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Evaluating the Hypothalamic-pituitary-adrenal Axis in Depression and Chronic Fatigue Syndrome

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Abstract--*The normally functioning hypothalamic-pituitary-adrenal axis is responsible for proper synthesis and secretion of a vast array of hormones including corticotrophin releasing hormone, adrenocorticotrophic hormone, and cortisol. Modifications to any parameter within the axis have been indicated in pathophysiological illnesses, namely, depression and chronic fatigue syndrome. Patients clinically diagnosed with depression often exhibit elevated hypothalamic-pituitary-adrenal axis activity. Conversely, axis suppression has been observed in individuals diagnosed with chronic fatigue syndrome. The literature discussed here summarizes previous investigations in order to define and clarify the problems associated with each of these illnesses and to suggest the next step in treatment.*

Introducing the Axis

Homeostasis is controlled by a complex interaction of hormonal and neurochemical mechanisms. The human body has evolved two major hormonal components to maintain this balance: the hypothalamic-pituitary system and the endocrine system (Drickamer, Vessey, & Jakob, 2002). The hypothalamic-pituitary system intimately connects nervous and endocrine tissues within the brain. However, endocrine glands in the periphery eject hormones that tend to direct global physiological responses such as the reproductive cycle and blood sugar levels (Silverthorn, 2001).

The hypothalamic-pituitary arrangement, as the name implies, connects the hypothalamus and the pituitary gland. The hypothalamus, located at the base of the brain, behind the nasal cavity, controls behavioral drives such as hunger, thirst, and mating (Bernstein, Clarke-Stewart, Penner, Roy, & Wickens, 2000). Neurons projecting downward from the hypothalamus to the pituitary gland synthesize and release hormones. Hormonal release from neurons of the hypothalamus affects the body in one of two ways depending on which region of the pituitary gland is stimulated: the anterior or posterior pituitary.

When the posterior pituitary gland is stimulated by hypothalamic neurons, hormones vasopressin or oxytocin may be released into the circulatory system. If however, the anterior pituitary gland becomes activated, then many hormones can be released. One example of a hormone made in the hypothalamus is corticotrophin releasing hormone (denoted as corticotrophin hereafter). Corticotrophin stimulates the anterior pituitary which subsequently secretes another hormone known as adrenocorticotrophic hormone (denoted as adrenocorticotrophin hereafter) (Silverthorn, 2001).

Adrenocorticotrophin, sometimes called the major stress hormone, stimulates yet another part of the body: the adrenal glands, located just above the kidneys (Comer, 2005). Cortisol is one of the many stress hormones released from the adrenal glands where it directs extensive physiological changes such as metabolism (Silverthorn, 2001).

The bulk of this review focuses on corticotrophin, adrenocorticotrophin, and cortisol. Therefore, it is important to differentiate the role of each. Corticotrophin is produced by the hypothalamus. When produced, it travels to the end of hypothalamic neurons where it is secreted. The secretion of corticotrophin stimulates the anterior pituitary gland. Stimulation of the anterior pituitary causes adrenocorticotrophin to be released into the circulation. Once adrenocorticotrophin enters the blood, it contacts the adrenal glands where cortisol is finally ejected.

The combination of the hypothalamus, anterior pituitary, and adrenal cortex is often referred to as the hypothalamic-pituitary-adrenal (HPA) axis.

Interestingly, components within the HPA axis have the ability to positively or negatively regulate other components within the system and these mechanisms are known as positive feedback or feedback inhibition, respectively. For example, when cortisol is secreted from the adrenal glands, it negatively regulates its own secretion by sending chemical signals to the brain. The syntheses of corticotrophin and adrenocorticotrophin then halt as does the amount of cortisol.

Alterations or malfunctions within the HPA axis have been implicated in many psychological and physiological illnesses. In particular, abnormalities of the HPA axis have been identified in both depression and chronic fatigue syndrome (CFS). However, evidence has been unable to directly link specific failures of the HPA axis with each of these illnesses. Current data suggests that excessive production of hormones in the axis is linked to depression. Comparatively, studies evaluating CFS have found associations with an insufficiency of hormone production. The purpose of this review is to assess the current literature pertaining to depression and CFS and how components of the HPA axis are affected in each.

Depression

Unipolar depression, generally known as depression, is one of the major affective disorders and is characterized by disordered feelings and continuous and unremitting thoughts of unworthiness and guilt (Carlson, 2005). According to Comer (2005), Kessler (2002) and Angst (1999, 1995) found that 17 percent of all adults in the world may experience an episode of severe depression at some point in their lives. Additionally, 15.9 percent of people with depression attempt to commit suicide (Chen and Dilsaver, 1996; as cited in Carlson, 2005). The high prevalence of this disorder makes it a priority for researchers to determine causality and find treatment.

Depression is thought to have a heritability component, and thus a physiological basis. Twin studies reported by Wallace *et al*. (2002) in Comer's Fundamentals of Abnormal Psychology (2005) found that when an identical twin had depression, there was a 46 percent chance that the other twin would have the same disorder. Similarly, when analyzing fraternal twins, it was found that the other twin had a 20 percent chance of developing the disorder (McGuffin *et al*., 1996; as cited in Comer, 1996).

Chemicals of the nervous system, known as neurotransmitters, have been implicated in depression; they are norepinephrine and serotonin. Low activities of these have been reported in depressed people. When medications designed to increase norepinephrine and serotonin levels are administered, the symptoms of depression can be alleviated (Bernstein, 2000).

In addition to genetic and chemical studies, researchers have learned that the body's endocrine system may play a role in depression. As mentioned earlier, the endocrine system is responsible for modulating hormone release into the circulatory system. Once these hormones have entered the blood, they can have vast affects on particular targets. One particular hormone, cortisol, is synthesized in the adrenal glands and is secreted during times of stress. Cortisol is thought to alter brain activity at the level of the hypothalamus and pituitary gland, which in turn alter cognitive processes. Given that stressful events can trigger depression, it is not surprising that abnormal cortisol levels may be present in depressed individuals (Comer, 2005).

With the partial account of depression etiology in mind, we can see how a myriad of treatments are currently being practiced. Electroconvulsive shock therapy, the application of electric current to the brain, causes some patients to feel less depressed. Because neurotransmitters in the brain are often reused, medications that prevent neurotransmitter recycling allow extended stimulation. Most current treatment plans do not target the HPA axis so the following section addresses current findings pertaining to abnormal HPA axis functioning in depression.

Assessing the Literature: Depression

Hormonal overproduction is one potential cause of unipolar depression. Therefore, measuring cortisol secretion is important for understanding the physiological basis of depression. Recently, morning cortisol sampling has been used because it is a simple and reliable means to assess the changing activity of

the HPA axis without intravenous discomfort. In a study conducted by Bhagwagar, Hafizi, & Cowen (2005), it was reported that salivary cortisol levels increased in depressed individuals after waking. Analyses of time points after awakening showed that salivary cortisol levels were significantly higher in patients with depression at 15, 30, and 45 minutes as compared to a control group.

However, Bhagwagar, Hafizi, and Cowen (2005) did not sample salivary cortisol levels throughout the day and thus were unable to comment on the possibility that experimental and control groups differ. It is important to note, however, that a single increased "pulse" of cortisol upon waking could be used for diagnoses. In other words, subjective report could be eliminated because direct physical measurement would be available.

Some contradictory evidence of decreased morning cortisol levels in depressed individuals was reported by Burke, Davis, Otte, and Mohr (2005). In their meta-analysis, they found that patients with major depressive disorder had lower baseline and stress cortisol levels than controls. However, analyses of afternoon studies revealed major depressives having higher cortisol levels than controls. In fact, they showed a steady increase in afternoon cortisol levels.

Even though Burke *et al.*'s (2005) morning cortisol data contradicts Bhagwagar's (2005) study, the afternoon data is consistent with hypercortisolemia, or excessive production of the hormone cortisol. The data reviewed thus far suggests that an increase in cortisol level may be prevalent among depressed individuals; however, accurate cortisol assays throughout the day are needed to confirm the relationship.

Depression has profound affects on cognition such as psychomotor slowness, executive dysfunction, and memory impairment (Egeland *et al*. 2005). It is thought that failure in the HPA axis contributes to these cognitive deficits. Egeland *et al*. set out to test this hypothesis by examining morning salivary cortisol levels in subjects with recurrent major depression. The Wisconsin Card Sorting Test, which assesses problem solving and ability to maintain effective work strategies despite distraction, served as the investigative tool. A positive relationship was found: higher salivary cortisol levels led to higher failure rates.

These same researchers evaluated other levels of cognitive irregularity and found that a high level of morning salivary cortisol was associated with executive dysfunction and some memory deficits. This indicates that excessive amounts of cortisol and therefore other hormones in the axis may have some cognitive consequences among patients with recurrent depression.

Other methods have been used to address hypersecretion of HPA axis hormones in depression such as by examining corticotrophin in cerebrospinal fluid. Corticotrophin stimulates the anterior pituitary to secrete adrenocorticotrophin, which then stimulates the release of cortisol from the adrenal glands. Measuring corticotrophin in the brain's cerebrospinal fluid can be an effective way to analyze altered physiological HPA response in depressed individuals.

One such study that helped to lay the framework for our current model of hypersecretion was conducted by Nemeroff *et al*. in 1984. Subjects had cerebrospinal fluid obtained in the morning hours and had been clinically diagnosed with major depression. These researchers found an increase in corticotrophin within the cerebrospinal fluid, supporting the hypothesis that HPA axis hyperactivity is due, at least in part, to hypersecretion.

Animal studies with altered corticotrophin and cortisol concentrations have narrowed the possible sources of depression. In 1996, Coplan *et al*. studied gown primates who were exposed as infants to unpredictable foraging conditions. Although this study pertains mostly to stressful circumstances, early life events such as neglect and abuse have been shown to contribute to the development of mood and anxiety disorders, including depression (Freud, 1966 and Hammen *et al*., 1992; as cited by Coplan *et al*. 1996). The authors reported that primates given unpredictable foraging supplies exhibited altered HPA axis function such that corticotrophin levels were increased and cortisol decreased. Thus, suggesting differential regulation of each hormone within the body.

Another study prepared in 2006 by Wisniewski *et al*. pertains to abnormal cortisol levels

in depressed men and women using heroin and cocaine. Users of illicit drugs showed statistically significant higher levels of cortisol as compared to nonusers. Further, depression was associated with high cortisol concentrations and interestingly, this association was particularly evident in women. The fact that women had higher cortisol concentrations introduces another variable: HPA axis dysfunction likely differs between genders.

Summarizing Depression

Thus far we have seen a common thread: elevated HPA axis activity may be responsible for depression symptomology. Bhagwagar *et al.*'s morning and Burke *et al.*'s afternoon data suggests that cortisol levels are increased. Egeland and his colleagues found similar trends in cognitive abilities. Extra cortisol production was associated with poor mental functioning, a trait commonly witnessed in depressives. Raised levels of cortisol and corticotrophin taken from cerebrospinal fluid of primates introduced the possibility of independently regulated hormones. Finally, gender differences may show that women using drugs are more susceptible to higher cortisol levels and thus more severe depression. Now we shall consider the antithesis of elevated HPA activity in depression by discussing hormonal depletion in chronic fatigue syndrome.

Chronic Fatigue Syndrome

Chronic fatigue syndrome (CFS) is one of the most puzzling illnesses found in today's society. CFS has no known cause and is characterized by unexplained fatigue, weakness, muscle pain, feeling poorly, trouble thinking, and sometimes, fever and/or lymph node swelling (Human Adjuvant Disease Corp., 2005). Occupational, educational, social, and personal activities are often substantially reduced in these individuals.

Today, many potential causes of CFS are being sought, including hormonal abnormalities. Blunted adrenocorticotrophin responses have been witnessed, leading to hypothyroidism (decreased activity of the thyroid gland) and/or low cortisol levels.

Like depression, CFS has multiple etiologies and thus many treatments. Sleep aids may be prescribed when a patient complains of poor or irregular sleep and excessive fatigue. Because many patients experience significant amounts of physical pain, pain relievers are often prescribed. Some authorities recommend lifestyle adjustments such as pacing, stress control, and formulation of support groups. Also, cognitive behavioral therapy has been shown to benefit up to 25 percent of CFS patients. Cognitive behavioral therapy teaches coping strategies to help people deal with cognitive impairments such as altered short-term memory and attention span.

Noteworthy of CFS treatment plans is the fact that hormone replacement therapy is not common. Although findings have shown that cortisol steroid treatment may produce short-term pain relief in CFS, substantiating evidence needed for proper treatment is lacking. The following literature pertains to CFS and the irregularities found within the hormonal systems of the body.

Assessing the Literature: Chronic Fatigue Syndrome

The onset of CFS remains unclear, but there is evidence that biological, psychological, and social factors play a role. Demitrack *et al*. and Cleare *et al*. have found that some of the symptoms of CFS could be due to low levels of serum cortisol (Jerjes *et al*., 2006). These results could reflect hypocortisolemia in CFS. Jerjes *et al*. set out to test this hypothesis via urinary analysis which is considered to reflect serum cortisol levels.

It was found that cortisol levels were significantly lower in CFS across a three day time period. However, enzymes in the blood can reversibly convert cortisol into cortisone, which could partially account for the decreased levels of cortisol. Therefore, cortisone levels were assayed and found to be significantly lower in CFS patients across the period than a control group.

Crofford *et al*. further studied undereactivity of the HPA axis in CFS patients (2004). They specifically proposed that disruption of the HPA axis may be directly linked to many of the somatic, cognitive, and emotional symptoms that characterize patients with CFS. They found an interaction: in the early morning period, there were several hours where patients with CFS had lower (but non-significant) cortisol levels as compared with controls.

An important implication of Crofford *et al.*'s data should be noted. A circadian cycle was seen with cortisol and adrenocorticotrophin across patient and control groups which could provide diagnosticians appropriate hormonal assay times. After confirmatory research has been conducted, it may be possible to accurately diagnose patients with CFS or other related illnesses based on concentration curves such as these.

Similarly, in 2001, Cleare *et al.* studied altered cortisol and adrenocorticotrophin levels in patients diagnosed with CFS. One extra level of control was held constant by Cleare *et al.*: possible confounds due to comorbidity with depression. Cleare *et al.* did not find statistically different levels of adrenocorticotrophin between groups, but cortisol levels were decreased. These latter data are in accord with current hypocortisolemia as a potential factor in HPA axis dysfunction in CFS.

Other parameters such as stress and exercise have been used to exacerbate chronic fatigue symptoms for study. The Trier Social Stress Test accomplishes this by emulating a real life job interview followed by a mental arithmetic task in front of an audience. Gaab *et al.* (2002) found significant effects between groups for adrenocorticotrophin; CFS patients had significantly lowered adrenocorticotrophin levels at baseline and 10 minutes after the Trier Social Stress Test. No significant decreases in cortisol were reported.

To further understand the physiological mechanisms underlying HPA axis activity, Gaab's (2002) research participants underwent incremental cycle ergometry. An ergometer in this case is an apparatus for measuring work performed by an exercising person. Again, groups differed significantly in their adrenocorticotrophin responses, but considerable differences were not seen in cortisol parameters.

Gaab *et al.*'s (2002) investigation highlights key points relevant to our current understanding of the HPA axis. Previously, it was thought that hypocortisolemia was an underlying contributor to chronic fatigue syndrome. Studies have shown that decreased cortisol levels are present in some patients suffering from CFS. Gaab *et al.*'s data does not contradict this completely because adrenocorticotrophin modulates cortisol secretion; however, it may be necessary to direct psycho-endocrinologist's attention to the integrative aspects of the HPA axis.

In the last portion of this review, the affects of dexamethasone suppression in CFS are considered (Gaab *et al.*, 2002). Dexamethasone is in a class of drugs that reduces swelling and decreases the body's immune response (Healthwise Drug Guide, 2004). It is used to treat endocrine disorders when the body does not produce enough of its own steroids. It is putatively thought that underproduction of cortisol (a steroid) is a contributor to CFS. If dexamethasone is administered to patients suffering from CFS, symptomology would be expected to decrease through a feedback mechanism.

Any hormone downstream in the HPA axis can regulate any other hormone that is produced before it. For example, when cortisol is released into the cardiovascular system, it negatively regulates its secretion by relaying chemical signals to the hypothalamus and anterior pituitary, dampening the amount corticotrophin and adrenocorticotrophin, respectively. So, since CFS may be caused by cortisol deficiencies, dexamethasone treatment targeted at raising these levels may be helpful.

To test the feedback hypothesis of dexamethasone, a low dose of the drug was administered to patients with CFS and circadian salivary cortisol levels measured. After administration of dexamethasone, patient and control groups had no significant endocrine responses in day one or two. Surprisingly, significantly lower levels of circadian cortisol were reported in patients with CFS on day three. It appears dexamethasone negatively regulates the making of cortisol by shutting down hormone production in the brain or elsewhere. Dexamethasone's synergistic affect with cortisol could explain why patients had reduced cortisol levels – the opposite of what was expected.

Summarizing Chronic Fatigue Syndrome

Studies of dampened HPA axis response have been less consistent, but a commonality is still present. When analyzing cortisol and cortisone, Jerjes *et al.* found decreased amounts in patients with CFS.

Crofford *et al*. were unable to find statistically significant relationships between hypocortisolemia and CFS, but noted a unique circadian cycle that could be used in diagnoses. Cleare *et al*. found a concurrent association between cortisol and CFS, but Gaab *et al*. did not. Additionally, Gaab *et al*. were able to show on multiple parameters that adrenocorticotrophin levels may be lowered in CFS patients. Lacking control for comorbidity may be an important confound with some of these data.

Implications for the Future

The literature reviewed herein is only a partial account of the current paradigm relating depression to HPA axis overactivity and chronic fatigue to undereactivity. These studies highlight several implications for the future of those diagnosed with these illnesses.

With respect to treatment in depressed individuals, some drugs that target the HPA axis forecast promising prognoses. Ketoconazole, a cortisol synthesis inhibitor, has been found to reduce symptoms in depression. Lewis reported (1999) that Wolkowitz treated ten patients diagnosed with various subtypes of depression. Serum cortisol levels and depressive signs declined after six weeks in seven of these individuals.

Despite the apparent discrepancies found within the literature, there does seem to be a trend toward elevated hormone levels in `depressed individuals. Because Bhagwagar, Hafizi, and Cowen found higher morning cortisol levels and Burke *et al*. found raised afternoon cortisol levels, more comprehensive studies are needed to evaluate multiple time points.

The putative dose response found by Egeland *et al*. is also consistent with hypercortisolemia in depressives. When targeting patients for treatment, it may be important to address the relative levels of this hormone. Perhaps those individuals located at the more severe end of the spectrum should be considered for hormone therapies whereas those at the lower end treated by more conventional methods such as antidepressants.

Early life events define another relevant realm to which researchers should focus. While the data presented in this review addresses early life stressors with non-human primates, there may be implications for humans. Since stress leads to depression in some people, effective methods of dealing with stress should be considered. Additionally, preventative measures implementing healthy rearing conditions may alleviate the prevalence of depression.

Experiments designed to further test gender and ethnic variation with respect to depression and hormonal hypersecretion should be created. By discovering general trends within the data, it will be possible to establish differences between all walks of life and thus allow the specific targeting of individuals.

While evaluating HPA axis dysfunction in CFS patients, Jerjes *et al*. found suppressed amounts of cortisol and cortisone in urine. These data are consistent with the current thinking; however, urinary sampling may only be revealing a partial account of physiological function. When Crofford *et al*. assayed blood samples across a 24 hour period, adrenocorticotrophin and cortisol levels were not significantly different. These incongruent data suggest that extensive and accurate measurements are needed. Cleare *et al*. mentioned that precision could be obtained by directly measuring cortisol excretion from the adrenal glands. In addition to expensive equipment for this method, patients would endure painful procedures.

The studies reviewed underline an important point about the hypothalamic-pituitary-adrenal axis: this homeostatic system is much more dynamic than once thought. Even though these data are generally consistent with hyper and hypo production of hormones in depression and CFS, respectively, we need to accommodate all of the findings. Until antithetical data can be resolve, we must develop better analytical techniques that will ultimately lead to a profound understanding of depression and chronic fatigue syndrome.

Author's Note

The last century has brought about a divergent host of scientific disciplines. The more knowledge our respective fields acquire, the more unanswered questions we formulate. With the putative goal of one day obtaining happiness for our kind, it only seems

likely that our scientific inquiry will continue to expand. However, we must remain conscious of our goal by drawing upon skills outside our normal realm.

With regards to illness, a holistic approach must be maintained. To successfully understand multiple causalities and develop efficient treatment plans, disciplines ranging from biopsychosocialism to neurochemistry will have to combine their expertise.

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Cognitive Development During Early Adulthood

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Abstract—*This study explores cognitive development during early adulthood (20-35 years of age). The 1st section provides a general overview of cognitive development; the 2nd section examines Piaget's Post-Formal Operations; the 3rd section discusses self-efficacy's role in the developmental process; the 4th section presents a case study of higher education's impact upon intellectual growth; and the 5th section synthesizes the relationship between personal control and post-formal thought in young adults. During early adulthood, intellectual growth drives the developmental process as people progress from formal thought to post-formal cognition. For most young adults, the emergence of dialectical thought coincides with a greater sense of personal control and self-efficacy. Though not fully understood, this crucial stage of cognitive development provides a foundation for future growth and vitality over the life span. Throughout this study, two tables and four figures present key concepts and relationships, thereby beckoning further research into the unknown realms of intellectual growth and development.*

Introduction & Overview

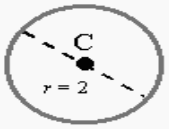
Cognitive development follows universal patterns and processes over the life span. Current research suggests that both nature and nurture affect an individual's unique path toward intellectual growth. Although *inter-individual variation* holds true for people of all backgrounds and cultures, cognitive development generally progresses through a series of stages from birth until death. For humans, the developmental process is woven into the changing life circumstances experienced from youth to old age insofaras intellectural growth parallels its emotional and spiritual counterparts. With inter-individual variation, cognitive development encompasses growth cycles defying exact measurement and prediction. Through continual adaptation to the environment, individuals form *schemas*—mental organizations of the world designating appropriate action—as the framework for advanced thought.

As a life-long process, cognitive development generally follows a set course determined by one's genes, environment, and experiences. During early adulthood, most people's intellectual abilities grow by leaps and bounds. For young adults aged 20 to 35, intellectual growth is both multi-directional and multi-contextual. *Multi-directional* intelligence develops along different trajectories with age, while *multi-contextual* intelligence facilitates circumstantial decision-making by evaluating interpersonal costs and benefits. Through higher education, most young adults develop the capacity for advanced thought combining objectivity with subjectivity and reason with expression.

With respect to cognition, young adults progress beyond adolescence only in their *use* of the intellect because new roles and responsibilities signal a switch from knowledge acquisition to its real-world application. Due to a polar world-view, adolescents tend to think dualistically and dichotomously, while adults learn to think holistically through a more contextual world-view. The transition from adolescent thought to adult cognition parallels biological maturation insofar as cognitive flexibility displaces mental rigidity and relativism outshines absolutism. As individuals begin to think post-formally, the world gradually becomes less clear-cut and more ambiguous. Since post-formal cognition is less absolute than formal thought, it facilitates adaptation to life's many contradictions and inconsistencies. This study delves

Table 1: Subjectivity vs. Objectivity

$A_C = \pi r^2$



$\pi \cong 3.14$

$A_C = 4\pi$

12.57

Subjective Logic	Objective Logic
◆ Why must I calculate the area of this circle? ◆ Although I enjoy math, this calculation seems like a waste of time. ◆ In reality, this problem is insignificant because its solution will not improve my quality of life.	◆ As directed, I must determine the area of this circle. ◆ In order to calculate the area, I must multiply π by the square of the circle's radius. ◆ According to the formula, the area of the circle equals 4π or approximately 12.57.

Table 1 provides an example of the subjective and objective thought processes. Subjectivity elicits personal concerns with emphasis upon life quality, while objectivity focuses on solving the problem.

into the nature of post-formal thought in young adults, and traces its impact upon cognitive development across the life span.

Post-Formal Cognition

Early adulthood coincides with the emergence of dialectical reasoning, enhanced problem-solving, and peak intellectual abilities (Demo, 1992). Between 20 and 35 years of age, young adults enter the final phase of cognitive development: Piaget's Post-Formal Operations. However, not all adults think post-formally, and post-formal cognition is asymptotic insofar as some people may approach but never fully achieve this capacity. Post-formal operations encompass a wide breadth of phenomena across many divergent contexts. Since it reflects the interplay of various circumstances and situations, post-formal cognition is "multi-contextual" (Berger, 2001). This *multi-contextual approach* yields insight into the nature of post-formal thought.

A Multi-Contextual Approach to Cognitive Development

Post-formal operations delineate a stage of adult cognition suited to solving real-world problems (Berger, 2001). From a pragmatic standpoint, post-formal thought enables young adults to survive and thrive in an uncertain world requiring continual adaptation. With integration of subjective and objective logic, this capacity fosters cognitive flexibility in young adults by exposing the fallacy of absolutism. A dichotomy exists between these two thought patterns because *subjectivity* arises out of personal experiences and perceptions, while *objectivity* derives from abstract reasoning and impersonal logic. According to Berger (2001), purely objective thought becomes maladaptive when coping with the complexities and commitments of the adult world. Thus, young adults gain a *contextual awareness* of reality by thinking subjectively as a means of negotiating the discrepancies and incongruities of day-to-day life.

Dialectical Thought

The integration of subjective and objective logic mirrors the dialectical process of cognition. This process originates out of the *Hegelian Dialectic*, which posits that every truth bears within itself the suggestion of its opposite insofar as each "thesis" necessarily implies an "antithesis." Berger (2001) defines *dialectical thought* as cognition characterized by an "ongoing awareness of pros & cons, advantages & disadvantages, and possibilities & limitations" (p. 491). As the most advanced level of cognition, dialectical thought comprises three stages: thesis, antithesis, and synthesis. The *thesis* is merely a proposition, while the *antithesis* negates this proposition. Finally, the *synthesis* reconciles the thesis and antithesis by integrating and refining them into a new truth

Dialectical Process

Table 2

Stages	Cognitive Logic	Moral Principles
1. Thesis	In most circumstances, honesty is the best policy, and lying is wrong.	Deontology
2. Antithesis	In some cases, honesty is not the best policy, and lying may be beneficial or necessary.	Relativism Self-Interest
3. Synthesis	In most instances, honesty remains the best policy because it tends to promote general welfare. However, lying may prove beneficial or necessary when the truth poses a threat to one's reputation, or undermines the common good.	Realism Utilitarianism Universal Ethics

Table 2 details each stage of the dialectical process as well as the logic and principles underlying the thesis, antithesis, and synthesis.

Dialectical thought is propelled by the universal need for *cognitive equilibrium*—a state of mental balance into which new ideas and experiences are accommodated or assimilated. Cognitive disequilibrium fuels intellectual growth by prompting modification of old concepts into new ideas incorporating personal experience. Accommodation and assimilation serve as tools for resolving cognitive disequilibrium insofar as individuals may employ them either alternately or simultaneously throughout life. By definition, *accommodation* refers to the process of modifying one's schemas in response to a new experience, while *assimilation* denotes the process incorporating a novel idea into an extant schema. Through accommodation and assimilation, people may establish a new cognitive equilibrium superior to the old one (thesis → antithesis → synthesis).

Figure 1 elucidates the relationship between dialectical thought and cognitive equilibrium by tracing the mechanisms, which paradoxically instigate yet resolve disequilibrium. The dialectical process continues indefinitely over one's life with the advent of each new synthesis. In this vein, the Hegelian dialectic illuminates cognitive development during early adulthood. By reconciling life's many contradictions and inconsistencies, dialectical thought precipitates intellectual growth. Hence, the dialectical process reflects the evolutionary nature of young adults' self-efficacy insofar as personal competence tends to grow with each new synthesis.

Self-Efficacy's Role in Cognitive Development

Self-efficacy plays a key role in cognitive development during early adulthood. Specifically, *self-efficacy* refers to an individual's assessment of his/her effectiveness, competence, and causal agency (Gecas, 1989). Cognitive psychology couches self-efficacy in terms of conceptualizations, rather than motivations. Funder (2001) defines *motivation* as "the drive to attain an end-state" or goal (p. 495). *Conceptualizations* of self-efficacy include three aspects: expectancies, individual perceptions of control, and control orientations. In this vein, self-efficacy underpins Bandura's Social-Learning Theory.

Social-Learning Theory

Social-Learning Theory distinguishes between efficacy expectations and outcome expectations. Gecas (1989) notes that "an efficacy expectation is a belief that one can successfully perform a particular action," while an outcome expectation is an estimate that a given action will lead to a particular result (p. 294). In other words, an *efficacy expectation* denotes a competency belief, while an *outcome expectation* entails a probabilistic deduction of a behavioral result in one's environment. Psychometric instruments for evaluating self-efficacy employ three different types of analysis: task-specific, domain-specific, or general (Gecas, 1989). *Task-specific* instruments attempt to gauge an individual's self-

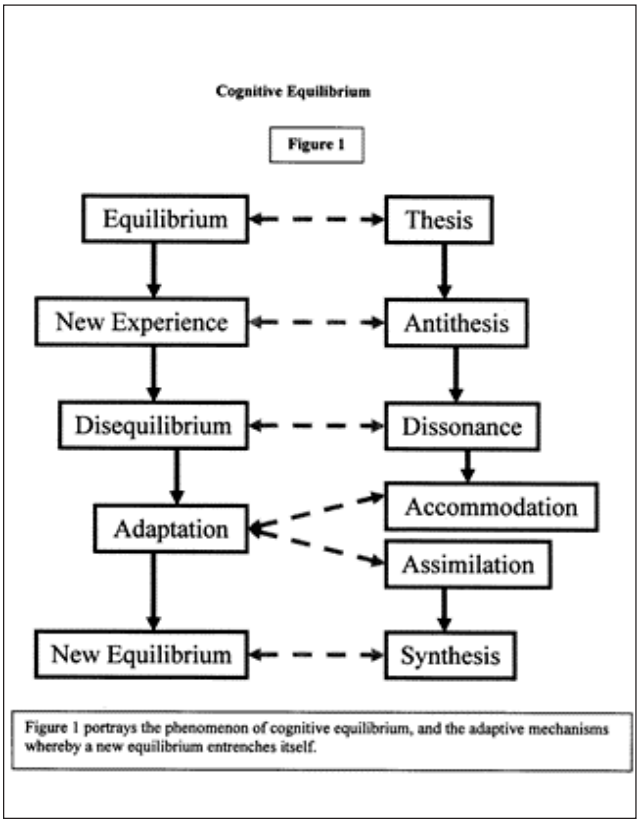


Figure 1 portrays the phenomenon of cognitive equilibrium, and the adaptive mechanisms whereby a new equilibrium entrenches itself.

efficacy by correlating his/her performance with *a-priori* expectancies. *Domain-specific* instruments comprise the Political Efficacy Scale and the Locus-of-Control Scale measuring individual control-orientations, while *general* instruments include the Personal Mastery Scale and the Self-Efficacy Scale measuring individual perceptions of agency.

Bandura's research has identified four main sources of self-efficacy: personal mastery, vicarious experience, verbal persuasion, and emotional arousal (Gecas, 1989). Of these four sources, *personal mastery* affects self-efficacy most significantly because individual expectancies draw upon past performance as a yardstick for personal competence. Current research indicates that high self-efficacy fosters adaptivity and intellectual achievement, while low self-efficacy leads to maladaptivity and stagnation. Individual achievement fuels self-efficacy through positive reinforcement over the course of one's life. In this vein, *achievement motivation* connotes a strong desire to perform on par with one's expectancies stemming from a personal valuation of activity, competition, and accomplishment. A symbiosis exists between achievement motivation and self-efficacy insofar as they reinforce each other by spurring a concomitant gain in task performance.

Figure 2 depicts the dynamic nature of self-efficacy across the life span. One's self-efficacy tends to evolve as he/she encounters new roles, situations, and life transitions (Demo, 1992). In Figure 2, this evolution follows the trend line, and peaks at age 60 for most people. With respect to self-efficacy, periodic

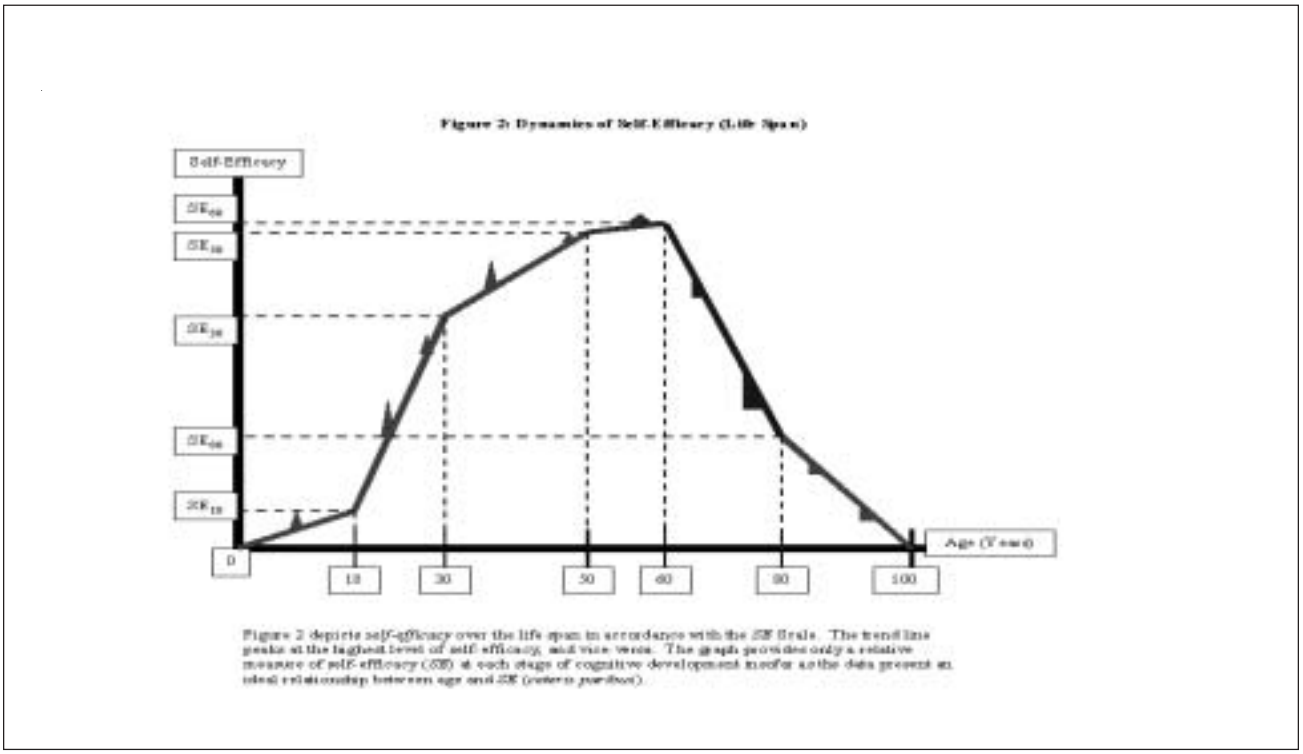
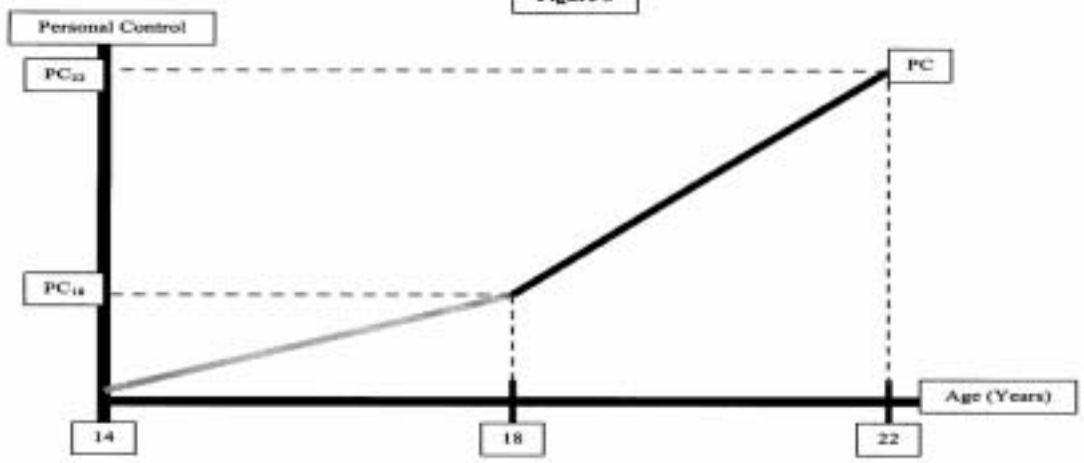


Figure 2 depicts self-efficacy over the life span in accordance with the *SE* Trait. The trend line peaks at the highest level of self-efficacy, and vice versa. The graph provides only a relative measure of self-efficacy (*SE*) at each stage of cognitive development insofar as the data present an ideal relationship between age and *SE* (pattern postbox).

Longitudinal Analysis of Personal Control vis-à-vis Age (1979-1992)

Figure 3



In Figure 3, *personal control* denotes an amalgam of cognitive skill and self-efficacy. Due to the positive relationship between cognitive skill and self-efficacy, the *PC* trend line slopes upward. As a relative measure, personal control (*PC*) derives from individual perceptions of agency insofar as the graph presents an ideal relationship between age and *PC* (*ceteris paribus*).

fluctuations in the trend line's slope pinpoint changes in the rates of increase and decrease. For instance, the rate of increase is highest between ages 18 & 30 and lowest between ages 50 & 60. The spikes above and below the trend line represent *situational fluctuations* in self-efficacy due to either vitality or ill health.

According to Figure 2, one's self-efficacy remains in a state of constant flux over the course of his/her life. For instance, self-efficacy is modified as young adults develop new cognitive capabilities and confront new social demands (Demo, 1992). In Figure 2, the high rate of cognitive development during early adulthood explains the steepness of the trend line's slope between ages 18 and 30. Likewise, cognitive stagnation during middle adulthood accounts for the flatness of the trend line's slope between ages 50 and 60.

Figure 2 implies that individual competence during adolescence leads to high self-efficacy in early adulthood. With respect to competence, self-efficacy entails assumptions and beliefs about the possibilities of action in the face of particular contexts and events (Clausen, 1991). For young adults, high self-efficacy fosters effective decision-making and realism. Clausen (1991) claims that high self-efficacy "tends to lead young adults to make more realistic choices in education, occupation, and marriage" (p. 811). Therefore, a positive relationship exists between self-efficacy and life satisfaction for individuals between 20 and 35 years of age. Overall, people with high self-efficacy lead stable and productive lives as opposed to their less efficacious counterparts.

Personal Control

Lewis, Ross, & Mirowsky (1999) argue that "personal control over one's life is a fundamental aspect of self-efficacy" (p. 1574). Personal control aids in developing high self-efficacy through mastery experiences. By definition, *personal control* entails a learned expectation that outcomes are contingent upon one's own choices and actions (Lewis *et al*., 1999). These three researchers posit that personal control develops during the transition from adolescence to adulthood, and in order to validate this hypothesis, they analyze data from the National Longitudinal Survey of Youth (NLSY). The NLSY sampled a cohort ranging from 14 to 22 years of age in 1979, and subsequently conducted a follow-up study in 1992 upon the same cohort ranging from 27 to 35 years of age (n = 11,532). In this study, the

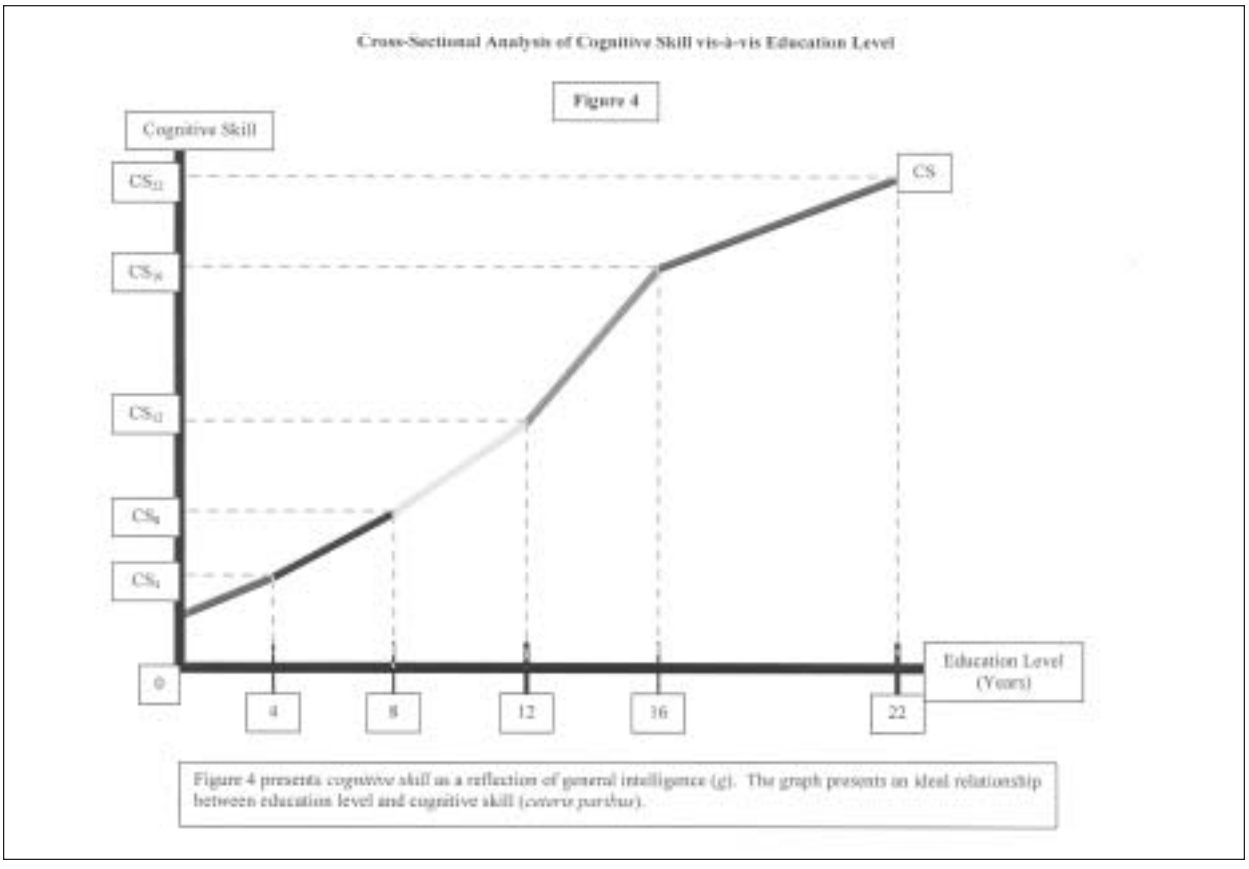
authors performed a multivariate regression-analysis of efficacy perceptions among adolescents and young adults, while controlling for education, income, cognitive skill, sex, and ethnicity.

Figure 3 demonstrates a direct association between personal control and age. The slope of the *PC* trend line depicts the rate of increase in personal control between ages 14 and 22. The researchers' analysis of the NLSY data indicates that cognitive skill and self-efficacy are positively correlated at the 0.015 probability level (Lewis *et al.*, 1999). For young adults, a statistically significant relationship ($t = 15.154$) exists between cognitive skill and self-efficacy insofar as intellectually advanced individuals perceive a greater sense of control over their own lives. This link explains the steepness of the trend line's slope between ages 18 and 22 because the *rate* of cognitive development peaks during early adulthood, especially for college students.

Case Study: Intellectual Growth Through Higher Education

> In general, education powerfully influences cognitive development. Years of education are strongly correlated with virtually every measure of adult cognition, even more so than….age and socioeconomic status. College education not only improves students' verbal and quantitative skills, [but]….also enhances the flexibility and resourcefulness of their reasoning abilities (Berger, 2001, p. 499).

As a prerequisite for post-formal cognition, academic rigor has proven conducive to every facet of intellectual growth. Specifically, college students have demonstrated significant gains in crystallized, fluid, and general intelligence. By definition, *crystallized intelligence* refers to the accumulation of knowledge acquired through education and experience within a culture, while *fluid intelligence* denotes the flexible reasoning used to draw inferences about the nature of relationships within the world (Berger, 2001). Whereas crystallized intelligence comprises long-term memory, in the transition to adulthood. *Social Forces*, 77(4), 1573-1599.



concrete thought, and analysis; fluid intelligence includes short-term memory, abstract thought, and decisiveness. Although both types of intelligence generally decline with old age, crystallized intelligence continues growing until the onset of a debility or illness such as Alzheimer's Disease. As an amalgam of fluid and crystallized intelligence, *general intelligence* (*g*) underpins advanced cognition throughout the developmental process.

Figure 4 illustrates a positive association between cognitive skill and education level. As a comprehensive measure of intellect and adaptivity, *cognitive skill* (*CS*) encapsulates the ability to marshal one's thought processes toward achieving a desired goal or outcome. The slope of the *CS* trend line indicates the rate of increase in cognitive skill between 0 and 22 years of education. The trend line's slope is steepest between years 12 (undergraduate freshman) and 16 (undergraduate senior) because intellectual proficiency develops most rapidly during college. This phenomenon parallels the rising rates of self-efficacy for individuals between 18 and 22 years of age. Thus, higher education qualitatively benefits most students as a form of delayed gratification, since some cognitive skills may not prove useful until middle or late adulthood.

For young adults, higher education tends to increase personal mastery by internalizing one's locus-of-control. Myers (2002) defines *locus-of-control* as "the extent to which people perceive outcomes as internally controllable by their own actions," or as externally controlled by the environment (p. 55). On the Self-Efficacy Scale, college students consistently score high in achievement motivation, individual autonomy, assertiveness, personal control, independence, and self-determination. In regard to social tolerance, Berger (2001) observes that "college experience seems to make people more accepting of others' attitudes and ideas" by broadening their minds (p. 501). This exposure to new ideas fosters dialectical thought in young adults, and facilitates universal appreciation for cultural and individual differences. Most importantly, college *actively* engages students in the learning process, and thereby permits them to become a *causal force* in their own cognitive development.

Conclusion

Since post-formal thought requires intellectual curiosity and life-long learning, individual volition lays the foundation for cognitive development during early adulthood. In other words, cognitive development between ages 20 and 35 constitutes an active and dynamic process. Active cognition encapsulates Piaget's Post-Formal Operations insofar as *contextual awareness* and *dialectical thought* precipitate intellectual ferment during early adulthood. A symbiosis exists between intellectual growth and self-efficacy due to positive reinforcement. Over time, cognitive skill bolsters individual competence and personal control. For young adults, an internal locus-of-control ensures high self-efficacy, and thereby promotes satisfaction and stability over the life span.

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Anxiety Reduction: Expanding Previous Research on Mandala Coloring

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Abstract—*Past studies have shown coloring a Mandala to be useful in reducing anxiety. However, more empirical data is needed to validate this method. The current experiment focused on two goals. First, the researcher explored anxiety type, assessing reduced-concreteness and concreteness of anxiety. Second, the researcher explored anxiety reduction triggered by various coloring conditions. Four conditions that will be compared include Mandala coloring condition with a brief Mandala synopsis, mandala coloring condition with no brief Mandala synopsis, coloring plaid condition, and free coloring condition. While, results showed there was no difference between conditions, the act of coloring by itself seemed to reduce anxiety. Additionally, coloring contributed to concrete anxiety reduction and was noted as not changing anxiety levels for those participants clinically diagnosed with anxiety disorder.*

Anxiety Growth

Increased levels in anxiety related illness, place emphasis on diagnosis and proper treatment. Researchers view modern era as having the highest levels of anxiety, and refer to the current decade as the 'Age of Anxiety' (Twenge, 2000). Twenge revealed that a current increase in anxiety is due to environmental as well as physical and psychological causes. Specific environmental effects include safety issues, social issues, acceptance issues, and job security. Physical and psychological anxieties show a direct relationship to health problems associated with disease and depression. Other societal trends explain anxiety as a leading cause in depression, substance abuse, and high mortality rates.

Anxiety Type

Stober and Borkoves (1992) described anxiety through the avoidance theory of worry, suggesting that worry represents a cognitive response towards feared stimuli. Stober (1998) furthered this idea and coined a new theory titled 'Reduced-Concreteness Theory.' Stober recognized that anxiety could be separated into two categories: reduced-concreteness and concreteness in worry. Concreteness in worry is easy to remedy and represents normal realistic worry. Although it is not likely that an individual will get hit by a car when crossing the street, this is an incident that could realistically occur if the individual does not follow visual directions. Reduced-concreteness of worry is more difficult to remedy, often the individual represses the worry and experiences trouble correcting as well as facing the fear. An individual may refuse to accept that the ghost creeping around the house is actually a rat creeping around the house. The belief in the ghost is an unrealistic and abstract notion and may eventually build into a greater fear or become a repressed worry.

Art in Therapy to Reduce Anxiety

The therapeutic use of art originated through the practices of Sigmund Freud and Carl Jung, who viewed art as a means of self expression (Eisdel, 2005). In therapy, artistic technique is personal and self directed, and allows individuals to gain increased

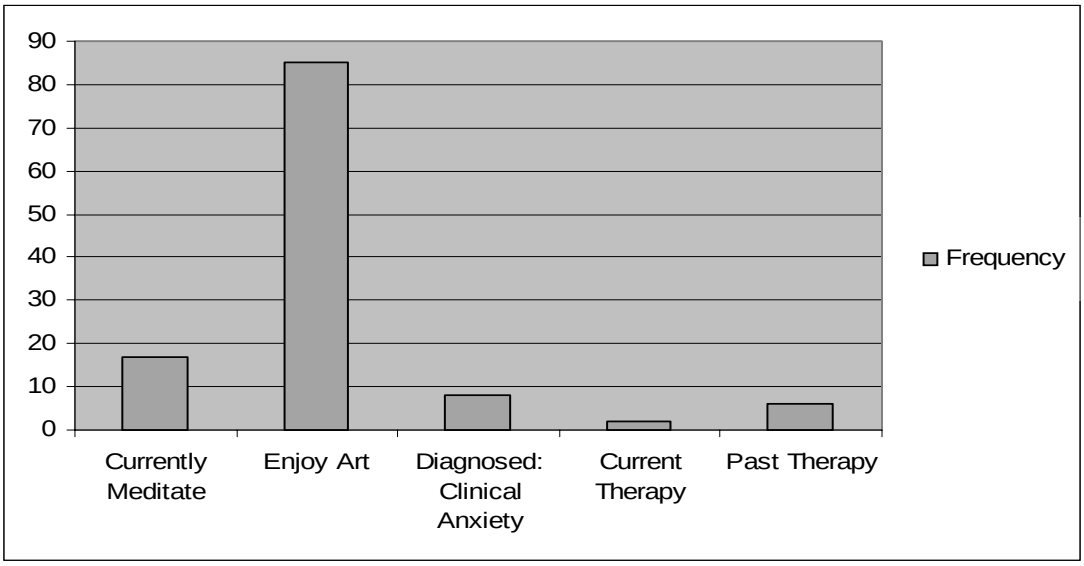


Figure 1: Frequency of prior art and therapeutic experience

understanding of their inner and outer views of the world. Art is also recognized as an alternative language that increases non-verbal communication (Miller, 1993). Individuals who suffer from repressed anxiety may be able to use art to communicate specific negative fears. Research has shown reducing anxiety through art therapy is most effective when controlled methods are employed. This suggest that using art in a abstract way may increase anxiety. Miller (1993) explored this notion by researching anxiety of medical residents using controlled and uncontrolled art techniques. During controlled conditions participants were given specific technique directions, while during uncontrolled conditions participants were given no technique instructions. Both groups were given the task of replicating the same style of art; however, only the controlled group was provided with an artistic synopsis before the beginning the task. Results showed that the brief synopsis provided participants with more confidence with the artistic task. Participants spent more time on the task and more anxiety reduction occurred.

Empirical research supporting the effectiveness of art in therapy remains scarce. Published research primarily focuses on theoretical concepts and case studies rather than the effectiveness of the technique (Reynolds, Nabors, & Quinlan, 1996). Reynolds and colleagues researched effectiveness of art therapy by using an archival research method to analyze literature and evaluate effectiveness as well as trends in art therapy. They chose articles that included the impact of art therapy on measurable outcomes, and of treatment on sample groups. Results varied due to diversity of the patient population. Much of the research they reviewed focused on adolescents dealing with varying mental illnesses. In addition, a significant range was noted in the amount of time the participants spent in the art therapy sessions. Along with these inconsistencies, sample sizes were often small and designs tended to use single groups with no control group. However, overall results showed significance and the authors concluded that art therapy sessions aided in recovery. Reynolds and colleagues believe that research supported the effectiveness of art in therapy; however, it was not more effective then standard therapy. Because, the majority of studies used adolescent populations, results may be different for other populations.

Additionally, art therapy is mainly used in combination with other forms of therapy and cannot be evaluated.

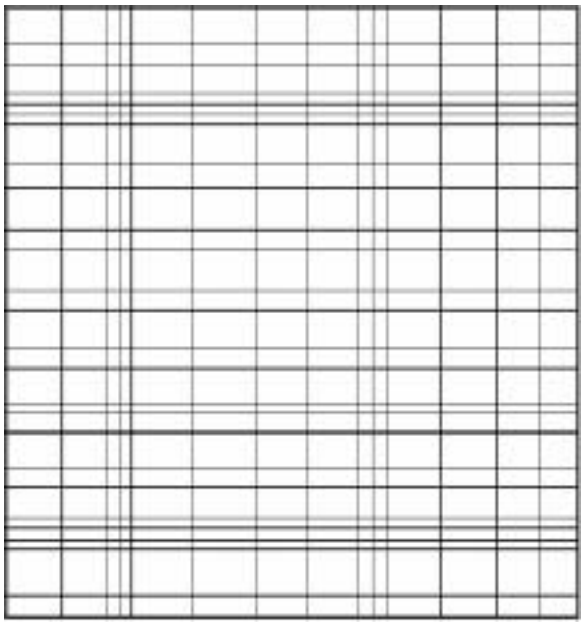
Past Research on Mandala Coloring to Reduces Anxiety

The circular geometric shape of the mandala is recognized as a universal symbol for spiritual growth. This symbol has a variety of meanings and can be used as a visual form of meditation. Mandala rituals evolve from the Early Buddhist practice believing that the world exists on two disconnected planes. To reach enlightenment, one must see beyond the illusion of difference to see the absolute truth. Mandala practices allow the individual to see beyond the division of all things to attain integration of the ego (Snyder, 1999).

Research supports the combination of art and meditation. Belchamber (1997) coined the term coloring therapy, for describing the connection between art and meditation. Within coloring therapy, the mandala represents a symbol of healing. By coloring the mandala, the individual enters a meditative state leading to self discovery. This enhances and suspends the individual's inner dialogue recognized as internal conversation, which can be self regulated when it is recognized. Therefore, this technique can reduce anxiety by controlling and understanding thoughts related to feared stimuli.

Figure 2: The mandala coloring condition.

Figure 3: The plaid coloring condition.



Curry and Kasser (2005) explored coloring therapy by studying anxiety reduction that resulted from mandala coloring. Researchers emphasized the importance of a deep state of engagement brought about by mandala coloring. This suggests that uniqueness of the mandala promotes relaxation and reduces anxiety. Experimental conditions distinguished the mandala geometric patterns from other geometric patterns by testing a plaid pattern as well as free coloring condition. The plaid pattern was used since it contains as many complexities as the mandala pattern. Researchers attempted to distinguish whether the uniqueness of the mandala was the essential cause of anxiety reduction, or if reduction was due to the intricacy of the pattern. Anxiety was explored within specific areas. First, participant anxiety was measured immediately upon entering laboratory and after the coloring was completed, using the State Anxiety Inventory (Spielberger, Gorsuch, & Lushene's, 1970). Second, participants underwent a brief anxiety induction experience. Researchers instructed participants to write about a fearful experience

on a sheet of paper for approximately four minutes. Experimental results showed mixed conclusions. Although coloring the mandala did significantly decrease anxiety levels, there was no distinction between the mandala condition and the plaid condition. Also, participants showed no change in anxiety levels in the free coloring condition. Researchers concluded that anxiety reduction occurred due to the structure and organization involved in the mandala and plaid condition. Because the free coloring condition was not defined, participants had to find a way to structure organized anxiety. Researchers believe that one limitation within the experiment may be due to possible confounds in measuring anxiety. Further research exploring other anxiety measures may show more variation in anxiety scores between the mandala and plaid coloring condition.

Current Study

This investigation draws on three specific goals. First, the researcher attempted to replicate and alter Curry and Kasser (2005) previous mandala coloring study. To reduce the possibility of confounds, the current study used a pre and post-test procedure employing the Worry Domains Questionnaire (WDQ; Tallis, Eysenck, & Mathews, 1992). Second, the researcher explored anxiety by analyzing reduced-concreteness and concreteness of worry. Third, the researcher explored spirituality associated with the mandala. I will attempt to create a spiritual presence by providing participants with a brief synopsis of the mandala religious ritual. This technique is similar to the art synopsis given to participants in previous research.

Furthermore, the researcher explored reduced-concreteness and concreteness of worry in four conditions, mandala coloring condition with a brief mandala synopsis, mandala coloring condition with no brief mandala synopsis, coloring plaid condition, and free coloring condition. Three distinct hypotheses were addressed. First, the mandala coloring condition will show higher levels of anxiety reduction compared with the plaid coloring condition and free coloring condition. Second, participants in mandala condition with brief mandala synopsis will a show higher level of anxiety reduction compared to the mandala condition with no brief mandala synopsis. Third, participants will have more reduced-concreteness in anxiety then concreteness in anxiety.

The importance of this study will show that mandala coloring can be used as a tool to decrease anxiety. Due to current high trends in anxiety, it is essential to evaluate anxiety and devise new methods of effective treatment. Additionally, this study will increase empirical research that supports and highlights the importance of alternative therapeutic methods.

Method

Participants

A sample of seventy-five participants ranging in age from 18-56 years of age (M = 26.37, SD = 17.59) volunteered to participate in the experiment. Participants included 35 men and 40 women of varying ages. Participants were assessed prior to the experiment on current meditation practices, enjoyment on art, current anxiety rate, clinical diagnoses of General Anxiety Disorder (GAD), current therapy, previous therapy, and current use of meditation combined with art. Frequencies of these behaviors can be seen in Figure 1. All participants resided in Charlotte, North Carolina.

Measure

The mandala and plaid design contain similar complexities and geometric pattern of those used in Curry and Kasser (2005) study, as shown in Figure 2 and Figure 3. The free coloring participants were given a blank piece of white paper. All coloring conditions templates will be consistent, using similar paper as well as allocated space for coloring.

The brief Mandala synopsis included summarized descriptions of Mandala practices in organized religious groups. The synopsis is

organized into five categorizes, including; Mandala in Hinduism, Mandala in Buddhism, Mandala in Vajrayana, Mandala in Nichiren Buddhism, and Mandala in Discordianism.

Participants were given an information sheet consisting of eight questions to complete prior to the pre-test. These questions assessed whether the participant has had any previous experience with meditation, art, anxiety, and therapy.

Anxiety was measured pre-test and post-test using the Worry Domains Questionnaire (WDQ; Tallis, Eysenck, & Mathews, 1992), assessing the amount of non-pathological worry using a Likert scale (1-5) ranging from not at all (0) to extremely (5). WDQ consists of twenty-five-items and covers five domains of everyday worry including, relationships, lack of confidence, aimless future, work incompetence, and financial issues.

Assessing reduced-concreteness and concreteness of worry was determined using the domains of the WDQ. The researcher assessed reduced-concreteness of worry by combing the categories of the WDQ, aimless future and socio-political worry. Both types of worry were determined to be uncontrolled by the individual and recognized as more abstract. Concreteness of worry was assessed within the WDQ by combing the categories work incompetence and financial worry. These two worry domains were determined as controlled by the individual and recognized as more concrete worries. Significance for these categories was determined by asking ten colleagues to sort WDQ domains in either a reduced-concreteness of worry category or in a concreteness of worry category.

Procedure

A between subjects randomized group design was used. Upon entry into the study, participants were randomly assigned to one of the four conditions, and were given an experimental packet. This packet included, the information sheet, the WDQ to be completed before and after the experimental condition, the coloring condition, and a box of six colored pencils (red, orange, yellow, green, blue, and purple). Participants within the mandala coloring condition that included a brief mandala synopsis were given a mandala information sheet in their experimental packet.

Participants were provided with minimal instructions before beginning the experiment. First participants were instructed to complete the information sheet, next participants were told to complete the WDQ pre-test, then participants were told to complete the experimental condition, and last participants were told to complete the WDQ post-test.

Participants were told that they could color as little or as much as they wanted during the experimental conditions. Participants were given no time restraints during the experimental conditions.

Results

The prospect of Type I error was kept at .05 for all succeeding analysis. The hypothesis predicting participants would have more reduced-concreteness in anxiety then concreteness in anxiety, showed significance. The mean reduced-concreteness score (M = 20.4, SD = 6.19) was significantly higher then the mean concreteness score (M = 10.8, SD = 7.2). The MANOVA was significant, F (1, 71) = .57, $p < .001$.

The hypothesis predicting that participants in mandala coloring condition with and without the brief mandala synopsis would show higher levels of anxiety reduction compared with participants in the plaid and free coloring condition showed no significance. The mean anxiety score for those in the mandala condition with or without the mandala synopsis (M = 32.70, SD = 19.41) was not significantly different and was higher then the mean score for those in the plaid condition (M = 31.0, SD = 18.16). Additionally it was only slightly lower then those in the free coloring condition (M =

34.47, *SD* = 19.31). The MANOVA was not significant, $F(3,71) = .26$, $p = .84$.

The hypothesis predicting participants in the mandala condition with brief mandala synopsis would show higher level of anxiety reduction compared to participants in the mandala condition with no brief mandala synopsis, showed no significance. The mean anxiety score for those in the mandala condition with synopsis (*M* = 28.80, *SD* = 16.8) was not significantly different, and was only slightly lower then the mean for those in the mandala condition (*M* = 32.70, *SD* = 19.41). The MANOVA was not significant, $F(3, 71) = .26$, $p = .84$.

Discussion

Results indicate that there was significance in anxiety reduction after all coloring conditions. The act of coloring may have acted as a self regulator allowing anxiety reduction to occur. Further research could explore these results by evaluating the act of coloring as a meditative technique. In doing this it may be necessary to use an adolescent population and explore the process of learning to color. Children may also have a larger tolerance to time spent coloring and further anxiety reduction may be determined. A longitudinal study would allow research to explore coloring throughout life, comparing the effects of coloring on anxiety during development. Added research on color choice and color technique may provide additional information on why coloring reduces anxiety.

The first hypothesis suggested that the mandala coloring condition would show higher levels of anxiety reduction compared with participants in the plaid and free coloring condition. However, results indicated that participants within the plaid color condition had lower anxiety scores then the mandala color condition, and participants in the free color condition had only slightly higher anxiety scores then participants in the mandala conditions. The second hypothesis tested whether participants in mandala condition with brief mandala synopsis will show higher levels of anxiety reduction compared to participants in the mandala condition with no brief mandala synopsis. Results showed that although the anxiety score was slightly lower the statistical analysis was not significant. The final hypothesis suggested that participants will have more reduced-concreteness in anxiety score than concreteness in anxiety score. This hypothesis was significant, and there was a decrease in anxiety scores from pre-test to post-test. In addition, there was more decrease in concreteness in anxiety scores compared to reduced concreteness in anxiety scores.

Curry and Kasser (2005) past research was not supported through the current experiment. The current research indicated that there was no significant distinction amongst the levels of the independent variables. The results have alternative explanations, including experimental, time, and the mandala indoctrination. First, the space used for participant testing was not consistent. Testing was done in varying environment and interruptions may have altered results. Future results may show increased levels of significance by using one specific setting and control all external distractions. Second, time spent on each coloring conditions was not consistent. Participants were given no time restrictions and time spent coloring varied. Future results may show significance if participants colored for the same allocated period of time. Also, increased time spent coloring may be essential in reducing anxiety. Results may show further significance if experimental conditions were practiced on a day-to-day bases for an extended period of time. Third, results show that the brief mandala synopsis did not enhance anxiety reduction and may have provided no education on the significance of the mandala. Future research may encourage the teaching of the mandala by providing more concise information. Also, the

current experiment did not evaluate whether the participants had any previous or current understanding of the mandala. A mandala pre-test that evaluates knowledge could be a successful indicator for participant understanding.

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Relationships of Locus of Control with Spirituality and Religiosity

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Abstract—*Religiosity and spirituality are ancient and ubiquitous practices in human history. For many people, being religious or spiritual is an integral part of their existence. This study aims to investigate the personality characteristics associated with the tendency to be religious or spiritual. Thirty adults in the Southeastern United States were surveyed to assess their locus of control, level of spirituality and level of religiosity. Rotter's Locus of Control, Delaney's Spirituality Survey, and Strayhorn's Religiosity Scale were used to measure these variables. An external locus of control was expected to have a positive relationship with a high level of spirituality or religiosity. Results showed that an external locus of control was significantly related with a high level of religiosity. However, there was no significant relationship between external locus of control and spirituality level. As a side note, there was a significant negative relationship between high levels of spirituality and high levels of religiosity.*

Recent studies have focused on measuring the effects of spirituality on one's overall health and well being. Because such tools as prayer and meditation have been used for thousands of years by people believing in their healing properties, researchers now want to measure this phenomenon (Barnes, Powell-Griner, McFann & Lahin, 2004). These so-called "mind-body medicines" are currently being studied by the National Center for Complementary and Alternative Medicine (Barnes, Powell-Griner, McFann & Lahin, 2004). Preliminary results have shown such promising relationships between overall health and spirituality that some care providers have begun taking inventory of a patient's spirituality to assist in prevention of and recovery from illness and disease (Kutz, 2004). A double-blind study from 2001 found that prayed-for patients (an experimental group of patients that had received prayer from a group of participants instructed to pray for them) diagnosed with bloodstream infections recovered significantly faster than patients with the same type of infection that had not received prayer (Kutz, 2004).

In the same vein, religiosity has been shown to have a positive relationship with individual health as well (Masters, 2005). In fact, in the overall studies involving health and its relation to religiosity, 81% showed a positive relationship between the two variables in relation to such illnesses as cancer and cardiovascular disease and many others (Matthews, McCullough, Larson, Koenig, Swyers & Milano, 1998). These studies take into consideration, and equalize, many variables such as race, ethnicity, age, gender, socioeconomic status and others (Matthews, McCullough, Larson, Koenig, Swyers & Milano, 1998). Another study which involved measuring religiosity as related to clinical mental health showed a significant positive relationship, especially in the case of depression (Matthews, McCullough, Larson, Koenig, Swyers & Milano, 1998). There are even studies that show religiosity as a deterrent for drug use (Matthews, McCullough, Larson, Koenig, Swyers & Milano, 1998).

Given these results, it raises the question of what makes a person want to be spiritual or religious in the first place since there are some individuals that choose not to be either, such as Atheists or Agnostics. Perhaps environment shapes some of the desire; it is possible that familial traditions can be a large influence on one's choice to be religious or spiritual. But perhaps the root of the choice goes deeper than just one's surroundings, and involves one's own personality. One facet of personality is how we as individuals perceive control in our lives; are we in control or are we shaped by forces beyond our control? Locus of control is defined as the perception of how much control an individual believes he or she has over life occurrences. An external locus of control would indicate that an individual views most things that happen to him or her as a result of environmental or external happenings (Rotter, 1954). In other words, he or she would be more inclined to believe in fate, chance and luck. Whereas an internal locus of control would indicate just the opposite, that the individual views him or herself as ultimately responsible and accountable for life occurrences and does not believe in the role of fate, chance or luck.

Both religiosity and spirituality involve seeking or acting outside one's self, in that religiosity involves incorporating outside doctrine and practices into one's life, and spirituality involves desiring to connect with a source (or sources) of power outside the individual. Because of this, it is reasonable to assume that individuals with a high external locus of control are more likely to be religious or spiritual. Likewise, individuals who are high on the internal side of the locus scale will be less inclined to be religious or spiritual, because they do not feel the need to seek outside themselves.

It is important to clarify at this point the definitions of the words "religiosity" and "spirituality" as used in this study. "Religiosity" refers to an individual's tendency to attend religious services, participate in religious practices and live by standards proposed by his or her own religious doctrine, if applicable. "Spirituality" refers to an individual's tendency to seek meaning or guidance by some higher or larger force or power outside him or herself.

The goal of this study is to help better understand the personality behind the tendency towards being religious or spiritual. Perhaps a better understanding of the personality will lead to an understanding of the health benefits that seem so synonymous with the tendency towards being religious or spiritual.

Method

Participants

This study used 30 adults located in the Southeastern United States. Because gender was suspected to cause a possible systematic variability, 15 males and 15 females were selected to take the surveys. Age was recorded only to ensure the participant was over the age of 18 years.

Materials

Each participant was given a copy of (1.) Rotter's Locus of Control, (2.) Delaney's Spirituality Survey and (3.) Strayhorn's Religiosity Scale. Rotter's Locus of Control consists of 29 paired statements which pertain to two differing viewpoints on a situation. For example, statements for #1 are: "a. Children get into trouble because their parents punish them too much." or "b. The trouble with most children nowadays is that their parents are too easy with them." The participant was to choose the statement that best fit his or her feelings on the issue. The purpose for this layout is to allow the participants two ways of viewing an issue and assessing, in this situation, whether they see the control as internal or external to the child. Other statement pairs related to obtaining career positions, personal happiness in relation to success, personal accountability and popularity among friends, and leadership. A high score on Rotter's Locus would indicate a high external

locus of control, whereas a low score would indicate a high internal locus of control.

Delaney's Spirituality Survey is a 23 statement assessment of how spiritual an individual is, as related to meditating, praying, belief in a Higher Power, and living in harmony with nature (Delaney, 2003). Each statement was given a possible answer range of 1 to 6, with 1 being "Strongly Disagree" (indicating a low spirituality level) and 6 being "Strongly Agree" (indicating a high spirituality level).

Stayhorn's Religiosity Scale measures the extent to which a participant is religious by assessing statements pertaining to attendance to religious services, service to a religious institution, relationship with God, awareness of God's approval of his or her actions (or lack of approval), donation of money to a religious organization, and level of religious purpose or goal in life (Strayhorn, 1990). The statements were rated using responses that were appropriate for each statement (i.e., "How often do you serve a church or other religious organization in Sunday school teaching, church project leadership, or other responsibilities?" and responses were: Never, A few times a year, Once/ twice a month, Weekly or almost weekly, or More than once a week). These responses were assigned a range of numerical value, with a value of 1 pertaining to a low religious response (i.e., Never) and 5 pertaining to a high religious response (i.e., More than once a week).

Procedure

Participants were obtained randomly at a local university. The participants were approached about a survey for an undergraduate research class. They were told that there were three different surveys that related to assessing personality characteristics and personal preferences. They were not told the nature of what was being measured. They were given contact information for the professor of the class in the event that they had further questions or concerns about the surveys after participating.

Results

The scores for were summed for each measure. Results for Rotter's Locus of Control were based on a possible high score of 23 which indicated a high external locus of control. Likewise, a low score indicated a high internal locus of control. Delaney's Spirituality Scale was based on a possible high score of 138 which indicated a high level of spirituality. Strayhorn's Religiosity Scale was based on a possible high score of 60, which indicated a high level of religiosity. After the scores were calculated, a Pearson Correlation coefficient was used to assess relationships between the three variables. There was a significant positive relationship between locus of control (M = 13.97, SD = 4.92) and religiosity (M = 37.63, SD = 14.07), r= .38, $p < .05$, indicating high levels of religiosity were associated with external loci of control. There was no significant relationship between locus of control (M = 13.97, SD = 4.92) and spirituality (M = 105.63, SD = 14.45), r = .042, $p > .05$. Although it was not a part of our hypothesis, it is interesting to mention the results of the relationship found between spirituality and religiosity. There was a significant negative relationship between spirituality (M = 105.63, SD = 14.45) and religiosity (M = 37.63, SD = 14.07), r = -.65, $p < .05$, indicating that higher levels of religiosity were associated with lower levels of spirituality, and vice versa.

Discussion

Overall, our hypothesis was partially supported in that participants with an external locus of control were associated with a higher level of religiosity. However, locus of control (external or internal) did not have any association with spirituality. So perhaps having an external locus of control may affect an individual's desire to be religious. Or perhaps the act of participating in religion leads one to develop an external locus of control. Because we are observing relationships, it is difficult to

determine the actual direction of influence for each variable.

The main question to be addressed is what do these individuals gain from seeking religion? Since most religions, if not all of them, center around a primary God (or an equivalent source of power), perhaps this allows individuals to seek a source of control in their lives. If they do not feel as if they possess much power in relation to what happens to them, perhaps this drives them to seek refuge in an external source of power. But how does this play a role in promoting overall health and well being, as previous studies have indicated? It is also possible, for many people, that religion is more than just seeking God. Most religions base themselves in bodies of similar people who meet regularly and typically form social, support-oriented groups that facilitate learning, care, leadership and fellowship. For instance, most traditional Christian churches (depending on the size of the church body) facilitate church retreats, community support groups, Bible studies, youth and children's groups, and a myriad of others socially oriented activities. The same is true for Jewish Temples, Catholic churches, Wiccan groups and others. So perhaps the effect of being religious is the sum of the total experience of belonging to a body of like people and not just the experience of seeking God.

In regards to locus of control and spirituality, there was no relationship between the two variables, whether the locus of control was internal or external. In fact, the distribution was scattered equally among the responses for locus of control. Given the high overall level of spirituality (M = 105.63 out of a possible high score of 138), this suggests that most of the participants rated themselves as moderately to highly spiritual. This could indicate that most individuals have a tendency to be spiritual but it could also indicate some unsystematic variability within our study. Perhaps the location of the study, relegated to the Southeastern United States, sampled a population of typically spiritual people.

It should also be considered that only 30 participants were studied and a higher sample size would have given more power to the outcome of this research. Another consideration is the surveys that were used. While Rotter's locus of control is a widely used scale for assessing control locus, the other surveys are more subjective in terms of their measurement. With Delaney's Spirituality Survey, the focus of the idea of spirituality was on the individual's tendency to meditate, interact with a Higher Power, feel at one with the Universe, and respect life. This may not fit some peoples' idea of what spirituality is about, although it did fit the criteria for spirituality as used in this survey. Likewise, Strayhorn's Religiosity Scale could be interpreted to measure religiosity in keeping with traditional Christian religion as it assesses frequency of prayer and quality of relationship with God, activity within a church, financial contributions and religious purpose in one's life. Other religions such as Wicca would be measured by a very different scale. Again, Strayhorn's Scale worked well for the concept of religiosity as used in this study.

Although it is no part of the hypothesis of this research, it is worth noting the significant negative relationship between spirituality and religiosity. The results suggest that the more spiritual an individual is, the less religious he or she will be and the converse. It is possible that, because the religion scale we used was more directed towards measuring the Christian religion, we captured a negative relationship that exists between religiosity and spirituality in relation to the Christian religion. Perhaps we would not see this negative relationship if we were to specifically measure other religions such as Wicca.

Overall, the ongoing research to measure health benefits as a result of being spiritual or religious is yielding some very promising results. Perhaps in the future we discover more health benefits and will have a better understanding of what contributes to these phenomona.

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