' stalled recovery increases my confidence that girls' well-being at the group-level may come at the cost of the highly depressed girls' self-isolation.

DISCUSSION

Scholars have long been intrigued by the phenomenon of "birds of a feather flock together," in large part because it is one of the most reliable patterns sociologists observed in the empirical data. A robust literature investigating depression homophily demonstrates that the experience of depression can both shape the outlook of one's social relations *and* be influenced by the exposure to their friends' depression (Christakis and Fowler 2013; Cornwell 2009; Hatfield et al. 1994), leading to friendship homogeneity along depression dimension. Despite rich sociological theories that point to gender differences in network structure, little research has examined how gendered network structures may play a critical role in contributing depression homophily among youths. This is rather unfortunate because elucidating the exact processes of depression isolation, rejection, and contagion may help policy makers and health researchers to intervene whenever depression clusters occur. With this study, I provide theoretical arguments as to why social relations among girls facilitate depressives' withdrawal while among boys, they serve as the conduits for depression contagion. To test my propositions, I use longitudinal data from 421 adolescents in six Taiwan high schools. Of the 13 classes surveyed, seven classes are single-gender (all-girl or all-boy), providing the advantage of preserving gender differences in a clear context. To consider both selection and influence processes, I rely on the SAB models that simultaneously consider the evolution of friendship formation and behavioral adaption.

My analyses are three folds. First, findings reveal depression homophily among boys and girls by showing significant correlations between ego's and alter's depression. Second, I find strong evidence to suggest gendered patterns of friendship networks. Although both boys and girls value mutual friendship, strive for closure, and exhibit some hierarchy in their networks

across various gender settings, they diff considerably the degree of these tendencies. Especially in gender segregated contexts, girls are much more likely than boys to withhold friendship to pre-existing relations and are less open for network closure.

I also find that depressed adolescent girls tend to withdraw from their networks when they are in unisex classrooms. This is consistent with the argument that depressives' withdrawal rather than peer rejection or preference is responsible for depression homophily (Schafer et al. 2011). Ironically, depressed girls' withdrawal to more marginalized network positions also separate themselves from the rest of the network. On a bright side, the intense and exclusive relationships girls developed and maintained through discussion and self-disclosure (Crosnoe 2000) may protect the healthy girls from the contagion of their depressed. Yet, from health intervention perspective, social isolation of mentally ill person would increase the difficulties of providing social support and integration.

In contrast, depression diffuses among adolescent boys in single-gender groups. In line with past research that finds psychologically healthy or non-depressed adolescent boys are subject to the influence of friends' depression and suicide attempt (Hogue and Steinberg 1995; Liu 2006), my finding suggest that once boys form interactional ties, they start to socialize each other by gravitating toward the behavioral levels of their peers. Perhaps, the durable social relations boys fostered through shared activities (McNelles and Connolly 1999; Lever 1974) also put them in vulnerable positions where they are exposed to strong peer influence.

Finally, I observe a significant interaction effect between gender and depression ego in the mixed-gender classes. It appears that when both adolescent boys and girls are presented as available interactional partners, depressed girls continue to disengage in their network, acting

similarly to those in gender-segregated settings. However, the exposure to depression is no longer contagious for boys. It may be that, in mixed-gender settings, strong gender homophily along with small clusters preferred by girls undermines structural forces that are vital to bind individuals, stabilize network, and disseminate behaviors of any kinds. In that case, the diffusion processes in the mixed-gender classrooms is expected to be dampened the same way as observed fragmentation in the all-girl classrooms.

This study has two implications for advancing sociological understandings of depression. One of the emerging concerns in health research is to examine exactly how social network ties affect health. I take this concern a step further in the current study by revisiting nuanced gender differences in social relations in an effort to understand how gendered networks might help researchers to explain, and ideally prevent, depression clustering. I identify and analyze different paths that could result in depression homophily among social groups. Of particular interesting of my study is the insight that although social integration has been traditionally conceptualized as the primary force that promotes solidarity, which in turn protects individuals from antisocial behaviors like suicide (Durkheim [1897]1951), it could be harmful as well. My findings reinforce the idea that the structures of social networks condition their role of enticing individuals to unhealthy behaviors (Abrutyn and Mueller 2014; Hass and Schaefer 2014). When friendships are structured by shared activities where individuals have less access to withdrawal, behavioral signals such as depression become less important for friendship development. Consequently, behaviors could be easily spread among peers in these contexts. Hence, my most essential contribution to the literature is to identify the precise structure and content of social network that either inhibit or assist the spread of depression.

A significant methodological contribution of this study is to control for several alternative mechanisms of depression similarity (i.e., selection and endogenous network processes) to the extent possible with survey data, while examining the effect of peer influence on depression. From a theoretic perspective, the SAB approach models and compares multiple dimensions of attraction and fundamental structural processes that have confounded previous investigation of homophily. It is therefore the most rigorous test on the topic of depression contagion.

Limitations

Despite the novelty of the study design, I point out three limitations upon which future research can improve. My findings are based on data from six high schools in Taiwan and may not be broadly generalizable. Several features of my context, including unisex and mixed-gender settings, class-based friendship network, and multiple measurement of behaviors and friendship networks, provided a rich context for studying depression homophily. However, future research needs to examine these effects in a larger and more representative sample. At the very least, I think my results apply to a large number of classrooms in Taiwan. In the United States, the effect size for peer influence should decline because classmates differ in their courses and students tend to make friends outside their class and school. Second, class size in my setting are larger compared to those in the U.S. context, and such large class may encourage stronger enforcement of collective norms and behaviors, resulting in stronger peer effects. Future research will need to examine whether friendship size matters in this regard.

Related to the issue of having a small sample size, this study is also limited in its scope since I was unable to exam whether peers are more influential on escalation or diminution of behaviors of the focal individuals. All but one studies (Hass and Schaefer 2014) adopting SAB

model assumes symmetry in peer influence that contagion operates equally strongly as a deleterious and a salutary factor. It is also the assumption we held in this paper. Because of that, we can't argue definitively whether the depression homophily we observed in all-boy networks is a result of epidemiological contagion or from the bright sight, a positive repercussion for emotion well-being at the group level, or both. Although additional parameters embedded in the SAB model could allow researchers to tease that out, splitting the contribution of depression convergence into multiple subcomponents requires more of the data, and statistical power will suffer if effects from subcomponents are similarly strong (Rieley et al. 2014). For this reason, further research with a larger database is needed to give more unequivocal results about the (a)symmetry of peer influence.

Lastly, this paper is limited by only investigating adolescents' depression diffusion without probing further the nature and motives of this emotion convergence. The transmission of depression among boys could be the product of relationship partners' creation of a shared environment, which in turn facilitates similar emotional reaction to the same context. Or it may be that adolescents conform to or learn from their friends' style of emotionally responding to events. The cognitive argument is consistent with the idea that adolescents are under pressure to promote group cohesion in social relationships. Finally, the patterns of diffusion can be attributed to social contagion of an epidemic. It is possible that emotion contagion might develop out of more "primitive" processes that individuals quickly and automatically detect and interpret the emotional expression of their peers and then become susceptible to it (see Anderson et al. 2003, for review). Testing motivation underlay the observed assimilation of social behaviors through controlled experimental study in a laboratory setting may be a useful avenue.

CONCLUSIONS

Sociologists use few words more often than "structure," especially in the phrase "social structure." It has been conceived as "one of the most important and most elusive terms in social science." (Sewell 1992:1) Structure is so powerful and pervasive in social life that not only does it shape social actions, it also dominates and reproduces patterns of relations. Furthermore, it affects "life chances" (Weber 1968) as fundamental as individual health. In this paper, I pay special attentions to friendship networks and investigate how they affect depression of adolescents. Drawing insights from scholarships on gender and social networks, my findings indicate that within the context of gender-segregation, depression homophily is created through social selection and peer influence for girls and boys, respectively. In revisiting the nuances of interactional forces that distinguish boys' and girls' friendship networks, understandings of how social isolation is realized and how depression is diffused in social settings will afford us clarification of structural accounts of health disparity.

NOTES:

1. Alternatively, manifestations of depression could presumably serve to foster alter-approach, rather than avoidance, through the elicitation of sympathy (Laible, Carlo, and Raffaelli 2000). This would work against observing depression based homophily.
2. The dataset contains friendship nominations and demographic information from two questionnaires. The long version of survey collected adolescents' demographic information, adjustment to school life, perception of school performance, life events, and most importantly, depression. At each assessment, students, their caregivers (usually father and mother), and school teachers were asked to complete questionnaires. The students were assured that their responses were treated with confidentiality and could not be traced back to them. Questionnaires were administrated by researchers and teachers in class and parents questionnaires were filled out by caregivers at home without the presence of researchers and returned by their children to school teachers. For the short survey on friendship networks, respondents were asked to nominate their friends in the classroom multiple times within each wave, especially at earlier stage of the study, to examine (dis)stability of friendship. (Wave 1: 4-7 times; Wave 2: 3 times; Wave 3: 1-2 times; Wave 4: twice; and Wave 5: once).
3. Wave 1 data was collected in December 2006 (N = 470); Wave 2 in May 2007 (N = 484); Wave 3 in December 2007 (N = 493), Wave 4 in April 2008 (N = 464), and Wave 5 December 2008 (N = 232). Wave 5 was collected five months after high school graduation. Because of the transition to college, the data suffered high attrition rate in the last round of survey.
4. We use two instead three waves of data (Wave1, Wave 2, and Wave 3) because the models we used in this paper require a modest change in both network ties and behavior since these

changes provide the information for estimating the parameters (Snijders et al. 2010). While six months could be considered as an appropriate length for behavior and friendship network change, a yearlong period gives us more power to observe changes that can be used to model the co-evolutionary dynamics of network structure and individual behavior.

5. Preliminary analyses investigated whether students retained in our sample (N = 421) were qualitatively different from youth who either transferred out or were absent from the survey (N = 45). Specifically, we compared our final sample and missing respondents on gender, depression level, numbers of stressful life events experienced, academic ranking, and individual's network position. T-test indicates that the two groups were not significantly different on gender (t(464) = -.648, $p = 0.52$), level of stressful life events experienced (t(464) = -111, $p = 0.91$), and academic performance (t(464) = -.752, $p = 0.45$). Missing respondents were more likely to have a higher level of depression (t(464) = -1.83, $p = 0.03$), have less outgoing ties (i.e. less active in their friendship nomination) (t(453) = 2.249, $p = 0.01$), and less incoming ties (i.e., less popular in receiving friendship nomination) (t(453) = 1.74, $p = 0.04$). Further analyses indicate the missing patters hold especially true for girls. That is, compared to girls who stayed in the data, more depressed and less popular girls (who received fewer friendship nominations) were more likely to drop out of our data.
6. Confirmatory factor analysis (CFA) was conducted on all sample (N = 421) at Wave 1 using Stata 14.0 SEM module. One-factor (baseline model), two-factor (as suggest by prior exploratory factory analysis), and a three-factor correlate model were explored. First, A two-factor model fit the data significantly better than a one-factor solution, $\Delta\chi^2(1) = 421.3$, $p < .001$. This was also suggested by a decrease of 419.2 in AIC. Furthermore, a three-factor

model fitted the data significantly better than a two-factor solution, $\Delta\chi^2(2) = 24.62$, $p < .001$. AIC also decreased for 25 points. This suggests a three-factor model is most appropriate for our data with good model fit (RMSEA = .077; CFI = .89; TLI = .87).

7. Before we summed up all items, we also examined individual CES-D items that were identified as producing biased responses in comparisons of male and female respondents (Stommel et al. 1993). Two items "I had crying spells" and "I talked less than usual" were expected to generate gender specific response patterns among men and women, who otherwise exhibit the same general levels of depressive symptomatology. We did find that responses to both items depends on the gender of the respondent even after controlling for respondents' general levels of depressive symptoms as represented by the remaining 18 unbiased CES-D items. Men who otherwise have the same level of depressive symptoms as women were less likely to have "cry spells" ($Coef_{male} = -.30$, $p = .000$), and depressed men were more likely to reduce their verbal communication compared with equally depressed women ($Coef_{male} = .12$, $p = .090$), a pattern runs toward the opposite direction. We removed the two items and ran all the models with only 18 items. The results were largely the same. So it is unlikely that any findings emerged from this study were resulted from the gender "biased" scales.
8. Stochastic actor based model (see *Model Overview* for details) used in this paper requires categorical behavioral data, and the number of categories should be small (mostly 2 to 5).
9. We tested our models with and without stressful life event scale to address the concern of model over-specification given the close association between stress life events and depression

(Thoits 1981). The results were substantively the same. So we included the stressful life events scale in all of our models.

10. The value is computed by dividing the overlap tie of the two waves (i.e., the number of ties that are present at both waves) by the sum of ties present at Wave 1 but absent at Wave 3; the ties absent at Wave 3 but present at Wave 1; and the ties present at both.

11. The test statistic in comparison of two estimated parameters in the independent groups is:

$$\widehat{\beta_1} - \widehat{\beta_2} / \sqrt{SE_1^2/N_1 \ + SE_2^2/N_2}$$

where $\widehat{\beta_1}$ and $\widehat{\beta_2}$ are the estimated effects of the first and the second data set, SE_1^2 and SE_2^2 are the estimated standard deviations of the first and the second data set, and N_1 and N_2 are the number of observations in the first and second data set.

The null hypothesis states the equal parameters in standard normal distribution (Ripley and Snijders 2010). We also compared whether there is a difference in the effect of closure, which is the sum of the effects of transitive ties and transitive triplets between the all-boy classes and the all-girl classes. The formula of the test statistic is modified to:

$$\widehat{\beta_{(trans.tri.+trans.ties)1}} - \widehat{\beta_{(trans.tri.+trans.ties)2}} /$$

$$\sqrt{(SE^2_{(trans.tri)1} + SE^2_{(trans.ties)1})/N_1 \ + (SE^2_{(trans.tri)2} + \ SE^2_{(trans.tri)2})/N_2}$$

12. To distinguish the directionality of social influence, we followed Hass and Schaefer's (2014) approach to uncover the complex role of peer in depression contagion. In particular, we included both evaluation function and endowment function of depression similarity in the behavioral evolution part (see Ripley et al. 2014). Our data did not born significance on either

coefficient (for evaluation: b =2.53, s.e = .299; for endowment: b = -2.83, s.e = .367). See discussion section for further information on this issue.

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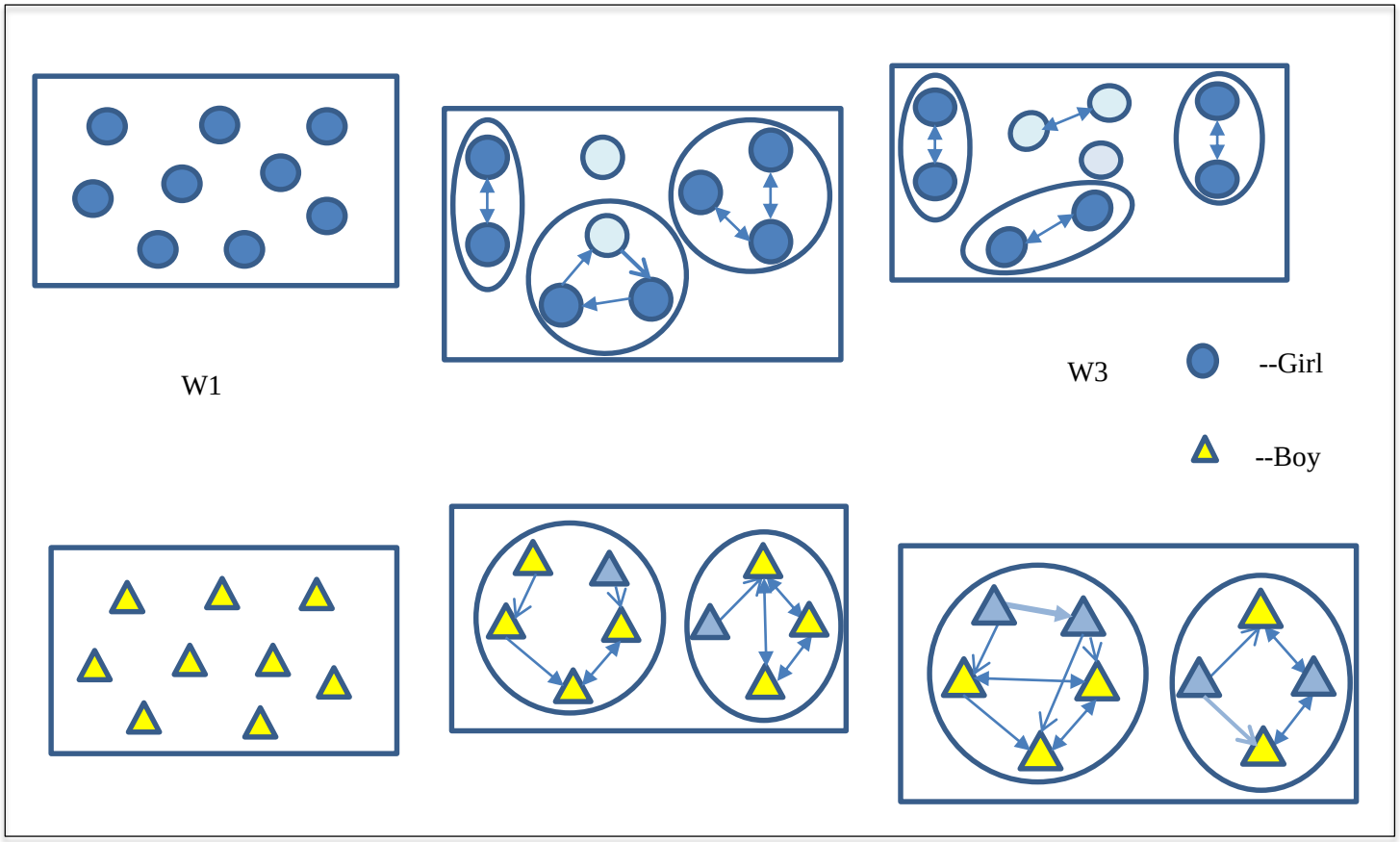

Figure 3.1. Hypothesized Network Dynamic by Gender
Note: Circles and triangles with lighter shade indicate individual girls and boys who are more depressed than others.

Table 3.1. Description of the Sample and the Variables per Observation Moment (N = 421)

	Time 1			Time 2				
	Depression	SLE	Grade Ranking	Depression	Range	All-girl	All-boy	Mixed-gender
Time 1								
Depression	__	.039	.061	.498**	1-4	2.04 (1.09)	1.89 (1.12)	2.15 (1.15)
SLE	.281**	__	-.100	.053	0-3	1.73 (.96)	1.66 (.95)	1.67 (1.04)
Grade Ranking	–.069	–.187*	__	-.002	1-4	2.66 (1.06)	2.41 (1.12)	2.53 (1.15)
Time 2								
Depression	.561***	.387**	-.124	__	1-4	2.11 (1.12)	2.07 (1.13)	2.06 (1.10)
Male					0-1	0.00 (.00)	1.00 (.00)	.48 (.50)
N						107	119	195

Notes: Correlation presented above the diagonal are for all-boy classes; below the diagonal for all-girl classes.
*$p < .05$; **$p < .01$; ***$p < .001$ (two-tailed tests)

Table 3.2. Longitudinal Network Transitions between Observation Moments

		N	Average Degree		Density		Jaccard	Behavior change (w1->w3)		
			W1	W3	W1	W3	W1->W3	down	up	constant
All-girl	class 1	33	3.33	2.91	.10	.09	.45	9	4	20
	class 2	38	4.74	3.97	.13	.11	.32	11	9	17
	class 3	36	3.44	3.17	.10	.09	.35	5	15	16
							Total	25	28	53
All-boy	class 1	34	1.71	2.32	.05	.07	.23	9	8	17
	class 2	29	3.86	4.83	.14	.17	.30	5	7	17
	class 3	33	4.97	4.70	.16	.15	.24	10	11	12
	class 4	23	1.78	1.57	.08	.07	.26	2	7	14
							Total	26	33	60
Mixed-gender	class 1	34	3.24	2.41	.10	.07	.26	12	7	15
	class 2	24	5.25	4.42	.23	.19	.46	7	1	16
	class 3	34	3.41	3.32	.10	.10	.34	10	8	16
	class 4	39	2.67	2.23	.07	.06	.21	5	11	23
	class 5	35	3.89	3.06	.11	.09	.26	10	7	18
	class 6	29	3.90	4.17	.14	.15	.31	6	10	13
							Total	50	44	101

Table 3.3. Meta-analysis Results from SAB Models for All-girl, All-boy, and Mixed-gender Classes

	All-girl (Model 1)			All-boy (Model 2)			Mixed-gender (Model 3)		
	Coef.	SE	t-ratio	Coef.	SE	t-ratio	Coef.	SE	t-ratio
Network Dynamics									
Outdegree	–2.434[a]	.128	***	–2.104[b]	.104	***	– 2.416	.091	***
Reciprocity	2.373[a]	.192	***	1.546	.136	***	1.802[c]	.125	***
Transitive Triplets	.428[a]	.075	***	.228	.045	***	.327	.048	***
Transitive Ties	.126[a]	.146		.720[b]	.133	***	.365	.110	***
3-cycles	–.376	.129	***	–.341	.083	***	–.272	.078	***
Male									
Alter							–.318	.104	***
Ego							.171	.108	
Similarity							.659	.093	***
Depression									
Alter (selection)	.120	.091		–.026	.065		.041	.053	
Ego (withdrawal)	–.184	.078	*	.029	.067		–.026	.047	
Similarity	.310	.388		.500	.367		–.029	.228	
Male * depression ego							.172	.100	+
Behavior Dynamics									
Linear Shape	.157	.101		.131	.123		–.043	.075	
Quadratic Shape	.099	.135		.306	.127	**	.024	.106	
Similarity Depression	–.074	.308		.825	.399	*	–.153	.298	
Male * depression similarity							.006	.395	

Notes: All models also included Grade Ranking and Stressful Life Events as controls.

+ p< .10; *p < .05; **p < .01; ***p < .001 (two-tailed tests).

a: t-test in comparison of coefficients for all-girl vs. all-boy classes is significant at .05 level

b: t-test in comparison of coefficients for all-boy vs. mixed-gender classes is significant at .05 level.

c: t-test in comparison of coefficients for all-girl vs. mixed-gender classes is significant at .05 level.

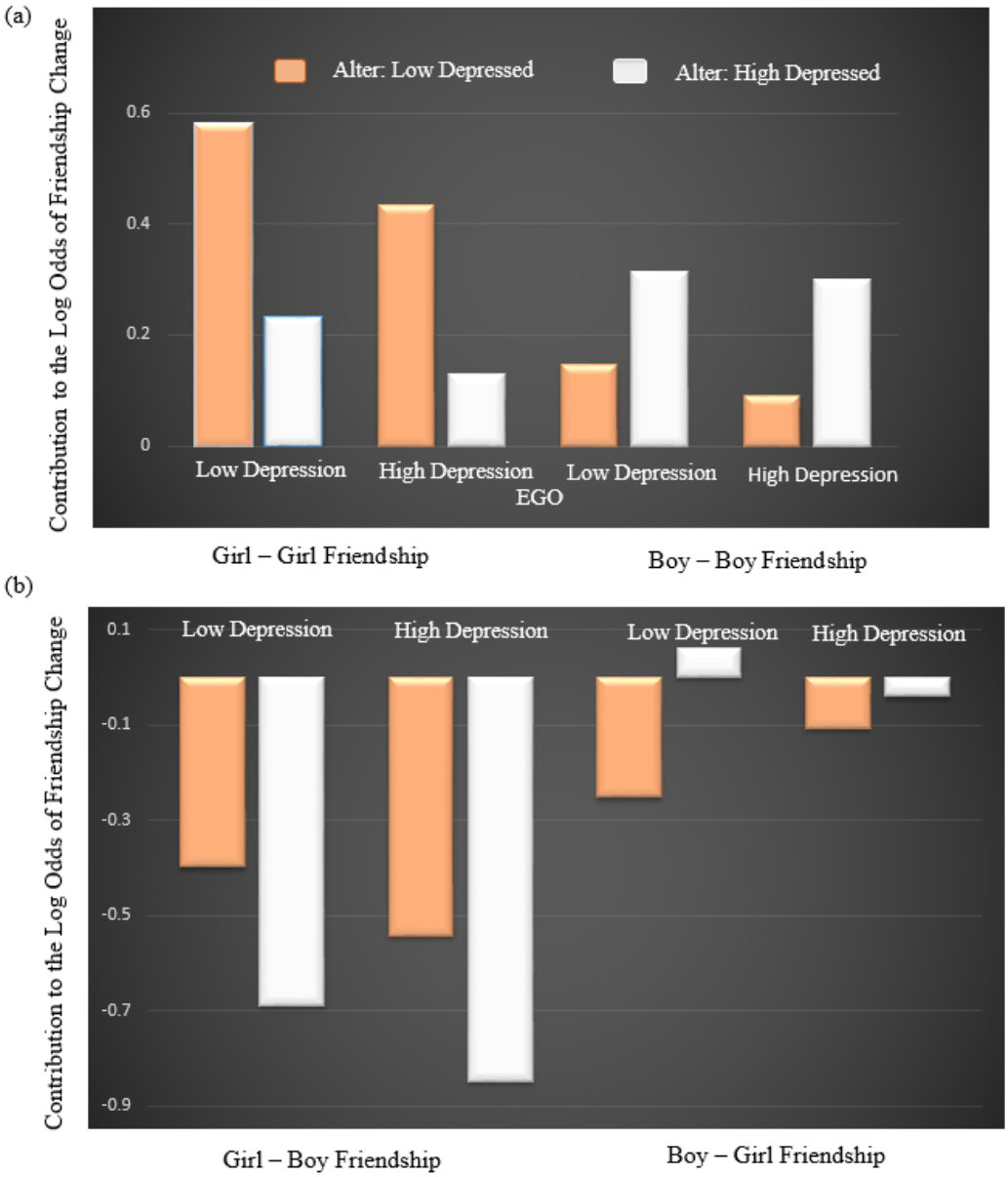

Figure 3.2. Log Odds of Friendship Ties in Mixed-gender Classes

Note: Values indicate the contribution of depressive symptom and gender to the log odds that (a) same gender and (b) cross gender friendship ties will change (see Ripley et al., 2014, for a description of how to obtain these values). We calculated the values shown based on different combinations of gender ego and alter (0 = girls, 1 = boys) and depression ego and alter (1 = low depression, 5 = high depression) using seven parameters from the final model: male ego, male alter, same gender, depression ego, depression alter, depression similarity, and male ego * depression ego.

Table 3.4. Means and Standard Deviations of Depression across Waves (N = 421)

	Depression Category at Wave 1	N	Depression at Wave 1	Depression at Wave 3[b]	Change (Δ)[c]
Boys in all-boy classes	1 ("no risk")	63	8.98 (3.91)[a]	13.0 (8.99)	-4.02
	2 ("at possible risk")	20	17.95 (1.64)	17.8 (8.33)	.15
	3 ("at probable risk")	18	24.06 (2.07)	24.61 (6.96)	-.55
	4 ("high risk-depressed")	17	34.06 (5.65)	24.18 (8.10)	9.88
Girls in all girl classes	1 ("no risk")	47	9.91 (3.74)	13.81 (7.35)	-3.90
	2 ("at possible risk")	23	17.87 (1.60)	17.47 (6.73)	.40
	3 ("at probable risk")	23	24.13 (1.84)	22.35 (7.92)	1.78
	4 ("high risk-depressed")	14	36.29 (6.40)	31.0 (7.46)	5.29
Students in Mixed-gender classes	1 ("no risk")	79	8.87 (4.23)	12.06 (7.44)	-3.19
	2 ("at possible risk")	45	18.76 (1.59)	19.38 (6.91)	-.62
	3 ("at probable risk")	35	24.49 (1.96)	20.26 (8.16)	4.23
	4 ("high risk-depressed")	37	35.14 (5.45)	28.81 (12.68)	6.33

Notes: [a] Standard deviations are in parentheses. Means are calculated using the raw score of depression at each waves. It ranges from 0 to 60 (20 items on a 4 point scale from 0 = less than one day to 3 = 5 to 6 days).

[b] Respondents' average depression score at Wave 3. Individual's depression category at Wave 3 may have changed but we calculated mean depression scores for the same group of respondents who were in each category at Wave 1.

[c] Change scores are calculated by subtracting depression score at Wave 3 from depression score at Wave 1.

CHAPTER 4

STUDY 3: MODELING AFFECTIVE BASIS OF MORALITY AND JUSTICE AMONG CHINESE AND AMERICANS[3]

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ABSTRACT

Building research on how affective sentiments organize social interaction, this study offers the first investigation on how social events shift such sentiments among Chinese. This paper is only the second exploration of impression-change in an Asian context, and is the first re-analysis of the classic U.S. impression-change data from the late 1970s, using new Bayesian methods that have been shown to be most accurate for these types of data (Morgan et al. 2016). Using Bayesian Model Sampling (BMS) techniques, I estimate determinants of normative sentiments changes in social events using data collected in China in 1990s. I then use Structural Equation Modeling (SEM) to compare the processes of impression change between Chinese and Americans. Results provide evidence for cultural similarities regarding how social events change people's normative sentiments about roles, identities, and actions into new feelings. Yet, findings also reveal important cultural differences in identity plasticity and individuals' response to transgression. Identities are more malleable in situations among Chinese than those among Americans. Moreover, while both Americans and Chinese value positively retaliation ("an eye for an eye"), Chinese believe that people occupying benevolent identities and their actions become more virtuous if they also direct good at their enemies. Americans, in contrast, rely on the moral standards of justice whereby people grant more positive evaluations to esteemed actors who punish transgressors. Implications for the affective basis of morality and justice are discussed.

INTRODUCTION

While recent scholarship on culture and action have shown an increasing interest in fast, unconscious cognitive processes (Miles 2015; Vaisey 2009; Vaisey and Lizardo 2010), the idea that individuals carry around beliefs, perceptual schemas, and predispositions that influence how they act has been around for more than half century (e.g., Mead 1934; Blumer 1969). In particular, affect control theory has long maintained that behavior is affectively generated and cognitively driven as to minimize mental disturbance in social interactions (Heise 1979, 2010; Smith-Lovin and Heise 1988).

At the core of affect control theory is the aim to understand the ways in which social actions shape and are shaped by affective meanings of cultural concepts. That is, how social events normatively transform individuals' affective sentiments toward identities and behaviors in situations from one state to another (Heise 2015). Prior work elucidating the cognitive process of impression formation focuses almost exclusively on western cultures such as United States, Canada, and Germany (Britt and Heise 1992; MacKinnon 1985/1988/1998; Schröder 2010; Smith-Lovin and Heise 1988; for exceptions, see Smith, Matsuno, and Umino 1994; and Smith, Matsuno, and Ike 2001). As importance as the these gains have been, I argue that affect control theory's propositions about the cognitive processes and the control principles need to be tested in a broader context where various social and psychological processes in interpreting events may be influenced by a given culture.

In this article, I ask the critical question about how social events systematically shift around Chinese's normative sentiments about cultural concepts, and to what extent these cognitive processes of Chinese are similar to or different from those of Americans. I present the

argument in two parts. First, I provide a synopsis of affect control theory, arguing that the core component of the theory—the process of impression formation—warrants further investigation in a non-English speaking, non-western culture. Second, I review recent methodological development in Bayesian Model Sampling (BMS) method, suggest that this new approach of model specification addresses the shortcomings of previous work, thereby making methodological advancement to the impression formation research.

Drawing on archived affect control theory data collected in Shanghai, China in 1999 and Chapel Hill, North Carolina, United States in 1978, I first estimate a set of impression formation equations for each culture. I then compare the impression formation processes of Chinese to those of Americans using structural equation framework. To preview my findings, results show evidence of cultural similarities with regard to the mental processes of forming new impressions after an event. However, cross-cultural comparisons also indicate important nuances in individuals' response to transgression. While both Americans and Chinese value retaliation, or the "an eye for an eye" strategy, Chinese believes that people occupying benevolent identities, as well as the actions, become more virtuous if people forgive, instead of retaliate, the perpetrators. In stark contrast, Americans rely on the moral standards of justice whereby people grant more positive evaluations to esteemed actors who punish villains. I conclude with a discussion of the implications of these results for sociological theory of culture and morality.

AFFECT CONTROL THEORY

Affect control theory arises from the tradition of symbolic interactionism (e.g., Mead 1934; Blumer 1969; Stryker 1980). The theory shares the premises of traditional symbolic interactionism in assuming that individual's action is guided by culturally shared symbolic

representation of identities, behaviors, emotions, and situations, and that languages are the interpersonal medium by which cultures are created and maintained (Heise 1979, 2007). Affect control theory sets itself apart from the classic symbolic interactionism, however, in two important ways. First, instead of viewing the processes of culture production as constantly fluctuating and therefore unavailable to modeling, affect control theory postulates the persistence of culture and delineates a set of mathematic models that describe how cultural meanings are brought into social interaction (Heise 1987). Second, it rests on the idea that our labeling of social situations evokes *affective* meanings. It is these affective meanings, rather than the specific labels (i.e., languages), that individuals try to maintain during interpersonal interaction (Heise 1979). To understand how people plan for, interpret, and redefine interpersonal interactions, affect control theory formulates its arguments in a three-part proposition—sentiment measurement, impression-formation equations, and mathematical minimization principles.

Sentiment Measurement

Affect control theory begins with the assumption that labels of cultural representation carry connotative, affective meanings or sentiments (Heise 1979, 2007, 2010). In particular, every cultural concept (i.e., identity, behavior, emotion, and social settings) has a affective profile that represents a location in a cross-culturally three-dimensional semantic space: (1) *Evaluation*—the approval or disapproval of something, based upon criteria as *bad*, *awful* versus *good*, *nice*; (2) *Potency*—based upon size, strength or power, as *little*, *powerless* versus *big*, *powerful*; (3) *Activity*—based upon perceptual stimulation (*noisy* versus *quiet*), speed (*fast* versus *slow*) or age (*young* versus *old*) (Osgood, Suci, and Tannenbaum 1957; Osgood, May, and Miron 1975). The EPA profile of the concepts is culturally determined and characterizes most people's

affective feelings attached to specific roles, identities, behaviors, etc. Because these affective sentiments are normative, they are referred as *fundamental sentiments* in the theory (Heise 1979). When an event occurs, interactants activate their fundamental sentiments attached to entities in the situation (i.e., actor, object, behavior, emotion, and setting) and use those affect-based information to plan for actions.

While fundamental sentiments allow people to form expectations of social events and effectively respond to them, meanings of identities, actions, emotions, and settings shift around when they combine in context such as in an interpersonal interaction. For instance, people within most cultures tend to view the action of killing as heinous. However, most people would also agree that the action of killing is less evil when it occurs between a solider and a terrorist in combat. Similarly, we often think of the identity of a criminal as quite bad. Yet when jurors observe a criminal confessing manslaughter with apparent signs of remorse, they evaluate him more positively than those who show no emotional displays of distress (Robinson, Smith-Lovin, and Tousdis 1994). In both cases, the observers' *in-context* impressions for the actor (i.e., solider and criminal), his behavior (i.e., killing and confessing), and the person who is the object of that behavior (i.e., terrorist and victim) are somewhat shifted from *out of the context* fundamental meanings given the combination of entities in these situations.

Thus, apart from measuring the enduring normative sentiments held by people socialized with a given culture, the theory also measures affective feelings that produced by events. Because these ephemeral feelings are generated by individuals' participation in social interaction, and events undermine normative sentiments more or less depending on the situations, affect control theory refers to these contextualized EPA sentiments as *transient impressions*. The

difference between fundamental sentiments and transient impressions can be conceptualized as psychological stress (or "*deflection*" in the theory) experienced by the interactants whenever implausible, surprising, or abnormal social events occur. Extant studies have found strong links between the degree of deflection and mental health consequences (e.g., Boyle and McKinzie 2015).

Impression Formation Equation

A key element of affect control theory is a formal delineation of the exact social psychological processes involved in the emergence of transient impressions. As Heise nicely summarized it, the goal of the impression formation research is to understand "how a social action normatively transforms individuals' feelings about interactants and behaviors from initial states to contextualized states." (2014: 2561). Theoretically, the impression formation process speaks to the basic assumption of interaction theory that, identity depends on the definition of a situation and different definitions of the situation evoke different identities. Methodologically, this means transient sentiments for behaviors, identities, emotions, and/or settings should arise from fundamental sentiments of each element in the situation along with the interplays between them.

Affect control theory specifies determinants of normative sentiments change in a set of impression formation equations. Because each event contains three elements (Actor, Behavior, and Object, ABO) and each element is measured along three semantic differentials (EPA), a total of nine equations are estimated for a given culture. Each equation characterizes how an element in post-event impression (A_e', A_p', A_a', B_e', B_p', B_a', O_e', O_p', O_a') is influenced by affective meanings of event elements existing before the interaction (A_e, A_p, A_a, B_e, B_p, B_a, O_e, O_p, O_a)

separately and jointly. In impression equations, each term represents a unique psychological process. For instance, research consistently finds the *stability* effects (e.g., the effect of Be on Be′, the effect of Ap on Ap′, etc.) in previous impression formation studies. These effects indicate that people's mind always transfers some pre-event feeling toward an event element to the post-event feeling involving the same event element. Thus, an actor seems nice after events if the actor was nice to begin with, and a potent behavior remains powerful in situations, regardless who inflicts them on whom, and so forth.

But of course, interactions change normative meanings of roles, identities, and behaviors depending on situations. Complex psychological processes involved in the emergence of impression have been taken into account through the examination of event element interactions. In particular, several interaction terms have been identified as both theoretically sounding and empirically significant (Britt and Heise 1992; MacKinnon 1985/1988/1998; Schröder 2010; Smith-Lovin and Heise 1988; Smith et al. 1994; Smith et al. 2001). For example, the *consistency* term (e.g., the effect of BeOe on Ae′) tests the justice expectation that people's actions should bring morally fair and fitting consequences to that person. In other words, we expect a good person to be treated nicely and a bad person to be treated harshly. In the more complicated *morality* term (e.g., the effect of AeBeOe on Ae′), it distinguishes, in a given culture, whether a good actor earns more respect by returning favors to a good person (when the coefficient is positive), or on the contrary, by rescuing an evildoer (when the coefficient is negative).

Mathematical Minimization Principle

The last component of affect control theory is the control principle that governs individual's social actions during interaction. Individuals seek to understand and experience the

world comfortably. In the framework of affect control theory, actors achieve this goal by constructing lines of social actions that reinforce cultural meanings. Hence, social actions are results of individual's psychological need to maintain consistency between culturally shared normative sentiments about social situations and transient impressions resulting from interpersonal interactions. When situations do not follow the mental script presumed by the observer, that is, when situations violate cultural expectations, individuals take various strategies to make sense of the situation (Boyle and McKinzie 2015; Kroska and Harkness 2011). Again pulling from earlier examples, observers may redefine the crime committed by a remorseful defendant as an "unfortunate incident" whereas a similar act from a relaxed defendant is referred as a "heinous crime" (Robinson et al. 1994). The theory argues that, as long as people operate in a cybernetic control fashion that strive to minimize mental disturbance in disconfirming events, researchers could reliably predict actors' future actions using estimates from impression formation equations.

To sum up, affect control theory proposes that the affective structure of our languages shapes people's social cognition and generates social actions so that emerging impressions would reinforce sentiments about salient identities, behaviors, and settings (Heise 2007). Predictions derived from the theory have been empirically tested in simulation, qualitative, quantitative, and experimental studies (for a review, see MacKinnon and Robinson 2014). Among the three parts of affect control theory, modeling the impression formation processes is of the most importance to social psychologists because it sheds light on a variety of social-psychological phenomena linking action to culture. In studying and comparing the cognitive processes cross-culturally, researchers also gain knowledge about societal norms that govern people's social behaviors and

discover cultural consensus or differences regarding psychological processes involved in interpreting events. Although in the early stage of the research program, affect control theorists assumed that affective processing of impression formation are universal, notable differences have appeared in studies to date (e.g., Schröder 2010; Smith et al. 2001). It is thus an open empirical question whether China, a society with long-tradition of collectivism and Confucianism, represents a distinctive culture that requires the development of new equations of its own.

MODELING IMPRESSION FORMATION USING BAYESIAN MODEL SAMPLING

Despite the importance of studying normative processes, researchers face methodological challenges in choosing a trustworthy procedure for model specification and estimation. Previous work on impression formation research has been mostly relied on stepwise regression analysis (Schröder 2011; Smith-Lovin 1987; Smith et al.2001; Smith et al. 1994). This approach conducts model specification (i.e., choose the appropriate determinants) and model estimation (i.e., produce coefficients) simultaneously by adding (forward stepwise regression) or removing (backward stepwise regression) predictors one at a time, with regression being re-estimated after each step. Known drawbacks of stepwise regression have been discussed elsewhere in detail (see Freedman 1983). In short, for models with large numbers of potential predictors, stepwise regression analysis tends to produce high rates of Type II error—the incorrectly retaining a false null hypothesis (a "false negative"), and may not give valid results about any individual predictors due to model multicollinearity (Heise 2012, 2015). Practically, this means that many *atheoretical* effects are mistakenly included in the final model and estimates of retained effects are somewhat biased (Morgan, Rogers, and Hu 2016).

Heise (2015) proposed an alternative approach, taking three steps in his analyses to minimize correlations and unbalanced variances among predictors. In the first step, researchers treat each potential variable as a micro-experiment—a manipulation that may or may not influence transient meanings—by converting continuous out-of-context ratings of stimuli into dichotomized factors. Such transformation minimizes correlations between predictors and creates equal variances for all variables. In the second step, researchers utilize Analysis of Variance (ANOVA) to identify important determinants/factors that are involved in the sentiments change process. In the final step, researchers proceed to structural equation modeling (SEM) to estimate model coefficients with the scalar values of factors rather than categorical transformations.

Compared to stepwise regression, the ANOVA-based procedure is straightforward and produces models with much lower rates of false identification (i.e., Type II error). However, the parsimony of the models comes at the cost for eliminating several medium-sized predictors (Morgan et al. 2016). Moreover, the general procedure of variable selection in ANOVA-based method is still largely deterministic, rather than probabilistic, in that it fails to consider the probability of an effect within the context of a distribution of more or less probable models.

In this article, I utilize Bayesian Model Sampling (BMS), a method that has shown considerable advantages over previous two approaches in model specification and estimation (Morgan et al. 2016). Specifically, Bayesian model sampling method selects variables based on their relative probability of inclusion in multiple models. Upon estimating hundreds of thousand possible models, the method aggregates all candidate models to give an estimation of a weighted distribution for each parameter. The higher the probability that a parameter is included in candidate models, the more important the predictor is. It is superior to stepwise regression and

ANOVA-based approach because the final model averages the likelihood of falsely including or rejecting a predictor by chance. As a result, it avoids type I error, or the incorrect rejection of a true null hypothesis, by averaging model uncertainty across multiple models and estimating relative importance of each predictor; it also avoids type II error by not eliminating predictors based on analysis order. Additionally, Bayesian model sampling method estimates models with different subsets of covariates instead of estimating models sequentially. This approach significantly reduces multicollinearity because all models estimated now are nested within each other in a hierarchical fashion. According to Morgan and colleagues (2016), Bayesian model sampling method "strikes the best balance between explanatory power and parsimony, with the lowest false positive rate, bias, and variance of all the method, and comparable true positive rates to ANOVA (p. 327)". To learn more about social science applications of Bayesian methods, see Lynch (2007).

THE CURRENT STUDY

The foregoing discussion provides a general overview of affect control theory that is empirically grounded and mathematical modeled. While the theory has introduced a greater falsifiability in sociological theory and has also helped address many of the debates among social psychological theories (Schröder, Hoey, and Rogers 2016), researchers have not examined the impression formation process among Chinese. Hence, this paper has two goals. First, it is the first attempt to estimate Chinese impression formation equations using Bayesian model sampling method. These equations will allow researchers to examine the cognitive processes through which affective meanings restrict and shape actions among Chinese. The second, more ambitious, goal for the current paper is to examine cultural consensus and differences in

cognitive processing of impression formation. By comparing impression formation processes of Chinese with those of Americans, this paper intends to uncover subtle distinctions that are culturally meaningful.

METHOD

Chinese Data

The Chinese data collection was supported by a National Science Foundation grant to Dr. Herman W. Smith (then a professor from Department of Sociology, University of Missouri-St Louis) and was collected by professor Herman W. Smith and Yi Cai (then a PhD candidate from Department of Educational Psychology, University of Wisconsin-Milwaukee) at Fudan University, Shanghai, PRC in 1999. There were two steps involved in the Chinese data collection process. Initially, researchers translated 467 Identities, 350 Behaviors, 99 Emotions, 199 Traits, and 179 Settings for 1294 common words in the American version of affect control theory semantic lexicons. These common words are representative of cultural concepts. Then, to ensure that all words are reasonably equivalent in denotative meanings in both cultures, items that are likely to evoke ambiguous meanings (e.g., stimuli with single or clear denotative translations in English may have multiple denotative meanings in Chinese) were taken out.

To estimate impression equations, both individual stimuli (words) and phrases (events) are included in data collection. Because Chinese follows the English language case-grammar in "actor-behave-object (ABO)" fashion, of which Affect control theory operationalizes its definitions of situations, all events were constructed in such way (e.g., "salesman serves schoolgirl"). Later, professors and graduate students at Fudan University went through the lists to make sure that all verbs were transitive and usable in sentence of the generic form "actor does

something to object." Finally, a separate group of undergraduate students were asked to check off the unclear concepts from the translated lists of potential stimuli. The final procedure has resulted several additions and deletions of items.

The final list of stimuli includes 450 Identities, 300 Behaviors, 99 Emotions, 150 Traits, 150 Settings, and 258 Events for the most common words or phrases. They come from the American stimuli, but are not a word for word translation of the American or Japanese semantic dictionaries. Ratings for individual stimuli of words are designated as "fundamental sentiments", whereas EPA ratings for identities and behaviors consisting of events are deemed as "transient sentiments" or impressions. EPA ratings on both in-context and out-of-context stimuli were aggregated from individual level data.

Although the 258 events that I used for impression formation estimation are not full factorial events design (see below for details), most impression-formation studies have limited their events between the numbers of 100 to 214 in order to economize data collection. Empirical results from a smaller sample of event sentences have also shown good external validity in terms of representing normative views of a given culture (MacKinnon 1985/1988/1998; Schröder 2011; Smith et al. 1994) and estimated coefficients from the large and small samples are reasonably close for terms that appear in both equations (Heise 2012).

Data were collected using applied techniques and instructions from prior studies to ensure standardized procedure. A Chinese version of standard data collection program ATTITUDE (Heise and Lewis 1988) was employed, resulting 1150 lexicon entry produced from 380 undergraduate respondents at Fudan University. Participants were presented stimuli randomly and asked to make ratings on each of the three semantic differential scales (*Evaluation*: good vs.

bad; *Potency*: powerful vs. powerless; *Activity*: lively, young, noise vs. slow, old, quite). Scores were assigned to scales that are anchored with the following adverbs: slightly =1 or –1; quiet = 2 or –2; extremely = 3 or –3; infinitely = 4 or –4; and neural = 0, right in the middle.

To ameliorate fatigue and other instrumentation biases, the study protocol restricts participants to rate an upper limit of 150 stimuli. For participants rating more than one dataset, a 15 minutes rest was required before participants proceed to the next scaling task. In general, studies have showed that this survey method leads to fewer errors than traditional paper-and-pencil approach does (Heise 1997).

The United States Data

For the U.S. culture, I draw data from the North Carolina 1978 dataset between EPA ratings of 721 Identities, 600 Behaviors, 440 Modifiers, and 345 Settings were obtained with paper questionnaires from 1,225 North Carolina undergraduates (Smith-Lovin and Heise 1988). In addition, it includes a total of 515 event sentences that were composed to reflect a full factorial design. The 512 events were included to exhaust all possible ± EPA profiles of actors, behaviors, and objects with each other ($2^3 \times 2^3 \times 2^3$) along with three additional events representing all-neutral sentences for administration purpose.

The newest U.S. affect control theory data has been recently collected in 2010 (Robinson and Smith-Lovin 2016). However, I decided to choose the U.S. 1978 data as my comparison because, in terms of social, economic, and cultural development, China in the late 90s more closely resembles the United States in the late 70s more than it does the United States in the 2010. Future research should investigate whether the impression formation processes among Americans change over time.

Analytic Strategies

I first employ the Bayesian modeling sampling method to estimate impression formation equations for Chinese and Americans separately. The Bayesian methods report inclusion probability for each parameter. An inclusion probability of one indicates that the parameter occurred in all models, whereas a value of .5 indicates a 50 percent chance for the parameter to be included in all models. I follow earlier work (Fernandez, Ley, and Steel 2001) in using a posterior probability of .5 as the cutoff for inclusion in a given model.

Upon establishing the impression formation equations for Chinese and Americans, I rely on multi-group analyses embedded in structural equation modeling (SEM) to determine whether impression formation processes are the same in two cultures. Finally I pool any specification that was significant in either culture, create interaction terms between each predictor and the U.S. culture, and estimate that cumulative model in both using Bayesian Model Sampling. If significant interaction terms are emerged from probabilistic modal sampling, however, I view them as evidences to suggest cultural differences between Chinese and Americans.

RESULTS

Cognitive Processes of Impression Formation among Chinese

Nine impression formation equations for Chinese are presented in Table 4.1. Using Bayesian model sampling method, the *Chinese* dataset produced 38 predictors in nine equations, including nine first-order main effects, six second-order, and two third-order interaction terms. These are the parameters that reach the lower bound of .5 threshold for model specification. That is, they showed up in at least 50% of models that were estimated. As discussed above, each impression formation model can include up to 63 different parameters and not all parameters are

theoretically relevant. To ease interpretation, Heise (2015) classifies terms in the equations as implausible or atheoretical if a term and the variable it predicts involve three dimensions (e.g., the effect of AeBaOp on Ae′). Based on Heise's classification, of the 38 predictors yielded from Chinese equations, only one term (i.e., the effect of AaBaOe on Ap′) is posited as atheoretical resulting from BMS method.

Among the predictors that are deemed as plausible, prior work has established a select few as culturally meaningful interactional mechanisms (see Heise 2007). Of the most documented are the *stability* effects, or the direct effects of fundamental sentiments about each event element on transient sentiments of that element in situations (e.g., the effect of Be on Be′, the effect of Ap on Ap′, etc.). Recall that these determinants suggest that people's mind always transfers some pre-event feeling toward an event element to the post-event feeling involving the same event element. Thus, the stability effect on actor's evaluation means that the niceness of an actor in a given situation (Ae′) is the generalized goodness people normally associated with the identity of that actor ($Ae_{(coef. = .40)}$). In a similar vein, behaviors seem powerful (Bp′) if they are potent to begin with ($Bp_{(coef. = .36)}$). As can be seen in Table 4.1, all nine stability terms are significant, with all but one (Ae′) being the largest predictors of impression in situations. The overall patterns on stability effects indicate that to a great extent, people stick to their fundamental feelings about others even when they perceive contradicting actions.

Social behaviors, nevertheless, do matter in impression formation. Chinese, like people in other cultures, also cognitively process a tight link between actors and their behaviors. In particular, behaviors seem nicer when they are done by good actors (i.e., the effect of $Ae_{(coef. = .17)}$ on Be′). Anything that a person in a powerful identity does seems more impactful than something

done by an actor occupying a lower power position (i.e., the effect of $Ap_{(coef. = .31)}$ on Bp'). In a similar vein, kind actions enhance actors' evaluation whereas dominant behaviors empower the actor (i.e., the effect of $Be_{(coef. = .59)}$ on Ae' and the effect of $Bp_{(coef. = .29)}$ on Ap'). Interestingly, in the eyes of observers, object persons exposed to dominant behaviors seem rather weak in the light of the event (the effect of $Bp_{(coef. = -.24)}$ on Op'). Consistent with other studies (Schröder 2011; Smith-Lovin 1987; Smith et al. 1994; Smith et al. 2001), this suggests that the power differential between actor and objects is of mutual importance for the potency impression in China: the stronger the actor, the weaker the recipient of a powerful behavior, and vice versa.

Chinese equations also demonstrate strong psychological consistency in social interaction. People perceive actors and their behaviors in a better light if person occupying positive identities does something philanthropical (the effect of $AeBe_{(coef. = .15)}$ on Be') or if a merciful act is directed at a good person (the effect of $BeOe_{(coef. = .36)}$ on Ae' and the effect of $BeOe_{(coef. = .29)}$ on Be'). That is, the effect of the behavior on the actor impression is moderated by situational expectation. In essence, this reflects the cultural belief that behavior should suit the status of the persons involved in the interaction. Accordingly, actors who behave assertively or forcefully to a nice person would incur social sanction by receiving a dent on their evaluation (the effect of $BpOe_{(coef. = -.13)}$ on Ae').

There are also some important three-way interaction effects. Specifically, the balance effects (the effect of $AeBeOe_{(coef. = -.11)}$ on Ae' and the effect of $AeBeOe_{(coef. = -.06)}$ on Be'), or the so-called *morality* term, speaks to the moral standards to which society builds virtues on. As discussed earlier, the *positive* interplay between actor, behavior, and object evaluation suggests that esteemed person become more virtuous if they return good with good (or repay insult with

insult). In contrast, the *negative* effects found in the China data indicate that in the Chinese culture, socially respectable actors, as well as their kind behaviors, earn more status if they choose to save or help, instead of revenge, villain objects. I will return to this point after discussing the opposite findings from U.S. equation estimation.

Cognitive Processes of Impression Formation among Americans

Results for impression formation processes of Americans are presented in Table 4.2. Using the same BMS method, the *U.S.* dataset produced 70 predictors in nine equations, including nine first-order main effects, twelve second-order, and four third-order interaction effects. Again, these are the parameters that reached the lower bound of .5 threshold for model specification. Compared to the Chinese equations, the U.S. equations have almost twice the predictors as those identified in the Chinese impression equations, with nine *new* terms emerged in the U.S. equations. The majority of the predictors were clustered in the top panel of the models, suggesting the major roles played by fundamental sentiments in forming impression in events. In line with previous findings, the *stability* terms are among the most important predictors in all but one equation (Ae'). Good actors retain much of their culturally-determined evaluation regardless of what happens during the event ($Ae_{(coef. = .54)}$). Potent behaviors remain quite strong, no matter who inflicts them on whom ($Bp_{(coef. = .78)}$), and so forth.

Nevertheless, how we think about an actor in a situation is also hinge on our normative understandings of his or her actions. Examining the seven behavioral effects (in orange cells) in actor impression equations reveals that people view actors as better, stronger, and livelier person when they behave accordingly (i.e., nicely, powerfully, and actively). Nevertheless, nice gestures also shadow the actors by making them seem weak and inactive. This pattern speaks to the

double nature of "playing nice" in interpersonal interactions. Acting friendly increases perceptions of how nice individuals are in that situation; but it also undermines evaluations about actors' competency and expressiveness during the same event.

Similar to the patterns found in the Chinese equations, Americans also demonstrate strong psychological consistency in social interaction. When good people behave nicely, every entity in that event, the actor, their behavior, and the object person, all seem nicer (the effect of AeBe on Ae′, Be′, and Oe′). Similarly, directing merciful behaviors toward good others (the effect of BeOe on Ae′, Be′, and Oe′) contributes to boost of evaluation on all elements. Moreover, confirming to the justice expectation, Americans see the actors in a worse light when they bully nice person (the effect of $BpOe_{(coef. = -.13)}$ on Ae′) or disrespect weak object (the effect of $BeOp_{(coef. = -.10)}$ on Ae′). In the latter case, the actors are likely to lose more status if they are socially esteemed actors (the effect of $AeBeOp_{(coef. = -.06)}$ on Ae′). Specifically, when people observe an actor disparaging a disabled person, they often think less of that actor. However, evaluation of that actor will be even worse if he or she turns out to be a doctor, an identity that we normally associate with high evaluations.

Finally, contrary to the Chinese results, I find significant and positive effects on the moral terms (the effect of $AeBeOe_{(coef. = .11)}$ on Ae′ and the effect of $AeBeOe_{(coef. = .09)}$ on Be′) in the U.S. impression formation equations. Combing with the consistency effect (the effect of $AeBe_{(coef. = .13)}$ on Ae′), this indicates that in the American culture, performing kind behaviors makes good person seems more virtuous, but even more so, if those acts were directed toward nice person. Similarly, Americans expect actors to penalize villains or reward heroes (the effect of $BeOe_{(coef. = .30)}$ on Ae′), but even more so when the acting agent is a socially respected person. It implies

that, in the U.S. society, actors, especially the esteemed ones, gain social status by restoring social justice through the punishment of transgressors.

Before pooling specifications from two cultures, Table 4.3 shows the numbers and proportions of theorized and atheoretical coefficients emerged in two sets of equations. In general, the U.S. equations identified more theoretically terms, possibly due to a larger sample size (Heise 2015), whereas Chinese equations yielded more concise models with fewer atheoretical terms. Most of the identified terms were the same across cultures, with all but two coefficients showing consistent signs across groups. To explicitly test whether impression formation processes are the same in these two cultures, I proceed to structural equation modeling constraining specification that was significant in either culture to be equal versus freely estimated.

Cultural Comparisons on Cognitive Processing of Impression Formation

Table 4.4 presents SEM results comparing Chinese impression formation equations with U.S. ones using equality constraint tests (Wickrama et al. 1995). I first run multi-group SEM models constraining coefficients to be equal across two groups (M1: equal). I then free all paths to determine whether letting coefficients to be freely estimated between groups (M2: No constrain) contributes to an improvement in model fit to the baseline model. McDonald and Ho (2002) propose that for an acceptable SEM model, RMSEA should be smaller than .08, CFI and TLI should be greater than .95, and the smaller the BIC, the better. For each equation, the table thus presents fit indices using these criteria and reports the change in $\chi 2$ and the p-value associated with this difference.

Table 4.4 shows that allowing the paths to vary between groups produced a significant improvement in model fit in all nine equations (all *p*s < .000). All models with free estimates between groups show excellent fit of the data whereas the models with constrains have bigger BIC values and poor RESEM and CFI fit. These results suggest that impression formation equations of Chinese, on a whole, significantly differ from that of Americans.

To investigate the exact cognitive processes that generate these distinctions, I created interaction terms between all previously identified predictors and a dummy variable representing U.S. data. Using Bayesian model sampling method again, I estimate whether specific determinants of impression formation are more impactful in one culture than in the other culture. Table 4.5 presents results from BMS estimations. Significant differences on coefficient estimations between U.S. and China are shown in cells, with the Chinese value first, U.S.A. second, separated by a vertical pipe (|). All coefficients are standardized.

Of the 72 predictors yielded in the equations (based on the .5 threshold in the BMS), 50 predictors are common in both cultures. It seems that, despite the disparities at the group level, most equations shared similar terms and the directions of coefficients were consistent across cultures. For example, people in both societies reinforce normative meanings of roles, identities, behaviors, emotions, etc., by sticking to the fundamental sentiments even when entities in situations change constantly. So Chinese and Americans may attach different meanings to, say, the role of a wife ($EPA_{Chinese}$ = 2.59, -0.01, 1.81; $EPA_{Americans}$ = 2.71, 2.17, 1.2), but when they process the cultural concepts in a situation such as "a wife adores a baby," the same psychological tendency of meaning reinforcement is activated in determining how they feel about that particular mother.

Results from Table 4.5 also reveal cultural similarities in how actors, behaviors, and object jointly shift normative sentiments. It seems that the psychological processes of consistency and congruency apply for both cultures, as evidenced by the nine predictors identified in the SEM models. The majority of these predictors differ neither in their presence nor magnitude. Hence, to a great extent, the foundational cognitive processes of forming impression remain consistent across cultures.

Cultural Nuances in the Impression Formations: Identity Plasticity and Morality

Despite the cultural consensus, two patterns are noteworthy regarding cultural uniqueness. First, most coefficients in the U.S. equations are notably larger than those in the China equations. It is plausible that there is cultural variation in identity plasticity. Whereas identity meanings among Chinese are more malleable and prone to reformation as other things change, normative sentiments are more rigid and unyielding among Americans. Perhaps, when rapid social changes occurs, identity meanings are less fixed. Recall that the Chinese survey was conducted in 1999, during which time rapid economic development and social changes in post-Mao China occurred. Dramatic changes at the societal level may have impacted the ways that people process information that they normally understand. Instead of keeping culturally embedded meanings intact, Chinese were more willing to deflect more from normative meanings by taking into account situational cues. Further research is needed to explore this possibility.

Besides identity plasticity, findings from Table 4.5 further reveal subtleties in morality, especially in individual's responses to transgression. I find that while both Americans and Chinese value positively retaliation ("an eye for an eye" as reflected in the effect of $BeOe_{(coef. = .35 \text{ and } .28)}$ on Ae' and Be'), Chinese believes that person occupying positive identities and their

actions become more virtuous if they treat their enemies nicely (the effect of AeBeOe$_{(coef. = -.11 \text{ and } -.05)}$ on Ae′ and Be′). Americans, in contrast, rely on the moral standards of justice whereby people grant more positive evaluations to esteemed actors who reward heroes or fight the villains (the effect of AeBeOe$_{(coef. = .07 \text{ and } .05)}$ on Ae′ and Be′).

To illustrate this point, I used computer simulations to explore Chinese and Americans' responses to moral events. Prior research has utilized cultural data and calculation tools from affect control theory to investigate implications of the theory and generate testable predictions on a variety of sociological topics (Kroska and Harkness 2011; Robinson 2015; shuster and Campos-Castillo 2017). Following procedures proposed by these authors, I utilized the Java INTERACT program (Heise 2001) to conduct a series of simulations.[6] This Java application can be download from the affect control theory website hosted by Indianan University (http://www.indiana.edu/~socpsy/ACT/interact.htm).

I explored morality differences by constructing two events "a hero saves a criminal" (++−) and "a hero saves an elementary school teacher" (+++) based on the evaluation profiles of the actor, the behavior, and the person on the receiving end of the behavior. Appendix A presents full sentiment profiles (pre-event: fundamental sentiments) used as inputs for this simulation and the calculated profiles (post-event) for transient impression of the actor and the behavior. For simplicity, this paper only displays impression changes on the evaluation dimension.

As seen in Figure 4.1, prior to any events (the blue bars), Chinese and Americans shared the same cultural views that the role of a hero and the act of saving someone are very good. People in both cultures also evaluate elementary school teachers positively but view criminals as cross-culturally bad. However, when individuals encounter the event of a hero saving a criminal

Figure 4.1 panel (a) shows that Americans would feel less positively about the hero, as well as the act of saving. When the criminal is the recipient of this heroic act, evaluations on both entities declined considerably. In fact, additional analyses show that Americans only expect roles like Mafioso and mobster to save a criminal. Perhaps, the sense of social justice ingrains deeply in American's cultures that they recompense bad for wrong and good for righteousness. In Figure 4.1 panel (b), we see exactly the same response. When Americans observe a hero saving an elementary school teacher, a familiar theme appeared in many mainstream movies and shows, every element in the situation (i.e., the actor, behavior, and the object person) is highly applauded.

In sharp contrast, Chinese would not only refuse to belittle the acting hero and his or her brave behavior when the criminal is the object person, they actually show strong approvals for such event by granting *more* status to everyone involved in the situation, including the criminal (see Figure 4.1 panel (a) the three orange bars on the right). Although Chinese would also praise a hero if a courageous act were directed to a nice object such as an elementary school teacher, as evidenced by ratings in panel (b), this event only enhances the positive feelings towards the action and the recipient. It did not, however, bring additional prestige or honor to the already socially respected actor.

DISCUSSION

In this article, I argued for a systematic examination to the cognitive processes of impression formation among Chinese in order to study culture and action. Applying Bayesian model sampling and structural equation modeling, my results support several specific conclusions. First, as the present project was based on material in Chinese and English, findings provide support

to earlier assumptions held by affect control theorists that the underlying determinants of impression formation are largely universal and the cognitive processes are ubiquitous (Heise 1979, 2007; MacKinnon 1994; Smith-Lovin and Heise 1988). Because the affective dynamics in the processing of cultural concepts are found in both cultures, several social psychological processes demonstrate excellent applicability cross-culturally. In particular, results from sets of equations show strong tendencies for normative meaning reinforcement and evaluative balance of mental representations (Heider 1946; Newcomb 1953): people expect good actors to act nicely and good object to be treated kindly. This is true regardless of which culture people are from.

I also find unique cultural traits of Chinese. Specifically, findings from this study suggest hidden moral codes between eastern and western cultures. Although the issues of moral standards have long been discussed in philosophical traditions, rarely do scholars investigate the drives behind these differences. Through my examination of the affective basis of morality in two societies, the current paper demonstrates two routes to obtain social status. Whereas Americans emphasize the sense of social justice in reserving kindness to good citizens, Chinese believe that noble men and women should reconcile with social outcasts. In preserving social harmony even with their enemies, individuals are held up as moral exemplars in Chinese society.

My findings from simulated events further demonstrate the nuances in individuals' expectations to social justice and transgression. Consistent with the ideas in traditional Taoism that everything is basically one despite the appearance of differences, my results reveal a popular beliefs among Chinese that good and evil are not in opposition to one another but are only two aspects of a single reality. Although philosophical Taoism was originated in China centuries before the beginning of the Christian era, modern Chinese people are still largely influenced by

it. Given everything and all beings are fundamentally one, Chinese often assume that the relativity between "good and evil" would be fully recognized when individuals offer no resistance to any would-be opponent. Due to this duality, moral agent's virtues are expected to be enhanced by acting nicely towards the other "evil" person (Mou 2001). This principle is often summarized as "overcoming evil with good" or "overcoming hatred with love" as compared to the moral strategies of "return justice for evil." In latter case, people believe that perpetrators should be repaid by justice, and kindness is reserved for the recompense of good, as we have seen in the U.S. impression formation equations.

Competing moral discourse are a constituent feature of modern social life. Although we see proponents from both sides even within the same culture, such that Confucianism in China advocates for reciprocal justice in "returning justice for evil" and Christians in the United States share the doctrine of "turning the other cheek" after being insulted, my findings nevertheless show the preferred moral codes or principles within each culture. Morality of any action changes depending on circumstances (Heise 2015). Yet by comparing the processes of impression formation, we gain deeper understandings on how cultures, along with circumstances, change the morality of action.

Although this study provides important insights into culture and morality, it has limitations. First, the U.S. data was collected nearly four decades ago and the China data was also almost twenty old. In 2010, a group of researchers have collected a new set of U.S. data (Robinson and Smith-Lovin 2016). However, I chose to use the U.S. 78 dataset in the current study for two reasons: first, this data has been empirically explored and tested in numerous studies (e.g., Smith-Lovin 1987). Thus it has high validity. Second, I argue that, in terms of

social, economic, and cultural development, China in the late 90s closely resembles the United States in the late 70s more than it does the United States in the 2010. Further investigation is warranted to examine if patterns discovered in the current study hold using newer data set.

This study is also limited by having an unbalanced sample size in two data sets. The U.S. survey includes a total of 515 event sentences, representing a full factorial design. The China data contains only 218 events. Prior study (Heise 2012) finds that the sample size is associated with the numbers of predictors identified in impression formation equations. Therefore, it is possible that the more concise models emerged from China data are due to small sample size and important cognitive processes of impression formation might be missed. Readers should be cautious in interpreting the absence of determinants when comparing cultural differences.

In closing, cultural meanings infuse interactions and shape our affective experiences by guiding our interpretation of events, evoking feelings about our core identities, and guiding our moral practice. Research on impression formation equations offers substantial rewards because well-executed impression formation study of events provides rigorous, falsifiable answers to multiple questions in the domains of social movement, morality, emotions, criminal justice, etc. In modeling the impression formation equations of two cultures and exploring the affective basis of morality among Chinese and Americans, the current paper hopes to shed light on future endeavors to expand sociological discussions on culture and morality.

NOTES:

1. Remember, in the impression formation equations, nine-first order terms from fundament sentiments on entities in situation are included as predictors, as well as their two-way and three-way interaction terms. Were all possible interaction between event elements considered, the model would need to adjudicate between 263 possible impression change models. Although affect control theory does not consider interactions relating to the same event element (e.g., AeAp), three-way interactions without clear theoretical interpretation, and higher order interactions, researchers are still left with 63 potential coefficients remain in each model, equating a daunting 2,610 possible model combinations.
2. They were selected to represent widely used overlapping concepts in the American and Japanese lexicons. The main criterion for choice of concepts was to get as close to as many of each of the eight basic prototypes in terms of EPA scores (e.g., +++, ++-, +-+, +--, -++, -+-, --+, --- ; where the first + or – sign denotes evaluation, the second potency, and the third activity) as possible with the fewest concepts rated (for detailed description of this optimum solution for a balanced design, please see Smith, Matsuno, and Umino, 1994).
3. Elements in all event sentences were rated on EPA dimensions by equal numbers of male and female respondents. However, due to techniques failure, impression for Object were missing for 128 events rated by female participants.
4. The 515-event dataset is available at the affect control theory website (http://www.indiana.edu/~socpsy/ACT/data.html) with the specific URL of http://www.indiana.edu/~socpsy/public_files/UNC78_Ratings_of_515_events.xls

5. BMS allows researchers to provide information from past knowledge in model specification by assigning a prior probability distribution to the parameters and to the models. That is, if population means and standard deviations of the measures are known, BMS could incorporate that information prior to their model specification and estimation. However, I have no initial knowledge on how each predictor is distributed population wise given this is the first impression formation research for Chinese. No informative priors were used for the current study.
6. I imported newly estimated U.S. and China equations into the current Java INTERACT program (Heise 2001) but relied on the dictionaries data (i.e., sentiment profiles in China and U.S. data) housed in the program.

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Table 4.1. Impression Formation Equations for Chinese using Bayesian Model Sampling

		Impression of Actor			Impression of Behavior			Impression of Object		
		Ae’	Ap’	Aa’	Be’	Bp’	Ba’	Oe’	Op’	Oa’
	Ae	.40			.17					
	Ap		.50			.31				
	Aa			.48			.28			
Behavioral Effects	Be	.59			.86					
	Bp		.29			.36			-.24	
	Ba			.20	-.22	-.09	.46		.30	
	Oe							.82	-.19	
	Op	.18	.08	.18					.66	
	Oa									.64
Consistency Effects	AeBe		.16		.15	.18		.15		
	BeOe	.36	.16	.26	.29		.25			
Congruency Effects	BpOe	-.13								
	BeOp									
	AeBa	.15					.08			
	AeOe					-.08				
	AaBa	-.14								
Balance Effects	AeBeOe	-.11			-.06					
	AaBaOe		.08							
	Intercept	.01	.14	.52	.07	.43	.34	.00	-.14	.02
	N	516	516	516	516	516	516	387	387	387

Table 4.2. Impression Formation Equations for Americans using Bayesian Model Sampling

		Impression of Actor			Impression of Behavior			Impression of Object		
		Ae′	Ap′	Aa′	Be′	Bp′	Ba′	Oe′	Op′	Oa′
Behavioral Effects	Ae	.54	-.07	.09	.13					
	Ap		.77	-.07		.21	-.07		-.04	
	Aa		.06	.86			.38			
	Be	.64	-.26	-.17	.85	-.37	-.14	.20	.32	
	Bp		.44	.09		.78	.13		-.11	
	Ba	-.09		.31	-.10		.72		.05	
	Oe		.05			.05		.89	-.21	
	Op								.80	-.04
	Oa						.04		.09	.86
Consistency Effects	AeBe	.13			.04			.09		
	BeOe	.30			.28	.07		.12	.10	
	ApBp		-.12							
Congruency Effects	BeOp	-.10			-.07					
	BpOe	-.05								
	AeBp								.04	
	ApBe		.11							
	ApOa					.05				
	AaBa			-.10						
	BpOp	.08			.03					
	BaOe								.05	
	BaOp				.04					
Balance Effects	AeBeOe	.11	.04		.09			.05		
	AeBeOp	-.06			-.03					
	AeBpOp	.06			.03					
	AaBeOp	-.03								

Table 4.2. Continued

	Impression of Actor			Impression of Behavior			Impression of Object		
	Ae′	Ap′	Aa′	Be′	Bp′	Ba′	Oe′	Op′	Oa′
Intercept	-.13	-.12	.08	-.08	.07	.06	.02	-.04	-.04
N	512	512	512	512	512	512	512	512	512

Table 4.3. Theorized and Atheoretical Coefficients Retained In Each Culture

	Definition	China (N = 218)	U.S.(N = 515)
		Identified/Potential	Identified/Potential
Stability effects	e.g., Ae→ Ae’	9/9	9/9
Behavior effects	Be, Bp, and Ba → Ae’, Ap’ and Aa’	3/9	7/9
Object diminishment	Be, Bp, and Ba → Op’	2/3	3/3
Consistency effects	BeOe and AeBe → Ae’, Be’, and Oe’; ApBp →Ap’, Bp’ and Op’	4/9	7/9
Congruency effects	BeOp and BpOe → Ae’ and Ap’	1/4	2/4
Balance effects	AeBeOe →Ae’, Be’ and Oe’; ApBpOp → Ap’, Bp’, and Op’	2/6	3/6
Total theoretical effects		21/40	31/40
Implausible effects	e.g., AaBeOp on Be’	1	3

Table 4.4. Comparison of Model Fit Indices in Multi-group Structural Equation Modeling

		BIC	RESEA	CFI	χ^2	DF	$\Delta\chi_{(df)}^2$	*p*
Ae′	M1: Equal	3006.098	.102	.947	135.220	15	135.220[a]	.000
	M2: No Constr.	2981.030	.000	1.000	.000	0		
Ap′	M1: Equal	2504.706	.155	.862	215.268	11	215.268	.000
	M2: No Constr.	2370.216	.000	1.000	.000	0		
Aa′	M1: Equal	2343.777	.198	.841	281.805	9	281.805	.000
	M2: No Constr.	2128.062	.000	1.000	.000	0		
Be′	M1: Equal	2638.987	.078	.981	56.501	10	56.501	.000
	M2: No Constr.	2655.921	.000	1.000	.000	0		
Bp′	M1: Equal	1959.896	.148	.889	160.648	9	160.648	.000
	M2: No Constr.	1865.339	.000	1.000	.000	0		
Ba′	M1: Equal	1980.095	.189	.868	227.841	8	227.841	.000
	M2: No Constr.	1811.001	.000	1.000	.000	0		
Oe′	M1: Equal	1865.994	.257	.902	239.778	5	239.778	.000
	M2: No Constr.	1662.498	.000	1.000	.000	0		
Op′	M1: Equal	2207.025	.184	.853	248.995	10	248.995	.000
	M2: No Constr.	2030.593	.000	1.000	.000	0		
Oa′	M1: Equal	2180.829	.478	.795	326.391	2	326.391	.000
	M2: No Constr.	1868.950	.000	1.000	.000	0		

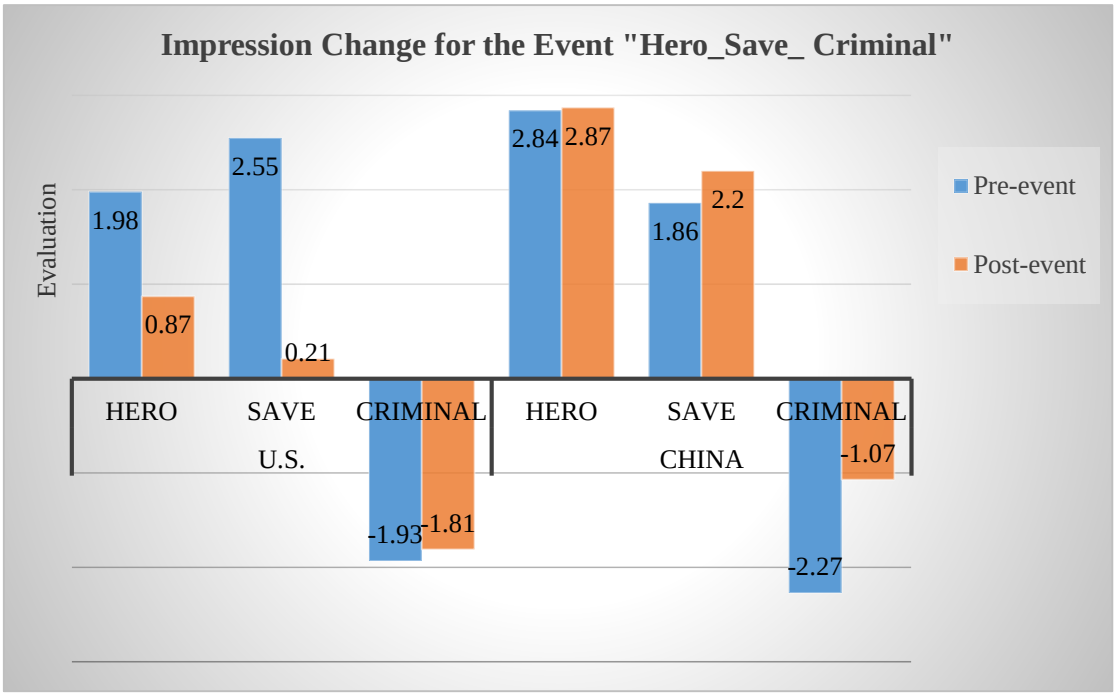
Note: M1: Equal = All coefficients are constrained to be equal between Chinese equation and U.S. equation;
M2: No constrain = All coefficients are freely estimated across groups.
a: The Chi-square difference between the model with constrained model and freely estimated model;

Table 4.5. Cross-cultural Comparisons in Impression Formation Processes Between Chinese and Americans

		Impression of Actor			Impression of Behavior			Impression of Object		
		Ae′	Ap′	Aa′	Be′	Bp′	Ba′	Oe′	Op′	Oa′
	Ae	.36 |.52	-.04 |-.07	*0* |.08	.16		.03			
	Ap		.48 |.77	-.04		.23	*0* |-.07		*0* | -.03	
	Aa		*0* |.04	.41 |.84			.15 |.36			
	Be	.63	*0* |-.24	*0* |-.16	.85	*0* |-.33	-.08	.06 |.18	*0* |.31	
Behavioral Effects	Bp		.41	*0* |.11		.31 |.79	.11		-.12	
	Ba	-.08	-.07	.21 |.30	-.19 |-.11		.29 |.72		.15 |.09	
	Oe		*0* |.06			.07		.58 |.91	-.12 |-.22	
	Op	.09		.13 |.04					.44 |.80	*0* |-.05
	Oa								*0* |.05	.37 |.88
	AeBe	*0* |.10			.06	.09 |.04		.10		
Consistency Effects	BeOe	.35	.09	.22 |.03	.28	.07		*0* |.10	*0* |.08	
	ApBp		-.12							
Congruency Effects	BeOp	-.07			-.08					
	BpOe	-.12 |-.07								
	AeBa	.16 |*0*								
	ApBe		.10							
	ApOa					*0* |.05				
	AaBa	-.18 |*0*		-.08						
Balance Effects	AeBeOe	**-.11 |.07**	*0* |.03		**-.05 |.07**			.04		
	AeBeOp	*0* |-.04			-.02					
	AeBpOp	.05								
	AaBeOp	*0* |-.06								
	ApBeOa	.03								
	ApBaOp								-.05	
	U.S.	-.07	-.05	-.15	-.07	-.10	.00	.00	-.15	.00

Note: Significant differences on coefficient estimations between U.S. and China are shown in each cell, with the Chinese value first, U.S.A. second, separated by a vertical pipe (|). All coefficients are standardized.

(a)



(b)

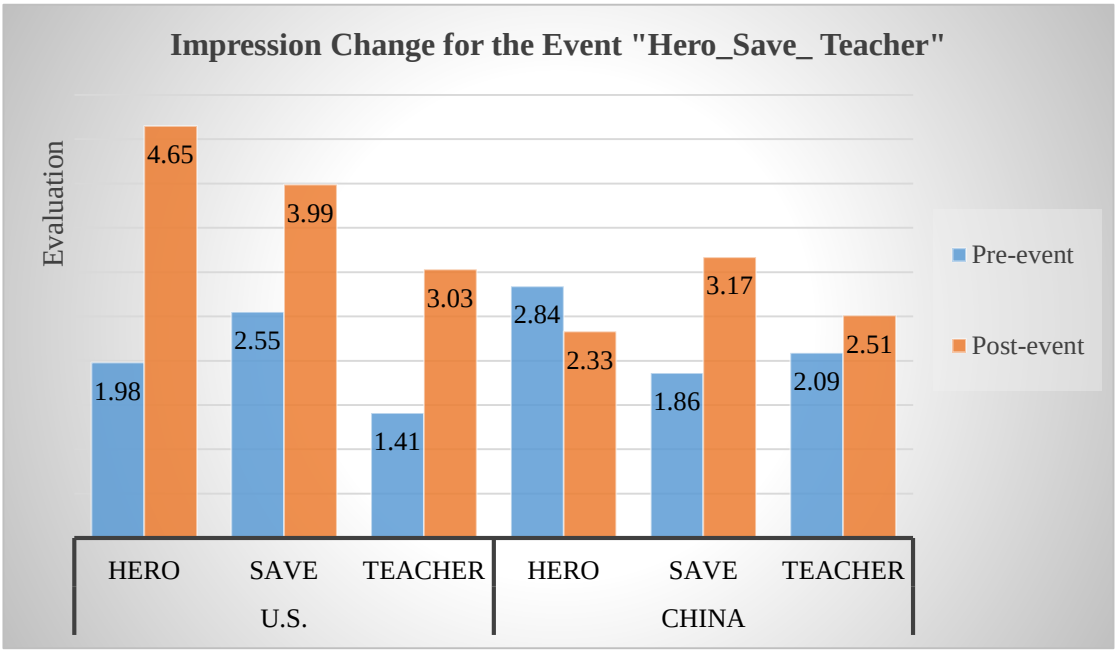
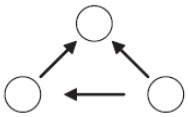
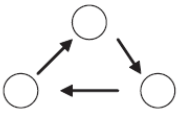
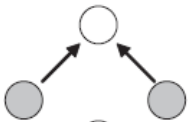


Figure 4.1. Cross-cultural Comparison from INTERACT Simulation

APPENDIX A. STRESSFUL LIFE EVENT SCALE

(1) I moved my house/apartment.
(2) I started dating.
(3) I had a boyfriend (girlfriend).
(4) I had more fights with my boyfriend (girlfriend).
(5) I broke up with my boyfriend (girlfriend).
(6) My best friend moved his (her) house.
(7) I broke up with my best friend.
(8) My sibling ran away.
(9) My parents separated or divorced.
(10) I had a younger brother or sister.
(11) Someone moved in with me (it could be relatives, friends, or others).
(12) My academic performance became worse.
(13) My sibling got disciplined at school.
(14) My sibling broke the laws.
(15) I started wearing glasses or teeth braces.
(16) My family was in financial trouble.
(17) My parents had more and more fights。
(18) Dad or mom stayed out of home more and more often。
(19) I was suspended from school。
(20) I had argument with schoolmates.
(21) I was badly injured or seriously ill.
(22) My best friend was badly injured or illed.
(23) My best friend had first intercourse.
(24) My best friend was pregnant.
(25) Dad or mom was badly injured or illed.
(26) My sibling was badly injured or illed.。
(27) My relative was badly injured or illed.
(28) I transferred school.
(29) I started drinking.
(30) I started using drugs.
(31) I caused a lot of troubles at school.
(32) I was banned from participating social events. (e.g., sports, music club, etc.)
(33) I ran away.
(34) I broke the law.
(35) Dad or mom was unemployed.
(36) Dad or mom broke the law.
(37) I became a victim of violence.
(38) I became a victim of domestic violence.
(39) I had more fights with others.
(40) One of my best friends died.
(41) My pet died.
(42) My sibling died.
(43) My relative died.

APPENDIX B. ILLUSTRATION OF THE NETWORK EFFECT (Sijtsema et al 2010)

Effect	Explanation	Graphical Presentation
Outdegree (density)	Preference for ties to arbitrary others, reflects the denseness of a network (positive value = increasing likelihood for ties over time; negative value = decreasing likelihood of ties overtime)	
Reciprocity	Preference for mutual ties	
Transitivity	Preference for ties with the friends of your friends. Provides a measure for network closure	
3-Cycles	Negative values denote preference for hierarchical ties in the networks. Positive values indicate generalized reciprocity	
Rate	Basic parameter indicating the number of opportunities to make changes	
	Selection effects	
Alter effect	Measuring whether actors with higher V values tend to be nominated by more others and hence have a higher indegree	
Ego effect	Measuring whether actors with higher V values tend to nominate more friends and hence have a higher outdegree	
Similarity	Measuring whether ties tend to occur more often between actors with similar values on V (homophily effect)	
	Influence effects	
Linear shape	Negative values indicate a tendency to report low scores on behavior. Positive values indicate a tendency to report high scores on behavior	
Quadratic shape	Models deviation from the linear tendency, as can be seen in U-shape or reverse U-shaped distributions of behavior	
Similarity	Socialization effect of certain characteristic (social influence)	

APPENDIX C. ROBUSTNESS TEST

Goodness of Fit (GoF) statistics: Introduction and explanation

The Goodness of Fit Statistics (GoF) were calculated using *SienaGOF* for four network indices: 1) the distribution of the nominations received (indegrees), 2) the distribution of the nominations given (outdegrees), 3) the geodesic distances in the networks, and 4) the triad census, all for friendship nomination.

A graphical representation of the GoF for the network indices is given in a plot. The plots show through the red line the observed values for each network, summed over two waves except the first. For example, for the *indegree distribution*, waves 3 the numbers of actors with indegree 0 for friendship is 0 in all-girl classes (see the first figure in S2). The rest of the plot refers to the simulated network. The so-called violin plots combine box plots with smoothed density plots (using a kernel density estimate). The dotted band is a pointwise 90% relative frequency region calculated for the simulated data. The data should be within the band; this is confirmed by a *p*-value larger than .05.

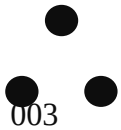
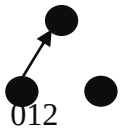
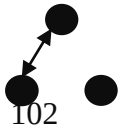
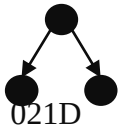
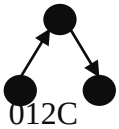
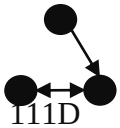
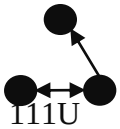
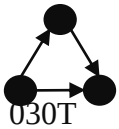
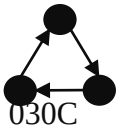
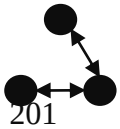
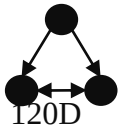
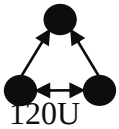
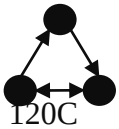
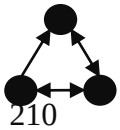
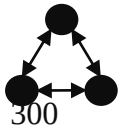
Next to the indegree and outdegree distributions, the distribution of the *geodesic distance* in the network is given. The geodesic distance is the shortest path between two actors in a network. If actors are not connected (neither directly nor indirectly through others), the distance between them is infinite (or undefined).

The *triad census* is a set of the different kinds of triads – relations between three actors. Wasserman and Faust (1994, p. 564-568) state that there are sixteen isomorphism classes for the sixty-four different triads that may exist. The possible triads can be labeled according to the following scheme:

1. The number of mutual dyads (M) in the triad;
2. The number of asymmetric (A) dyads in the triad;
3. The number of null (N) dyads (or empty dyads) in the triad;
4. A character to distinguish further among the types: T is for Transitivity; C is for Cyclic; U is for Up; and D is for Down.

This labeling scheme is also called the M-A-N scheme. The following table provides the 16 different M-A-N triads, corresponding to the triads in the triad census of the GoF plots.

Table S1: M-A-N Triads in Triad Census

Number of ties in the triad				
0	 003			
1	 012			
2	 102	 021D	 012U	 012C
3	 111D	 111U	 030T	 030C
4	 201	 120D	 120U	 120C
5	 210			
6	 300			

Results of the Goodness of Fit Statistics

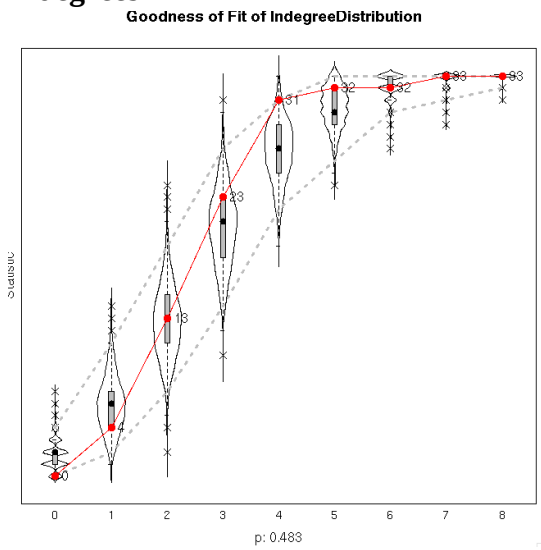
The goodness of fit of the models can be considered acceptable for almost all of the inspected network indices (see S2-S3). The observed data (red line) fall mostly within the simulated data distribution, as can be seen in the figures and is confirmed by (most) p-values larger than .05.

In order to obtain well-fitting models, i.e., models that represent important network characteristics sufficiently well, some extra parameters had to be included. For example, for all-boy classes, the outdegree distribution of the defending network was initially not fitted well, requiring additional parameters for the indegree popularity and outdegree popularity.

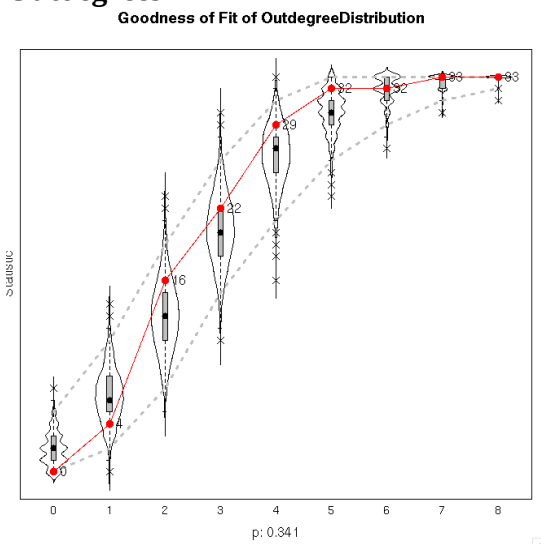
Using the current parameterization in the models, the GoF statistics were satisfactory for the distributions of the indegrees and outdegrees of the all-girls networks, as well as for the geodesic distances in these networks. For the all-boys networks, the geodesic distance was represented adequately by the model, but this was not the case for the other three indicators, despite the efforts made to include more traditional network structure parameters in the model.

Goodness of Fit Statistics for Multi-group Meta-analysis for All-girl Classes

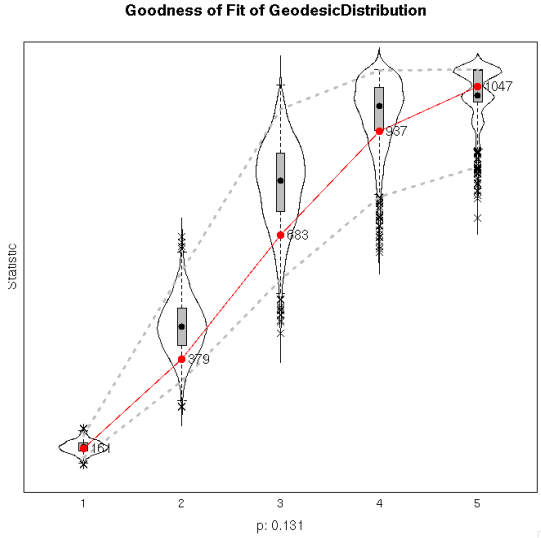
Indegrees



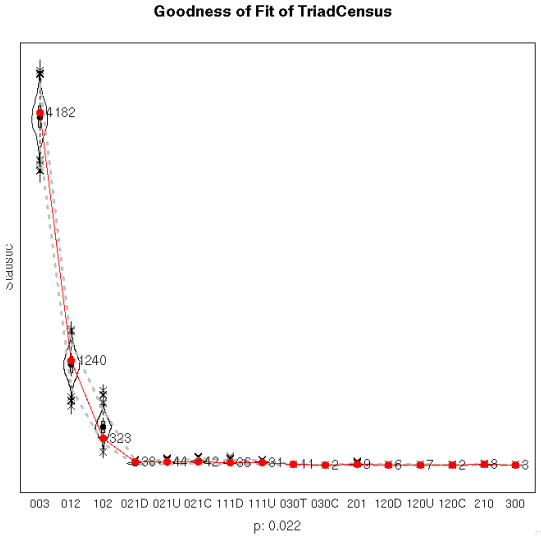
Outdegrees



Geodesic distance

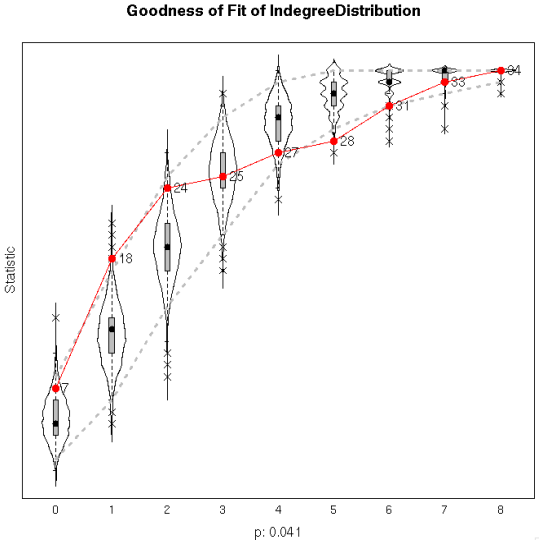


Triad census

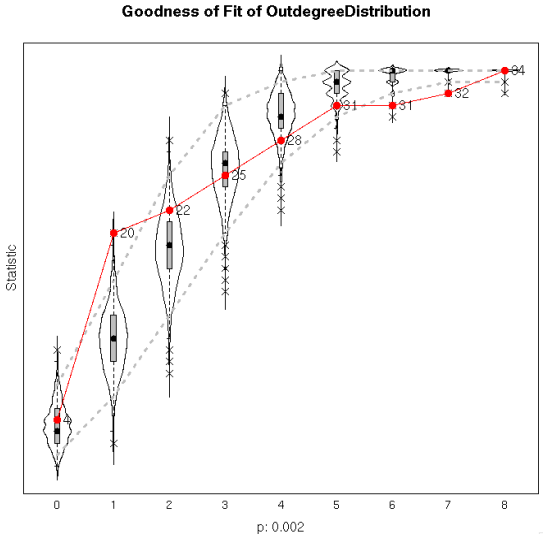


Goodness of Fit Statistics for Multi-group Meta-analysis for All-boy Classes

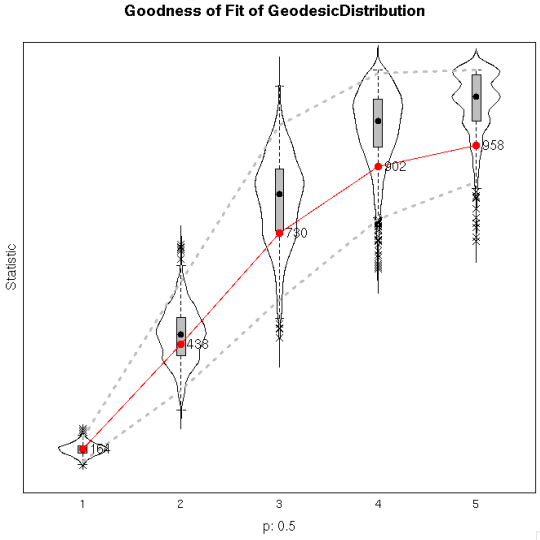
Indegrees



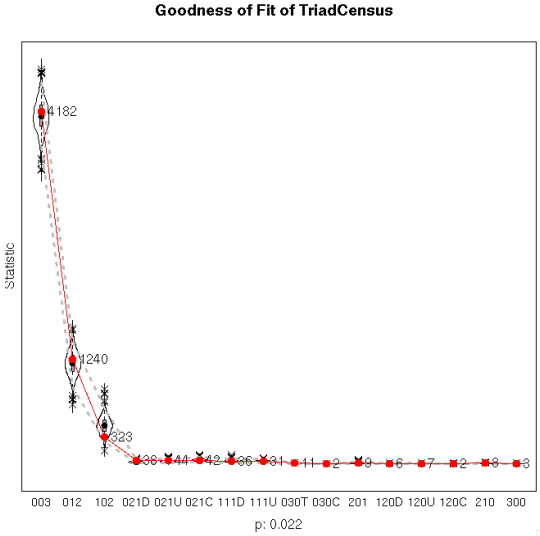
Outdegrees



Geodesic distance



Triad census



APPENDIX D. PRECITED IMPRESSION BY EVENTS AND CULTURES

		Hero_Save_Criminal						**Hero_Save_ School Teacher**					
		U.S.			China			U.S.			China		
Pre-event	Actor	**1.98**	2.20	0.96	**2.84**	2.92	1.86	**1.98**	2.20	0.96	**2.84**	2.92	1.86
	Behavior	*2.55*	2.11	1.26	***1.86***	1.72	1.10	*2.55*	2.11	1.26	*1.86*	1.72	1.10
	Object	-1.93	-0.47	1.00	-2.27	0.73	-0.56	1.41	0.83	0.42	2.09	1.04	1.71
Post-event	Actor	**0.87**	1.33	0.96	**2.86**	1.96	0.67	**4.65**	2.17	0.96	**2.33**	3.99	2.83
	Behavior	*0.21*	0.90	1.14	***2.20***	3.32	0.56	*3.99*	1.60	1.11	*3.17*	2.33	2.59
	Object	-1.81	0.25	0.84	-1.07	0.69	-0.34	3.03	1.60	0.29	2.51	0.07	1.11

Note: Each profile contains three numbers, representing the evaluation (goodness), potency (power), and activity (expressiveness) associated with each concept. The sentiment ratings can vary between 4.3 and −4.3.