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Chaotic Environments, Learned Helplessness and Academic Achievement in Adolescence

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Abstract

This study demonstrated that exposure to chaotic home environments predicted academic achievement in thirteen year old, rural adolescents (N = 145) living in Upstate New York. It was hypothesized learned helplessness may mediate the relationship between childhood environment and academic achievement in adolescence. In this thesis I propose a unique pathway to explain poor academic achievement in early adolescents living in chaotic environments as mediated by learned helplessness. Regression analysis revealed learned helplessness as a mediator between chaotic environments and academic achievement. Young adolescents with high levels of home chaos had higher levels of learned helplessness, which resulted in lower English and Math grades. Confounding covariance with income is discussed.

In 2006, 39% of America's children lived in low-income families. This percentage represents 28 million children living in households with incomes that cannot provide for their most basic needs. Nearly 13 million of these children live in families below the federal poverty level, which was $20,650 for a family of four in 2006. As can be readily appreciated from this value, these official poverty statistics underestimate the true prevalence of disadvantage in American families with children. The number of officially poor children is on the rise in the U.S.; from 2000 to 2006 there was an 11% increase or 1.2 million more children living below the federal poverty level. (National Center for Children in Poverty, 2007)

Minority children are disproportionately poor in the United States. 33% of Black children and 27% of Latino children live in poor families compared to 10% of White children. Yet, White children constitute the largest number of children living in poor and low income families at 4.2 million and 6.8 million, respectively (NCCP, 2007). Rural children are more likely to live in households where family income cannot provide for their basic needs. In 2006, 5.2 million or 47% children in rural areas lived in low-income families and 2.4 million or 22% children in rural areas lived in families below the federal poverty threshold (NCCP, 2007)

As the number of children growing up in poverty increases, the nation's human capital erodes. Numerous studies have linked growing up in poverty to negative outcomes for physical health, cognitive development, academic achievement and socio-emotional health (Brooks-Gunn & Duncan, 1997). Child developmentalists have long studied the outcomes of poor early childhood environments, and the literature is clear that the social and environmental context the child lives in from birth impacts his or her cognitive, social and emotional development.

In this study I address the question of the effect of chaotic environment on academic achievement in early adolescence. Specifically, the purpose of this study is to investigate the mediating effects of learned helplessness on academic achievement.

The association between low-income and future negative outcomes is pervasive. Children growing up in low SES families performed below their middle class peers on intelligence tests and have lower academic achievement (Bradley & Corwyn, 2002). Children living in poor families score consistently lower on IQ tests and school readiness assessments than their middle class peers and also have higher levels of learning disabilities, as well as, internalizing and externalizing behaviors (Heckman, 2006; Duncan & Brooks-Gunn, 1997; Ackerman, Brown & Izzard, 2003). School outcomes for children who grow up in poverty compared to middle class peers include higher grade repetition (29% vs. 14%) and lower high school graduation rates (21% vs.9.6%) (Duncan et al, 2007).

Which factors in families with inadequate income explain such a profound impact on child development? This core question guides my thesis and I have carried this question with me for a number of years. One could look to inequalities in the education system. Schools remain unequally funded in the U.S, but a 2007 meta-analysis by Duncan, Brooks-Gunn and colleagues found that children from families living in poverty enter school behind their middle-class peers on assessments of pre-reading skills, pre-math skills, and attention (Duncan et al, 2007). This evidence also suggests that the negative effects of childhood poverty on cognitive development and academic achievement begin well before school entry. In 2004, Evans found that perhaps the confluence of risk factors found within poverty environments is responsible for the numerous physical, emotional and cognitive deficits that accompany childhood poverty (Evans, 2004). Children in high poverty environments accumulate more risk factors and experience higher

levels of stress and home chaos than their middle class peers (Evans, 2004). In particular, parents and caregivers under stress experience fatigue from the confluence of social and physical demands they must contend with (Evans, Gonnella, Marcynszyn, Gentile, & Salpekar, 2005). This, in turn, could influence critical parenting processes that might affect children's socio-emotional and cognitive development. Chaotic environments are characterized as low on structure and routine and high on unpredictability, activity and background stimulation (Wachs, 2005). This instability denies the developing child sustained, structured exchanges of energy with persons, objects and symbols that are necessary to promote sound development (Evans, 2003). Increasing chaos and stress, in childhood environments, limits depth and breadth of the child's experience during what Bronfenbrenner termed as the proximal processes - the close exchanges of energy between the child and their parents and caregivers that are the foundation of early learning (Bronfenbrenner & Evans, 2000; Bronfenbrenner & Morris, 1998) Chaotic environments may affect development of the child by interfering in the duration and sustainability of proximal processes, making the environment between the child and his or her environment unpredictable, thereby decreasing the time the child spends fully engaged in exploring and deepening their cognitive abilities (Bronfenbrenner & Evans, 2000).

Studies on the link between chaos and academic achievement have found that children in households with more structure and routines have better academic achievement (Brody & Flor, 1997; Fiese, Tomcho, Douglas, Josephs, Poltrock, & Baker, 2002) and young children in more chaotic homes reveal cross-sectional and longitudinal deficits in cognitive development (Petrill, Pike, Price, & Plomin, 2004; Hart, Petrill, Deckard, & Thompson, 2007). Routine, or family management, is positively associated with academic self-concept and school engagement (Seaton & Taylor, 2003). Early learning takes place within the dynamic relationship between the child

and their caregivers. Children living in chaotic environments experience both stress and neglect - stress due to high levels of noise, crowding and a lack of routine and higher levels of unpredictability in the home. They also experience neglect due to a reduction of positive and elaborative exchanges with parents and caregivers leading to diminished learning opportunities within the home. A question that remains to be investigated is: how does the confusion and unpredictability of highly chaotic childhood home environments translate into poor academic outcomes?

Based on Evans work, poverty environments create a confluence of risk that surround the developing child, the construct of home chaos may also reflect multiple physical and socio-emotional factors that contribute to poor academic achievement. Household chaos leads to higher levels of stress within the developing child's home (Taylor, Eisenberger, Saxbe, Lehman, & Lieberman, 2006, Evans & Stecker, 2004: Evans & Kim, 2007). Studies investigating the relationship between stress and the developing brain have shown how excess or elevated cortisol damages the hippocampus and prefrontal cortex in children (Anda, Felitti, Bremner, Walker, Whitfield, Perry, Dube & Giles, 2006). Chronic stress leads to over-activation and dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis. When an individual experiences chronic stress the increased levels of cortisol in the body circulates back to the hippocampus and induces atrophy and halts neurogenesis in hippocampal neurons and decreases the volume of the hippocampus (McEwen & Sapolsky, 1995). The subsequent damage to the hippocampus and pre-frontal cortex results in decreased declarative memory and executive functioning, both of which are related to learning (Anda et al 2006). Adverse experiences in childhood can be disruptive to neurodevelopment and result in neural re-organization and deficient brain functioning throughout life (Perry, 2002)

Evans et al. (2005) found that poverty, chaos and learned helplessness were highly correlated. Children in the Evans's study - the first study of poverty to include chaos and learned helplessness - found that subjects that were high on poverty, chaos and learned helplessness had poorer socioemotional adjustment as adolescents. Learned helplessness in humans has been defined as motivational, cognitive, and emotional deficits resulting from experiences with inescapable environments and uncontrollable events (Peterson, Maier & Seligman, 1993). When individuals feel they have control, they sustain interest, optimism, attention, problem solving and action. People who feel they have control over their environment exert effort and persist through failures and setbacks. But when an individual feels their environment is uncontrollable they withdraw, escape, and become passive, fearful and pessimistic (Seligman, 1975). The individual learns that the environment cannot be altered through their actions and generalizes this belief to future events and environments. This results in higher levels of learned helplessness, poor socio-emotional development and lower levels of academic achievement (Evans & Stecker 2004; Repetti, Taylor & Seeman, 2002; Duncan & Brooks-Gunn, 1997). According to Schneider, "The effects of uncontrollable tasks on humans are well documented: stress from inescapable aversive events and unsolvable cognitive problems reliably produce passivity, cognitive deficits, and emotional change" (Schneider, 1996). Learned helplessness also appears to be related to depression in children (Lackdawalla, Hankin & Mermelstein, 2007). Depression in children and adolescents has been linked to diminished motivation and poorer cognitive development and academic achievement (Repetti et al., 2002).

This thesis does not explore the association between childhood depression and academic outcomes - the literature is rich in the area of depression and negative cognitive outcomes. Instead, I posit that learned helplessness itself may mediate the relationship between childhood

environment and academic achievement. In this thesis I propose a unique pathway to explain poor academic achievement in early adolescents living in chaotic environments as mediated by learned helplessness (See Figure 1.)

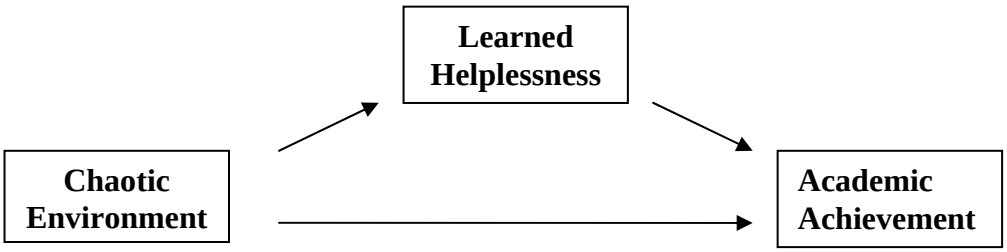

Figure 1. Conceptual model of mediation.

The developmental effects of learned helplessness, induced by exposure to chaotic environments, on cognitive development and academic achievement in humans have not been investigated.

The dynamics of school achievement are highly complex. Dweck and colleagues have linked helplessness to the performance-approach goals theory of academic motivation (Elliot, 1999; Diener & Dweck, 2000). Academic motivation refers to student engagement and effort in learning activities (Connell & Wellborn, 1991). Students with high academic achievement also have high levels of task persistence whereas low achieving students consistently have less persistence when engaged in challenging tasks (Diener & Dweck, 2000). In addition, children in Diener and Dweck's study who were identified as high on learned helplessness attributed their failure to low ability and responded to failure with poor performance whereas the children identified as 'mastery-oriented' did not focus on failure but persisted in the difficult task and improved their performance (Diener & Dweck, 1978, 1980). Helplessness is negatively correlated with task persistence (Singer & Glass, 1972). The effects of helplessness also persist over time. Helplessness in a sample of third graders was related to subjects' achievement test scores in the fifth grade (Fincham, Hokoda & Sanders, 1989). The literature on helplessness and

academic achievement has focused on motivation and attribution, but little research has been conducted directly linking learned helplessness, cognitive development in humans and academic achievement (see Eccles & Wigfield, 2002, for review). A recent animal study found learned helplessness and chronic mild stress decreased cognitive performance in stressed mice in a water maze. The effects diminished with intervention but the stressed mice never performed as well as the controls (Song, 2006).

The current investigation uses secondary analysis using a longitudinal data set collected by Dr. Gary Evans, myself and other students on the effects of rural poverty on physical, socio-emotional and cognitive development. I am interested in answering the following research questions: 1) Does home chaos predict academic achievement? 2) Does learned helplessness mediate the relationship between chaotic environments and academic achievement in early adolescence?

Methods

Participants. The participants were 145 adolescents living in rural, Upstate New York. Subjects were 13 years old (M = 13.37 years, 54.3% male) at Wave 2. Unfortunately only some teachers were willing to supply school records of grade, thus limiting our analysis to this subset of children. Participants were recruited from public schools, New York State Co-Operative Extension programs, and various anti-poverty programs. One child per household participated in the study. Low-income families were over-sampled and the ratio of income-to-needs of children at each Wave was calculated. Participants were not clinically depressed at Wave 2. The sample was predominantly White (94%), reflecting the demographics of rural upstate New York. Subjects were blind to the poverty component of the study and told they were participating in a study of stress and housing. Subjects were compensated $200.for their participation in Wave 2.

Materials. Chaos was assessed with a highly reliable version of The Confusion, Hubbub, and Order Scale (CHAOS) (Matheny, Wachs, Ludwig, and Phillips, 1995). Items were added to increase coverage of routines and rituals in the home (α for revised chaos scale = .77). These additional items came from the Family Ritual Questionnaire (Fiese & Kline, 1993) and the Family Routines Inventory (Jensen et al., 1983). For this measure of chaos, the mother answered ‘‘true’’ or ‘‘false’’ to statements describing environmental stimulation (‘‘You can’t hear yourself think in our home’’), confusion (‘‘We can usually find things when we need them’’), and rituals and routines (‘‘[Target child] does his[her] homework at the same time each day’’). Learned Helplessness was measured in Wave 2 through age appropriate insolvable puzzle tasks (Glass & Singer, 1972) adapted for children (Bullinger, Hygge, Evans, Meis, & Van Mackensen, 1999; Cohen, Evans, Stokols, & Krantz, 1986). Learned Helplessness was measured by time in seconds the subject persisted on the unsolvable puzzle task. The subject was shown a picture of a tangram and asked to reproduce the illustration with multiple plastic pieces that fit into a rectangular frame. The subject first received a test puzzle after an experimenter demonstration to ensure that he or she comprehended the task. The subject could work on the puzzle until it was solved or until he or she felt unable to solve it. At that point, the subject could move on to another tangram puzzle. Once the subject moved on to the second puzzle, he or she could not return to the first puzzle. The subject did not know the first tangram puzzle was unsolvable. The second puzzle was solvable. A total of 15 minutes was available for each of the two timed puzzles. The number of seconds the subject persisted on the first puzzle was the index of learned helplessness: less persistence indicates higher learned helplessness. This learned helplessness measure is related to experimental manipulations of control and chronic exposure to uncontrollable stressors (Evans &

Stecker, 2004; Glass & Singer, 1972). Academic achievement was measured by calculating the mean of the subject's English and Math grades collected in Wave 2 from school records.

Procedure. All data was collected with a standardized protocol in the participants' residences (See Evans, Gonnella, Marcynyszyn, Gentile, & Salpekar, 2005). The Teacher Evaluation Questionnaire was mailed to the child's teachers with parents' permission to collect grades. All proper consent protocols were followed.

Results

As indicated in Table 1. Chaos, Learned Helplessness and English and Math Grades were intercorrelated. A mediation model was analyzed using multiple regression analysis to test if the interaction between chaotic environment and grades was mediated by learned helpless during early adolescence. Table 2. depicts basic descriptive data for the study variables.

Table 1. Intercorrelations for Study Variables

Intercorrelations between Wave 2 Variables (N=145)

Variables	1	2	3
1. Chaos	--	-.175**	-.164*
2. Learned Helplessness		--	.326**
3. English+Math Grades			--

*$p < .05$. **$p < .01$.
One-tailed correlations

Table 2. Means and Standard Deviation for Study Variables.

Wave 2 Variables			
Variables	Mean	Standard Deviation	Range
Chaos	1.27	0.19	0 to 2.0
Learned Helplessness	506	297.54	0 to 900
English/Math Grades	2.6	1.22	0.0 to 4.0

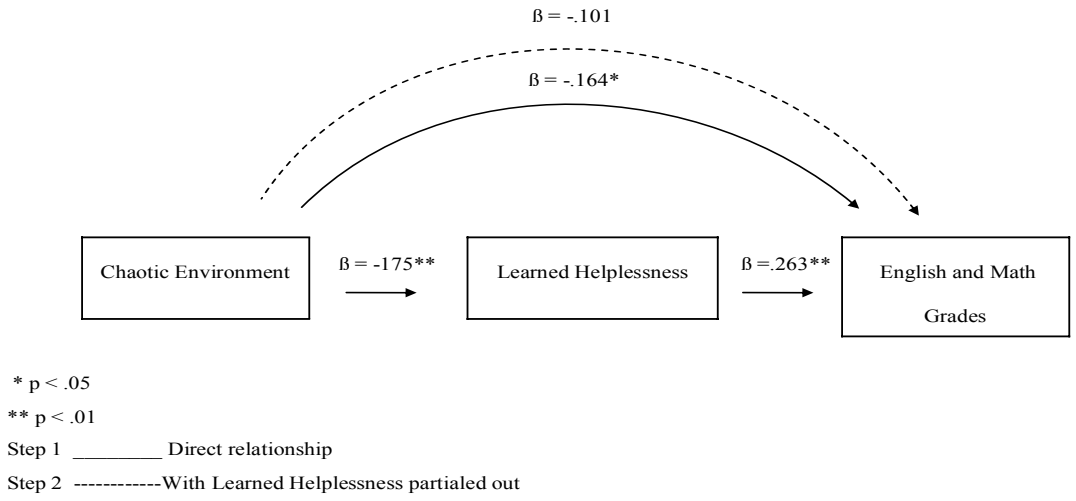

Figure 2. Learned Helplessness as a Mediator of the Relationship between Chaotic Environment and English Grades in Early Adolescence.

As indicated in Figure 2, the significant interaction between chaos and grades became non-significant when learned helplessness was partialed out. The interaction between chaos and grades was fully mediated by learned helplessness as indicated by a significant reduction from ß

= -0.164 to ß = -0.101, t (144) = 3.73, p> .001. Shrinkage of 39% in the standardized beta weight after partialing out learned helplessness indicates substantial mediation.

Discussion

As stated earlier, chaotic home environments have negative physical, social and cognitive effects on the developing human being. Learned helplessness in humans has been linked to cognitive deficits. In this study chaotic environment, learned helplessness, and academic achievement during early adolescence were highly correlated (see Table 1.). As Figure 2. suggests, learned helplessness substantially mediates the relationship between chaotic environments and academic achievement in early adolescence.

Although the results provide support for my hypothesis an investigation was conducted to rule out possible confounding factors. An alternate explanation for the model shown in Figure 1. could be poverty and perhaps the intercorrelations depicted in Table 1 reflect covariance with income. To test for possible covariance I conducted an additional analysis to control for poverty.

Table 3. Regression Results for Chaotic Environment, Learned Helplessness and English/Math Grade Controlling for Proportion of Time in Poverty from Birth to Wave 2.

N = 145	Predictor	*B*	*SE B*	ß	*df*
English/Math Grades	Chaotic Environment	-0.41	0.51	-0.07	146
English/Math Grades	Learned Helplessness	0.001**	0.00	0.26**	145
Chaotic Environment	Learned Helplessness	-281.19*	129.53	-0.183*	144

p<.05 *, *p*<.001**

As reported in Table 3., Chaotic Environment and Learned Helplessness, and Learned Helplessness and English and Math Grades, maintained statistical significance when controlling

for poverty. Poverty was measured by the proportion of time, in months, the subject's family lived at or below the annually set federal poverty level from birth until Wave 2. However, when controlling for poverty, the relation between Chaotic Environment and English/Math Grades was no longer significant. The results illustrate a non-significant pathway between the Chaotic Environment, Learned Helplessness and English/Math when poverty was used as a control variable. As a result of this analysis a future study using hierarchical analysis will be conducted to determine if the Poverty→ Chaotic Environment →Learned Helplessness→English/Math Grades pathway merits further investigation.

A limitation of this study is the issue of selection bias in reporting of grades by teachers. It is possible that teachers who are more invested in high performing students responded to the Teacher Evaluations thus biasing the grades sample. Also, another limitation of the study is the small sample size especially for math grades. The low reporting of math grades necessitated using the mean of combined English and math grades to represent academic achievement. A recent meta-analysis of six studies by Duncan and colleagues (Duncan et al., 2007) found that early math skills upon school entry predicted future academic achievement over and above early reading skills or attention. This finding encouraged me to include math in the grades variable. Earlier regression analysis demonstrated shrinkage of 30% in the raw beta weights between Chaos and English grades once learned helplessness was partialed out ($b = -1.19$ to $b = -.833$, $t(138) = 3.55$, $p<.001$). Precursors of early math skills are logic and reason - if one's early environment is unstable and unpredictable it is possible that the resulting inner disorder could manifest in less persistent, disordered and illogical thinking.

These limitations aside, this study suggests interesting avenues for future research. Given the relation between learned helplessness and academic achievement in a study of young

adolescents who were not clinically depressed, an investigation of the neural mechanisms underlying learned helplessness is warranted. Due to advances in neuroscience we now have the tools to study the neural substrate and neurochemistry underlying an individual's development or what Hertzman described as the "biological embedding" of early childhood experiences. Hertzman hypothesized early damaging childhood experiences, especially systemic differences in the quality of early childhood environment in terms of stimulation, and physical and emotional support, affect the maturity of the brain in ways that adversely effect behavioral, social and cognitive development (Hertzman,1999). A study by Schneider and colleagues found increased brain activity in the amygdala, which activates when individuals are exposed to fearful stimuli, and decreased hippocampal activity (the brain area related to memory and learning) when subjects were engaged in an unsolvable puzzle task (Schneider, 1996). Schneider concluded that this finding may be an initial step toward understanding the neural substrate that underlies learned helplessness.

The post-analysis in Table 3. demonstrates the importance of including poverty when studying children's physical, socioemotional and cognitive development. Given the current economic recession, poverty in American families will likely increase in the coming years and the percentage of children living in poverty may rise. Thus, the deleterious physical, socio-emotional and cognitive effects of poverty and subsequent home chaos on the developing child may also increase in the coming years. Federal, state and local governments underestimate real poverty in the U.S. through an antiquated system that does not measure the basic, let alone, developmentally adequate resources children need to grow up healthy and whole. As research continues to show, growing up in poverty is not just a social question; poverty influences human development down to the very architecture of the human brain. A final question to consider -

what steps can parents, educators and policy makers take to end the erosion of our human capital and prevent disadvantaged children from being damaged by the environments and circumstances beyond their control? For children, being born into poverty is simply an accident of birth yet current poverty policies assist families and children only once they are in the most abject of circumstances. As the literature on children and poverty grows, it becomes clear that economic and family policies need to be created to insure that no family's income and resources falls below levels needed for healthy child development. We all pay for allowing poverty to continue - poor children most of all.

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