

Unpacking the Triggers of Interest in Academic Material: An Appraisal Perspective

by

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Abstract

A study was conducted to apply a recent model of interest (Silvia, 2006) to educational goals and an educational context. The model is based on appraisal theory, and contends that interest is an emotional state dependent on appraisals of the novelty-complexity of an object of study and of one's coping potential to understand the object. Thus far, this model has been validated when the activity under investigation is viewing polygons and paintings, or reading poems, but the model's applicability to educational goals hasn't been investigated previously.

The present research attempted to evaluate the significance of the model regarding the activity of reading expository, academic-oriented text, and to evaluate whether interest could be manipulated through alterations to a treatment text and contribute to increased learning compared to a control group as measured by a text comprehension test. Sixty-five Auburn undergraduate psychology students completed several instruments after random assignment to treatment and control groups, including assessments of interest and three appraisals at two times (pretest and one-third complete), the comprehension test, and measures of three control variables: trait curiosity, modal learning preference, and verbal ability. In addition to investigating effects on interest and learning, a third appraisal – goal relevance (Lazarus, 1991) – was postulated and measured to respond to a call in the literature (Silvia, 2005c) for a third appraisal for interest.

Results showed that manipulations of the treated portion of the treatment text enhanced appraisals of coping potential to a statistically significant degree at a within-person level across time ($F = 5.315$; $p = .025$; partial eta sq. = .079). Additionally, the previously untested third

appraisal, goal relevance, was shown to predict interest across the sample to a statistically significant degree (Unstandardized $\beta = .567$; $t = 6.258$; $p < .001$), displaying more predictive power than the combined effects of the original two appraisals. Non-significant findings included the absence of statistically significant differences in coping potential between-persons, in interest at between and within-person levels, and in learning.

Statistical analysis of the present research and two pilot studies yielded the following implications. First, interest in academic material appeared to be manipulable rather than simply present or not present in the student without attributable cause. Second, this manipulated interest appeared to affect learning in a way consistent with the literature such that higher interest leads to higher learning. Third, hints of an extended appraisal model of interest emerged. A new model would include goal relevance alongside novelty-complexity and coping potential as interest's appraisals, and would identify vividness, coherence, and concreteness as key objective features strongly affecting the original two appraisals.

The implications of this proposed extended model contribute two important features to our understanding of interest. First, additional insight is offered into the causes of text-based interest, including three key text features and a new appraisal. Second, in addition to a functionalist approach to interest, which accounts for novelty-complexity and coping potential appraisals, there appears to be a role for *functional autonomy* (Allport, 1961) in the generation and function of interest as well, which adds the effects of personality features and other individual differences to the functionalist account. Goal relevance, whose predictive power was the most significant finding of the study, fits well within the theoretical framework of functional autonomy, and would account for a diverse element of interest that enriches what the literature has already acknowledged about its universal element.

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Chapter One: Introduction

Since there is no single set of abilities running throughout human nature, there is no single curriculum which all should undergo. Rather, the schools should teach everything that anyone is interested in learning.

-- *John Dewey*

Background of the Study

The momentary human experience of interest in an object, event, or topic may be an emotional state entirely dependent on two cognitive appraisals – an object’s novelty or complexity and the observer’s self-perceived potential to cope with, or comprehend, the object (Silvia, 2006). Simply expressed, interest is an emotion generated by one’s encounter with what is unknown but perceived as knowable. This explanation of interest diverges from other, well-known formulations in which interest is defined as cognitive processing of person-environment interactions (Ortony & Turner, 1990) or as a psychological state of attention with an affective component (e.g., Hidi & Anderson, 1992; Renninger & Hidi, 2002; Schiefele, 1992). If this reconceptualization of the state of interest is accurate, a significant breakthrough in research on the relationship between interest and academic learning is possible. Such research could contribute substantially to curricular and instructional reform. But for interest’s educational applications to be immediately useful, researchers must identify the right levers by which to manipulate interest in educationally fruitful directions. Research on appraisal theories of emotion (e.g., DeRubeis & Hollon, 1995; Smith & Lazarus, 1993) has supported the idea that if the appraisal structure of an

emotion is known, and classes of stimuli that feed the appraisals are identified, then these appraisals could be modified to influence the emotion itself (Roseman, 2001).

Cognitive appraisals and their antecedents

From the body of research on appraisal theories, Lazarus (1991; Lazarus, Averill, & Opton, 1970) and others have emphasized the mediational role of biological factors and the moderational role of psychological and social (cultural) factors that act as antecedents to cognitive appraisals. These classes of antecedents, applied to the emotion of interest, offer the best available means through which curriculum and instruction can be tailored to enhance interest's beneficial effects on learning. (See Appendix B for an everyday example of an emotionally charged event in which these classes of antecedents influence appraisals to produce familiar emotional states)

Five important aspects of emotional events must be considered if we are to arrive at a balanced, well-reasoned approach to the investigation of these appraisal antecedents. First, if the human emotion system is to be understood as an effective (though imperfect) adaptive system rather than a source of "disruption" (Leeper, 1948), then appraisals are critical to this system due to their ability to relate "features of external situations to internal motives and resources" (Roseman & Smith, 2001, p. 8). Without appraisals or some other intervening property, stimulus events would lead directly to emotional states, as supposed by Watson (1919) and others, creating an inflexible, maladaptive emotion system. Instead, according to Roseman and Smith (2001):

Appraisal provides a highly flexible and therefore especially useful emotion generation mechanism, decoupling emotional responses from rigid one-to-one relationships with situational conditions. Emotional response will vary with variation not only in external

circumstances but also in internal needs and coping resources. Emotions can then be conceptualized as organized and organizing responses that, because they are fine-tuned to particular external and internal conditions by the appraisal process, tend to be adaptive. (p. 8).

Second, cognitive appraisals need not be acutely conscious, ponderous chains of reflective thought as they are sometimes portrayed by critics of appraisal theory (Lazarus, 1991; Smith & Kirby, 2001). Third, the way emotions occur in real life as responses to appraisals of objects and situations is a complex affair subject to rapid changes and reappraisals (see Smith & Kirby, 2001 for an example of a coherent appraisal process model which accounts for the relationships among these processes). Fourth, scientific research designed to manipulate and study such events must be done with care, and the experimental need to isolate particular variables within an emotional event will cause some loss of approximation to the real thing. Finally, the antecedents that feed our appraisals are an extremely important aspect of emotional experience, and are both capable and worthy of being studied if we are to increase our understanding of emotional states and redress the lack of research on appraisal antecedents identified by Roseman (2001). Smith and Kirby (2001) have also called attention to this deficit in the literature:

Relatively little work has examined...the antecedents of the appraisals themselves...Nonetheless, such work, by expanding the domain of appraisal theory beyond the relations between appraisals and subjective emotional experience, is vital. Beyond knowing which appraisals are associated with the experience of which emotions, it is also important to know about how those appraisals are generated...(p. 122).

The “emotion of interest” and its effect on academic learning: An unexplored area

The imperative to improve our knowledge of emotions includes the need to turn to the above recommended lines of research on antecedents in order to better understand processes such as interest's effects on academic learning. A troubling but resolvable difficulty here is that, thus far in the research record, while the bodies of research on interest's educational impact and interest as an emotion are separately extensive, researchers haven't combined these complementary topics into a substantive educational research program (Silvia, 2006). Silvia (2006) recommends such a program, pointing out the advantages of the appraisal model for educational research, which "makes causal predictions and provides a set of methods for testing appraisal hypotheses" which, for example, "can help the study of text-based interest to advance beyond correlational designs" (p. 205).

While he hasn't begun this kind of research program himself, Silvia (2006) has made the following convincing argument in support of research synthesizing emotion research and educational research on interest:

Many continuities in the psychology of interest are obscure and unappreciated... (One such) continuity is the functional role of interest in learning. Emotion psychologists contend that a key feature of an emotion is adaptive significance across the lifespan. Emotion psychology has had much to say about the adaptive functions of interest, asserting that interest improves learning, builds knowledge and skills, and promotes engagement with the environment... but has not tested these assertions. In contrast, educational psychology has had little to say about the functions of interest, but it has provided a large literature documenting the constructive effects presumed by emotion psychology. Researchers in these areas could learn a lot from each other. (pp. 83-84)

With all the work that has been done on interest and learning, how is it the above-proposed line of research remains unexplored, as pointed out by Silvia? What possible impediments might have delayed progress in this direction?

This absence in the literature is surprising. Study of the intersection of interest and academic learning is a rich scholarly tradition among psychologists, education researchers, and educational psychologists that extends back almost two centuries (e.g., Herbart, 1816/1891). A central facet of this tradition is the widely shared assertion that interest “has a constructive functional role in motivation” (Silvia, 2006, p. 202), promoting goal achievement, increasing academic learning and performance, and influencing important learning choices (Köller, Baumert, & Schnabel, 2001; Sansone & Smith, 2000b; Schiefele, 1999; Schiefele, Krapp, & Winteler, 1992). However, while research programs investigating interest’s effects on learning continue to receive scholarly attention, this branch of the literature is also hampered by (at least) five factors.

First, interest research is a sprawl of diverse niches including the fields of education, vocational counseling, behaviorist theory, text processing, and emotion research (Silvia, 2006). Second, little progress has been made on unresolved theoretical challenges such as the failure to agree on and distinguish terms such as situational, actualized, and individual interest and the lack of a coherent conception of interest itself. Third, the research record includes several stalled research programs unsupported by the evidence such as the *seductive details* (e.g., Wade, 1992) and *interest-attention-learning* (e.g., Anderson, 1982) studies, and interest researchers as a whole haven’t synthesized the results of these negative findings with more fruitful lines of inquiry. Fourth, the research methodology has been weakened by a recycling of similar theoretical approaches and study designs, such as has occurred within *text-based interest* research programs,

and by a reliance on correlational studies (Silvia, 2006). Lastly, interest as an educational topic has suffered from a bias found in the political arena and in the subtext of the traditional curriculum in favor of standards and aggregation of data and against inquiry-type learning models, individually-oriented instruction, and interest-based curriculum (Eisner, 1995; Johnston, 2009). For interest research to move forward, new research programs must be developed that help the literature to push past these entanglements.

Silvia's appraisal model of interest: A new way to look at interest's effect on learning

A way out of this difficulty, as has been pointed out, is Silvia's (2006) re-conceptualization of interest as an emotion with a distinct appraisal structure. While interest has been previously characterized as an emotion by other scholars (e.g., Izard, 1977; Tomkins, 1962), only in three studies (Ellsworth & Smith, 1988a, 1988b; Smith & Ellsworth, 1985) have researchers other than Silvia attempted to connect interest with one of the most significant bodies of research in the emotion literature – theories of cognitive appraisal (e.g., Lazarus, Averill, & Opton, 1970; Scherer, 1984). However, these studies were weakened by a retrospective study design, and additional theoretical flaws as well as problems with these researchers' proposed appraisal structure of interest have been identified in subsequent research (Turner & Silvia, 2006).

Silvia has initiated a new research program with stronger methodological approaches that has attempted to join a coherent concept of interest with the best work to date on appraisal theories of emotion. His initial investigations (see Silvia, 2005a, 2005c; Turner & Silvia, 2006) have thus far been supportive, but he has not yet explored in-depth applications of his theory nor has he specifically researched possible connections to educational goals. Much research remains to be done by other researchers if his theory is ever to be sufficiently validated, extended, and

applied. It is this researcher's contention that one of the most promising applications of Silvia's theory is in the area of education research, and that his marriage of interest and emotion research has the potential to achieve three goals: to stimulate a synthesis of the interest literature, to resolve some of its thorny theoretical disputes, and to lead to the most significant advances to date in research on interest's effect on learning.

The present study: Manipulating interest's cognitive appraisals to enhance learning

Silvia's (2006) appraisal model of interest, in which interest depends on appraisals of novelty-complexity and coping potential, is uniquely well-suited as a vehicle to aid researchers in heading toward these three goals. By manipulating its appraisals and adding control measures, experimenters can attempt to isolate and influence interest and then ascertain its effect on learning through measures of academic performance. The current dissertation study attempts to manipulate interest by presenting treatment and control versions of a novel, unpublished text to different subjects. The treatment text's opening paragraphs have been altered to heighten subjects' appraisals that they can cope with the material. Differences in coping potential, interest, and learning between the treatment and control groups will be measured with instruments from Silvia (2005c) and others as well as with a comprehension test. As a check on Silvia's appraisal model, a third appraisal of *goal relevance* (Lazarus, 1991) is included in the study design, and will be measured along with novelty-complexity and coping potential.

Statement of the Problem

Any educator's dream is to have a classroom in which the majority of students really involve themselves in the assigned material. The well-documented reality is that very often students appear to be drawn toward competing motivations often at cross-purposes with learning, such as achieving a certain high or low-end test score or grade (Covington & Mueller, 2001),

avoiding work (Nicholls, Cobb, Wood, Yackel, & Patashnick, 1990), or avoiding the appearance of stupidity (Covington & Omelich, 1991). The ability to engage a wider number of students to immerse themselves in the curriculum, and to more deeply process its material, may hinge on a reformulation of the concept of interest as an emotion with a distinct appraisal structure.

The current status of interest research: A diverse sprawl of contributions and conflicts

Educational research on interest is poised to reach a significant breakthrough on the motivation to learn, but so far the latest progress on interest has been limited to fields such as emotion research and aesthetics. Consequently, these accomplishments haven't yet carried over to research on the relationship between interest and learning. Meanwhile, existing educational research programs using the most popular methods of researching interest's effects on learning – often variations of the classical *situational-individual interest* (e.g., Hidi, 1990) and *text-based learning* (e.g., Anderson, 1982) models – have produced substantial empirical data but in many cases are treading water, covering similar topics and producing similar results and insights to what has been investigated periodically over the past thirty or so years.

The studies using these models, when considered collectively, also suffer from a lack of coherence in theoretical reasoning (Silvia, 2006) which has complicated their validation through empirical research. For example, studies from a situational-individual interest perspective (e.g., Hidi, 2000; Krapp, 1999) have not agreed on a coherent explanation of the concept of interest itself, while text-based learning studies (e.g., Schraw, 1997; Wade, Buxton, & Kelly, 1999; for reviews see Schraw & Lehman, 2001; Silvia, 2006, chap. 3) have proposed several different sources of interest without specifying how they are related or why they create interest. Older theories of interest tended to suffer from another theoretical flaw.

These theories (e.g., Berlyne, 1960; Hebb, 1955; Nunnally, 1981; Tomkins, 1962) operate from a behavioristic assumption that interest derives from objective qualities of an object or event (e.g., is it interesting?) rather than interpretations of these objects and events (e.g., am I interested in it?) (Silvia, 2006). Although this assumption, an offshoot of the recurrent debate over the validity of external versus internal factors, led to the identification of useful variables affecting interest such as novelty and complexity (Berlyne, 1960), it creates problems when one tries to account for the inherent variability in the experience of interest. If an object (photograph, poem, painting, etc.) or event (weekly social club meeting, staff party, football game, etc.) is objectively interesting, then why do different people experience it along a range all the way from intensely interesting to hopelessly tiresome, and why do the same people change their interest level regarding the same object or event over time? According to some researchers, only theories allowing for subjective appraisals of objects and events offer satisfying explanations of such variability (Lazarus, 1991; Roseman & Smith, 2001; Silvia, 2006).

I would also like to point out a final theoretical problem just as likely to plague newer as well as older theories of interest when the assumptions of appraisal theory aren't taken into account. Taken as a whole, this collection of preceding theories has done little to clarify the underlying connection between cognition and emotion that supports or generates interest. Some variants approach interest as entirely cognitive (e.g., Iran-Nejad, 1983, 1987; Ortony & Turner, 1990; Wilson, 1971), never fully accounting for the affective and related physiological correlates that underlie or accompany the experience of interest such as facial expressions, motivational and goal-oriented behavior, and subjective-feeling components (Silvia, 2005c).

Others choose an uneasy middle ground, classifying interest as a psychological state of attention with an affective component (e.g., Hidi & Anderson, 1992; Renninger & Hidi, 2002;

Schiefele, 1992) or proposing a distinction between cognitive interest and emotional interest (e.g., Harp & Mayer, 1997; Kintsch, 1980) – both versions leave interest’s status unclear. In some examples of this kind of research, the authors (e.g., Schiefele, 1992) also blended their conception of interest with other emotional states such as enjoyment without clear theoretical backing, and without addressing contrary research (e.g., Day, 1967; Reeve, 1989) which has established these states as distinct. Silvia (2006) has pointed out that the above “compromise” theories which characterize interest as somehow related to but something less than emotion make it more difficult to research – for one thing there are no “continuities between interest and other emotions” (Silvia, 2006, p. 188) within such an approach. Finally, early theories of interest as an emotion were typically either sidelined in the mainstream emotion literature or heavy on theory and light on empirical research (Silvia, 2006). As a result “emotion psychology has seen little sustained research on interest” (Silvia, 2005c, p. 89), and therefore has not been able to contribute very much to explanations of cognition’s role in interest.

Appraisal theory: a new means of synthesizing the interest literature

A view informed by appraisal theories of emotion (e.g., Arnold, 1960; Lazarus, 1966, 1991; Scherer, 2001a) resolves these theoretical difficulties. The concept of interest is no longer fractured into uncomplementary sub-topics such as momentary investments of affect-tinged attention versus the sustained pursuit of idiosyncratic hobbies like stamp collecting. Instead, interest becomes an emotion elicited by cognitive appraisals which, when experienced repeatedly, lead to positive attributions that can contribute to sustained personal interests in which the relationship between the person and the object or event remains an emotional one (Silvia, 2006). The source of interest is made quite clear – appraisals of objects and events that, if they change in a negative direction, can change our emotional state and lead to disinterest or

even boredom. As stated, an appraisal view is also capable of accounting for just the kind of variation in different people's unique combinations of interests and changes in the same person's interests over time that we expect to see and are used to observing in our daily lives. Finally, an appraisal view provides the complementary perspective on cognition and emotion that allows researchers to synthesize the diverse literature on interest and move ahead on empirical studies of interest without giving short shrift to the contributions cognition and emotion both make to the actual experiencing of interest. The current researcher therefore proposes to open up a new line of research by applying Silvia's (2005c) appraisal model of interest to academic learning with a particular focus on improving curriculum and instruction. The current state of U.S. education certainly suggests that multiple areas, including these topics, are in need of reform.

Purpose of the Study

Many researchers and educational theorists (e.g., Eisner, 1991, 1994; Johnston, 2009) have recognized and deplored the unappealing nature of our traditional curriculum. Others have suggested this curriculum fails to engage the majority of US students or to meet many of their current and future adaptive needs (Brooks & Grennon-Brooks, 1999; Kohn, 1993). It is suggested here that if interest is recast as an emotion with a compatible structure to other emotional states and investigated on this basis – as the current researcher has suggested – curricular material can manipulate this interest and thereby promote optimal student engagement. Based on a review of the emotion literature, it is clear that appraisal theories of emotion are best suited to the researcher's goal of mining the contributions of emotion research to develop meaningful and practical methods of manipulating interest through curriculum design and thereby to improve learning.

Can an appraisal model of interest inform educational practice to enhance learning?

A key aspect of appraisal theories of emotion that holds promise for the above proposed research program is the composition of the antecedents that feed into cognitive appraisals. More research on these antecedents has been called for in the literature (Roseman, 2001). Lazarus and others (e.g., Lazarus, 1991; Lazarus, Averill, & Opton, 1970) have proposed and investigated biological, psychological, and social (B-P-S) antecedents of appraisals within the structures of various emotions. There is significant support across disciplines for the effects of these three types of antecedents on emotional states (e.g., Geary, 1995; Griner & Smith, 2000; Mauro, Sato, & Tucker, 1992; Roseman, Dhawan, Rettek, Naidu, & Thapa, 1995). A brief history of the emotion literature is helpful here to show how emotion research evolved to include the kinds of appraisal theories most relevant to this dissertation.

The study of emotion has been a mainstay in the scholarly literature from the present day to Aristotle (e.g., 1966; Descartes, 1989), despite challenges to its validity as a legitimate research topic such as those voiced during the behaviorist era which portrayed emotion as simple activation (Duffy, 1934) or a form of disruption (Leeper, 1948). Emotion research has flourished since the 1960s (e.g., Arnold, 1960, Plutchik, 1962; Tomkins, 1962), but the field remains conflicted over several theoretical disagreements including disputes over the cause of emotional states (Roseman & Smith, 2001). Some researchers have argued that emotions are caused directly by environmental conditions (e.g., Watson, 1919), physiological states (e.g., Cannon, 1927; James, 1894), or facial expressions (e.g., Tomkins, 1962). A fourth explanation, coarsely put, is that some sort of “thinking” precedes most emotional states – this perspective emphasizes the role of cognitive acts, attributing emotions to evaluations or appraisals of external or internal conditions (e.g., Arnold, 1960; Lazarus, 1968, 1991; Roseman, 1984).

Modern appraisal theory is credited to Arnold (1960), who wrote “How, then, can emotion be distinguished from sense perception? Both perception and emotion have an object; but in emotion the object is known in a particular way...To arouse an emotion, the object must be appraised as affecting me in some way, affecting me personally as an individual with my particular experience and my particular aims” (p. 171). This theory was developed with careful consideration for the need to effectively relate sense perception, cognition, and emotion, and to explain how these related systems together serve humans’ adaptive needs. It is important to note here that appraisal theorists have a very expansive idea of what constitutes “thinking” – arguing for a whole range of cognitive processes occurring at varying speeds (from deliberative reflection to parallel processing to memory priming down to primitive processing of the sensory properties of objects and events) that can generate appraisals depending on the circumstances and that still qualify as cognition (Roseman & Smith, 2001; Scherer, 2001; Smith & Kirby, 2001).

A central push in this branch of the literature is to identify the specific appraisals that lead to a particular emotion (Smith & Kirby, 2001), thus comprising that emotion’s *appraisal structure*. While periodically challenged in the literature as too cumbersome, cerebral, or cold-hearted (Lazarus, 1991) to explain emotion, this fourth view has gained increasing attention and received significant empirical support in recent years (Roseman & Smith, 2001). Consequently, these *appraisal theories of emotion* have been widely cited and asserted in the literature as the most productive working explanation of differentiated emotional states that also differ in type and intensity between persons and within the same person over time (Smith & Kirby, 2001).

Aristotle (1966), who over two millennia ago offered specific ideas to orators on how to create emotional responses in their audiences, has been credited as the first scholar to

hypothesize about the appraisal-emotion relationship (Roseman, 2001). Much later, various modern appraisal theories have been developed, tested, and refined since their origin in the 1960s, and especially during the last thirty years. Among the many important research questions that have come up since this more recent work began are questions about the antecedents of appraisals – what is the nature of the events that influence the cognitive appraisals that determine emotional states? Several in the field have called for such research on the antecedents of appraisals (e.g., Roseman, 2001; Smith & Kirby, 2001) to increase our understanding of emotions in general, and in a specific sense to develop practical applications of appraisal theory. For instance, it has been recognized that if the nature of antecedents of certain appraisals leading to an emotional state is known, then these antecedents might be manipulated to change a person's appraisals and, in turn, change his emotional state (Roseman, 2001).

B-P-S antecedents: Potential triggers for the manipulation of appraisals

Many scholars have theorized about and found empirical evidence for various classes of antecedents that feed appraisals. Three of the most frequently researched and well-supported have been biological (e.g., Roseman et al., 1995), psychological (e.g., Griner & Smith, 2000), and social or “cultural” (e.g., Mauro et al., 1992). These three classes fit neatly into the specifics of one of the most frequently cited appraisal theories, namely that of Lazarus (e.g., 1966, 1968, 1991). According to Lazarus and colleagues (Lazarus, Averill, & Opton, 1970):

Emotional responses must be broken down into component reactions, and the biological, cultural, and psychological determinants of these reactions examined... (A) method of studying appraisal and reappraisal involves the selection of subjects who differ in their emotional predispositions. Such differences may be due to biological, cultural, or psychological factors... Such (species-specific) biological predispositions undoubtedly

also exist in humans, although their influence is typically obscured by the great variability introduced by cultural and psychological factors. (pp. 223, 227)

Lazarus has established an interaction among biological, psychological, and social (cultural) factors that feed into the appraisal process and within which a species-wide set of universal biological antecedents mediates appraisals, while psychological and social (cultural) antecedents moderate these appraisals depending on the nature and demands of the appraised object or event. Such a framework easily accounts for the well-documented universality in emotional experience across various groups of humans as well as the manifold individual and cultural variations found between and within these groups. This framework also suggests that these biological antecedents are phylogenetic in nature, while the psychological and social (cultural) antecedents are best described as ontogenetic.

These features of Lazarus' framework of appraisal antecedents are reflected in his more refined theory of emotion that appeared later in his large volume, *Emotion and Adaptation* (1991). In the book he proposed a challenge that any viable theory of emotion should be able to withstand: "A major problem that must be faced by any theory of emotion...is how to provide enough room to accommodate the obvious biological, social, and individual contributions to the emotion process" (p. 190). Consequently, "for emotions to play their vital function in human adaptation, the emotion process must be variable and flexible enough to permit intelligence, learning, and judgment to shape the response to adaptational business and, at the same time, to operate in accord with biological species principles" (p. 190). Here is Lazarus' explanation of the emotion process, which answers his challenges and accommodates the full range of possible "psychobiological *and* sociocultural factors" (p. 190) potentially contributing to emotional states:

If a person appraises his or her relationship to the environment in a particular way, then a specific emotion, which is tied to the appraisal pattern, always follows. A corollary is that if two individuals make the same appraisal, then they will experience the same emotion, regardless of the actual circumstances. I think of this as a psychobiological principle, which provides for universals in the emotion process of the human species... What, then, are the sociocultural, personality, and individual developmental contributions to variability in the emotion process?... Personality, which includes what is important to the individual person (i.e. value and goal hierarchy) and a set of beliefs... is forged... by the individual in an effort to create meaning out of social influences – by living in a particular society and culture and by selectively internalizing some of its values, meanings, and social rules. Individual variability in the emotion process is predicated on differences in how people appraise their person-environment relationships... Appraisal is always influenced by the confluence of what is in the environmental display and the personality... How, then, does culture shape an emotion?... it helps us identify the signs of being loved... when we have been demeaned... and so on. (pp. 191-194)

In these passages Lazarus (1991) accounts for species-universal biological antecedents that feed cognitive appraisals – at first – without regard to one's individual traits or cultural background. This mediation of appraisals explains why the circumstances of an event, when they are appraised as demeaning and controllable, tend to elicit anger across people and cultures. At the same time, he allows for individual psychological components and cultural meanings to moderate one's construal of appraisal antecedents, whether they are from the environment or internal factors such as values or memories. In other words, one's potentially anger-eliciting appraisals are moderated by, at the individual level, unique psychological (personality)

tendencies and, at the group level, shared perceptions now linked by qualities of one's culture rather than one's species. In this way, Lazarus has indeed developed a flexible and variable theory of emotion robust both to what psychologists find from studies of emotion and what ordinary people observe from everyday life. But what has this to do with the experience of interest and its effect on academic learning?

Using B-P-S antecedents to manipulate student interest: Will it enhance learning?

Given the resurgence of scholarly support for interest's classification as an emotion with defined, empirically supported appraisals (Silvia, 2005a, 2005b, 2005c, 2006; Turner & Silvia, 2006), the call for research on antecedents of emotion-eliciting appraisals (Roseman, 2001; Smith & Kirby, 2001), and the current lack of educational research on this new conception of interest and on its environmental antecedents, the current researcher proposes to investigate Silvia's appraisal model of interest in an educational context, manipulating this interest and determining its impact on learning. The design of the present study includes the random distribution of treatment and control versions of text on the same topic, in which the treatment text contains selected B-P-S antecedents chosen to enhance interest in a complex topic by feeding appraisals of coping potential. Measures related to Silvia's two appraisals will show variance in interest levels, while a text comprehension test will demonstrate whether higher levels of manipulated interest translate into stronger academic performance, which would suggest learning has been enhanced.

Research question and hypotheses

The following research question generated the hypotheses for this study: can biological, psychological, and social antecedents influence appraisals of coping potential when students are confronted with new or complex content, such that the emotion of interest is able to be

manipulated on the basis of these antecedents in a direction supportive of academic learning?

The following testable hypotheses were developed to respond to the above research question:

Hypothesis 1: Subjects exposed to text with a manipulated set of biological, psychological, and social antecedents (treatment text) will report a significantly higher level of the appraisal of coping potential for this text than subjects exposed to the same text but without this set of antecedents (control text), while controlling for trait curiosity.

Hypothesis 2: Subjects exposed to the treatment text will report a significantly higher level of interest than subjects exposed to the control text, while controlling for trait curiosity.

Hypothesis 3: Subjects exposed to the treatment text will report a significantly higher rate of change in the appraisal of coping potential across time as compared to subjects exposed to the control text, while controlling for trait curiosity.

Hypothesis 4: Subjects exposed to the treatment text will report a significantly higher rate of change in level of interest across time as compared to subjects exposed to the control text, while controlling for trait curiosity.

Hypothesis 5: Subjects exposed to the treatment text will demonstrate a significantly deeper level of learning than subjects exposed to the control text, while controlling for learning style preference and verbal ability.

Hypothesis 6: Goal relevance is a significant predictor of interest.

Overview of Methods

The researcher will randomly distribute treatment and control versions of a short academic text on the subject of free will versus determinism to Auburn undergraduate students in a classroom or auditorium setting in Haley Center. Learning will be indirectly assessed through a

comprehension test to be administered after students complete the entire text. Students' cognitive appraisals and interest levels will be collected and isolated in the following manner. Brief measures of the following constructs (eight total items) are to be administered in the form of written instruments at two different times (pre-test and one-third complete): interest, novelty-complexity, coping potential, and goal relevance. Three additional constructs serving as control variables will be measured once by written instruments: modal learning preference, trait curiosity, and verbal ability. Trait curiosity will be measured in terms of its covariance with interest, while the other two control variables will be measured against achievement scores on the comprehension test.

To test Hypotheses 1, 2, 3, and 4 ANCOVA and ANOVA designs will be used to measure interest and its appraisals at both between and within-person levels. These designs will be used to analyze variables at Time 2 (one-third complete), and then will be used again within a repeated measures design specifically for Hypotheses 3 and 4 to compare rate of change across time. Treatment and control groups comprise one independent variable on two levels. ANCOVA will be used for the dependent variable of coping potential, and ANOVA for interest. There are two dependent variables, coping potential and interest, and one covariate of trait curiosity to be used only with coping potential.

To test Hypothesis 5, ANCOVA analysis will be used. The ANCOVA includes treatment and control groups as one independent variable on two levels, achievement scores on the comprehension test as one dependent variable, and two covariates: 1) modal learning preference and 2) verbal ability.

To test Hypothesis 6, multiple regressions will be used. The multiple regressions include three cognitive appraisals as predictors (novelty-complexity, coping potential, and goal

relevance), and interest levels (from Time 2) as one dependent variable. The influence of goal relevance on the dependent variable will be measured by the increase in R^2 .

Significance of the Study

In the present study, the researcher is attempting to apply a new model of interest (Silvia, 2006) as an appraisal-based emotion, which has received initial empirical support, to the classroom. Under investigation is the idea that this model represents a new opportunity to understand, measure, and manipulate interest in and learning of academic content, specifically text-based content. A primary outcome of the study is the potential for further validation of Silvia's model under new conditions. While the model has been applied to interest in text once before (Silvia, 2005c), the text was a poem and therefore a bit atypical of most academic content, and moreover academic achievement (e.g., text comprehension) wasn't measured. Previous applications of the model also investigated reactions to objects such as polygons and paintings (e.g., Silvia, 2005a, 2005c; Turner & Silvia, 2006), which have educational applications to be sure, but are less representative of most curriculum than text articles transmitting largely semantic knowledge. The researcher is also seeking to validate the conceptualization of interest as an appraisal-based emotion specifically to broaden views on interest in educational research. It has been pointed out that the *situational-individual interest* model has predominated in most educational studies of interest, and that theoretical difficulties within this classic model have tended to obscure the interest-learning connection (Silvia, personal communication, September 9, 2009).

The present study also is intended to extend Silvia's (2006) model in significant ways. While there is a significant body of theoretical work on the antecedents of appraisals (e.g., Lazarus, 1991), the literature is short on empirical investigations of their nature and function

(Roseman, 2001; Smith & Kirby, 2001). At the same time, it has been acknowledged that appraisal antecedents represent a potent mechanism for measuring and manipulating appraisals of emotional stimuli (Roseman, 2001). By introducing operationalized biological, psychological, and social antecedents of coping potential into the study, the researcher intends to stimulate further research on appraisal antecedents on interest and other emotions as well.

A final extension of the model includes the introduction of a third potential appraisal. While the possibility of a third appraisal has been entertained (Silvia, 2005c), no one has yet tested whether goal relevance figures into the emotion of interest alongside novelty-complexity and coping potential. The argument can be made that an object appraised as novel or complex becomes relevant to one's goals by virtue of the object's appraised adaptational significance (e.g., necessity of exploring one's environment) – if true then it would be expected to see novelty-complexity and goal relevance loading as one factor. Regressions will be run to test for this third possible appraisal.

There are multiple implications of this study. First, Silvia's (2006) model may be extremely well-suited to the investigation of interest in academic content, which would breathe new life into this branch of educational research. Second, appraisal models reorient focus away from objective features of an object and concentrate attention on subjective judgment. This study suggests such a reorientation may be warranted, thus challenging a long-held assumption in educational circles that content can be objectively "made interesting".

The study calls for an additional reorientation based on educational goals. Interest has been somewhat marginalized in the education literature, in part because of a stagnant debate over its processes and relation to learning. Meanwhile, research programs on intrinsic motivation, metacognition, and self-regulation are beginning to converge on the idea long ago presented by

Dewey that “interest-based learning requires no coercion. According to Dewey, external attempts to ‘make something interesting’ lead to only temporary effort and do not result in identification with the material” (Schiefele, 1992, p. 152). It is time re-engage with interest as an educational topic and seek to understand its workings better.

A final implication, maybe the most crucial, leads directly from the above call for renewed vigor in the investigation of interest as an educational topic. If the researcher’s chosen antecedents appear to contribute to increased appraisals of coping potential, then a significant lever for forming and reforming curriculum and instruction has been obtained – pending more research. Almost any topic in the curriculum can be imbued with antecedents designed to increase the appraisals that lead to greater student interest, and perhaps to more meaningful engagement and identification with academic content.

Limitations of the Study

There are a few limitations within the study design that need to be addressed. Short-term memory has been indicated in the literature as a potential confound for studies attempting to link interest to learning (Schiefele, 1992). The risk is that academic achievement scores attributed to higher interest could actually have resulted from higher ability of some subjects in short-term memory, when this ability is related to the nature of the achievement measure’s items. However, the researcher hasn’t yet found a short-term memory measure that is suitable and practical within the present study design. Instead, the text comprehension test to be used to indirectly measure learning will be comprised, not of items requiring only surface-level processing, but of deeper-level processing questions that should help mitigate effects of short-term memory.

Additional limitations are presented by the possibility that people would report higher interest not because they're interested, but because they're experiencing a different reaction altogether that seems similar to them. Enjoyment is recognized in the literature as related to interest in some respects, such as similar evidence of positive affect (Mayer & Gaschke, 1988; Watson, 2000). So while it is possible interest and enjoyment could be mistaken for each other, a long research record has established important differences between them. When conceptualized as emotions, interest and enjoyment differ in antecedents, expressions, functions, and consequences (Day, 1967, 1968; Evans & Day, 1971; Reeve, 1989). Recent research has supported these earlier findings on the divergence between interest and enjoyment (e.g., Turner & Silvia, 2006). Based on this research, it is possible to control for enjoyment by limiting the study to appraisals specific only to interest.

Two more issues should be mentioned as limitations here. First, in many cases learning can only be measured indirectly by measuring or collecting data on grades, test scores, reports of self-efficacy, or other evidence of achievement. It is widely recognized that students may show signs of achievement without having necessarily learned the content in a meaningful or lasting way. The present study depends on a test of text comprehension, which is limited like other achievement measures in its ability to reflect actual learning. The researcher intends, by using deeper-level processing questions, to at least avoid the occurrence of people getting high test scores based on an easily gained and easily lost surface understanding of the article used in the study.

Second, the study relies primarily on self-report measures for much of its data, such as items requesting that people report their own levels of appraisals and of interest, as well as self-report measures of control variables including trait curiosity, verbal ability, and others. The

single instrument that is close to approximating a behavioral measure is the test of text comprehension following completion of the text article and final measures of appraisals and interest. Future studies should incorporate more behavioral measures such as time spent on task and task preferences, but again limited resources required a narrowing of the study's scope.

Chapter Two: Related Research

If we know how interest enhances learning, how can we teach better classes, write better books, be better mentors?

-- *Paul Silvia*

Introduction

This review of the literature is intended to be synthetic rather than merely descriptive. Following the advice of other scholars (e.g., Boote & Beile, 2005; Strike & Posner, 1983) on the writing of a strong, synthetic dissertation literature review, the researcher chose three goals for this chapter: 1) to identify and resolve theoretical stumbling blocks; 2) to suggest a new perspective on a significant topic that offers additional explanatory power; and 3) to logically lead to and justify the selection of a valid theory yielding testable hypotheses. In the accomplishment of these goals, the researcher also sought to describe the historical context of interest research, distinguish charted from uncharted waters in this diverse literature, and justify his methodological choices. The researcher also recommends reviewing Appendix A of this dissertation for definitions of key terms relevant to the present research as a supplement to this literature review.

As science has recognized, humans are natural learners – hardwired for collecting and processing new information (Brooks & Grennon-Brooks, 1999). Interest has been acknowledged as a critical motivational mechanism (Deci, 1992) supporting the act of learning (Voss & Schauble, 1992) that carries significant adaptive value across the lifespan (Fiske & Maddi, 1961; Izard & Ackerman, 2000; Lazarus, 1991; Sansone & Thoman, 2005; Tomkins, 1962). Therefore, interest is neither artificial nor inconsequential in human life but is endemic to human nature

itself (Camras et al., 2002; Dewey, 1913; Izard, 1977; Tomkins, 1962) and integral to growth and learning (Deci & Ryan, 1985; Frederickson, 1998; Hidi, 2000; Rathunde, 1996, 1998; Schiefele, 1999). As such, interest ought to figure prominently in psychological theories of development, motivation, and particularly education.

Interest – The “Poorly Understood” Construct

Interest as a psychological construct has been widely studied (Silvia, 2006), suggesting that the scientific understanding of interest should be fairly well developed at this point. However, as has been pointed out, the literature on interest is scattered across several thinly related disciplines, and advances in its study have rarely been synthesized (Silvia, 2006). For this and other reasons, interest has not fared all that well, even in two of its most natural habitats – educational and motivational research – prompting Silvia (2008b) to report that “psychologists typically overlook interest itself as a facet of human motivation and emotion” (p. 57).

Interest’s marginalization in educational circles

For all the mention of “interesting” curriculum, it is suggested here that our traditional Western curriculum assigns interest an external role, at least partly because of interest’s incompatibility with the standards-based approach (Eisner, 1995), and in turn because of this approach’s dependence on unforgiving lists of required subjects and skills. In this context, interest is relegated to a sideshow role as a function of artifice in instruction. The idea of interest playing an integral role at the center of instruction, in spite of the recent attention educational theorists have given it (e.g., Hidi & Ainley, 2008; Renninger, 2009), seems at once foreign and impractical in the realm of education, and even contrary to educational goals.

Researchers have repeatedly pointed out (and criticized) the persistence of the general view in education and in politics that the curriculum is a fixed body of largely semantic

knowledge that must be transmitted to students without regard to individual or universal interests or natural tendencies (e.g., Bruner, 1996; Buss, 2008; Petrina, 2004; Pinker, 2002). Some (e.g., Pinker, 2002) have attributed this view to the now obsolete presumption of a “blank slate” model of human nature. The implicit assumption behind this view and the model that supports it is that the curriculum is unpleasant stuff that must be taught, exists in its own right as an important entity independent and irrespective of the nature of the learners, can be made tolerable in its packaging, and – as an afterthought – could in some cases be “made interesting” as time, resources, and talent allow.

Interest was not always viewed in this secondhand manner in the context of education. James (1899) wrote that “no topic has received more attention from pedagogical writers than that of interest” (p. 91). The prominent theorists that first emphasized interest as a distinct scholarly topic (see DeGarmo, 1902; Dewey, 1913; Herbart, 1816/1891) gave it a central, even indispensable role in the learning process, and insisted on the need to highlight it in educational theory and design. James (see esp. 1899, Chap. 10) argued that the curriculum must cooperate with the “native interests” (p. 92) of the student to succeed.

After Dewey, this perspective on interest was lost in the literature for several decades. The rise of the motivation literature, still a dominant force in educational research as an outgrowth of the cognitive revolution begun by Bruner and others (e.g., Bruner, Goodnow, & Austin, 1956), was interest’s next best opportunity to gain significant attention. It would be reasonable to expect the state of interest to be just as prominent in this psychological sub-discipline with its strong links to education – but the record has been rather in the reverse direction.

Interest’s Poor Showing in the Motivation and Education Literature: Five Reasons

Interest can be a highly effective motivator, and has been demonstrated to have powerful effects on deep-level learning (Schiefele, 1991), academic achievement, and self-regulation in studies (Hidi & Ainley, 2008). Yet, while there are exceptions, a review of the motivation literature shows that interest has rarely been emphasized by scholars to the same degree as more prominent constructs such as goal orientation, self-determination, expectancy-value theory, or self-efficacy. Five developments may partly explain why motivation scholars haven't emphasized interest to the degree we might expect: the evolution of the traditional curriculum, the influence of behaviorism, the scientific and educational bias toward aggregation, the separation of the act of learning from the content to be learned (Zull, 2002), and the evolution of interest as a specialized research topic (Silvia, 2006).

The Traditional Curriculum and Interest

In spite of innumerable attempts at reform, the traditional curriculum of the Western world continues to default to a refried version of the ancient model of the *trivium* (grammar, logic, rhetoric) and *quadrivium* (arithmetic, astronomy, geometry, music) couched in contemporary language (Kaminsky & Forbes, 2009; Petrina, 2004). Whatever its merits and its detractions, this version has been written into our laws, ably defended, and strongly reinforced by a variety of powerful forces, of which two bear mentioning due to current conditions in the US education system.

First, the curriculum has become another battleground for the political struggle between Right and Left (Gitlin, 2005; Kaminsky & Forbes, 2009). As a result, the bulk of all discourse on the curriculum, no matter how well intended, is diverted to feed this struggle (Apple, 2000). Thus, narrow political victories become the primary concern, while the curriculum "as it truly is" (Eisner, 1994) and meaningful curricular reform get pushed to the background. In this thorny

environment, identifying the subtext of the curriculum as a first step on the path to real change becomes quite difficult, whereas instituting constructive, lasting change seems virtually impossible. It is small wonder many scholars report on the results of our many cycles of supposedly sweeping educational reform over the past several decades with distinct pessimism (e.g., Bruner, 1983, 1996; Eisner, 1994). That so little has changed in the curriculum may be due to our culture's self-created fractal pattern in which the "basics" are championed, narrow and ideologically driven reform programs live and die for the sake of scoring political points, and the clamor for a desperately needed return to the basics is heard again – all in a context increasingly complex and difficult to unravel.

Second, the "standards movement" so aptly criticized by Eisner (1995) almost twenty years ago has picked up the pace in our country, increasingly shouldering aside other, equally valid educational goals. Players in the educational process (superintendents, principals, teachers, etc.), as opposed to the politicians, can no longer afford to experiment with the curriculum – whether the object is tinkering or cleaning house – bombarded as they are by the external pressure to maintain or exceed competing layers of standards. The stakes are higher now than in the past. Under No Child Left Behind (NCLB) requirements, schools are expected to thrive while living in continual danger of losing their funding and being taken over by the government.

One likely result of this new level of threat is an increase in the politicization of education at the local level. Superintendents and principals can be expected under such conditions to be at least tempted to make choices that push standards and higher test scores at the expense of more meaningful instruction and a higher quality of learning. Overwhelmingly, these standards and tests reflect the "grammar and syntax of the trivium and quadrivium" (Kaminsky & Forbes, 2009, p. 19). With jobs, plans, and futures in the balance, unless the standards

movement is torn to its foundations the traditional curriculum is almost certain to remain in the bedrock. Tinkering and sweeping is left to the curriculum theorists, who since the 1960's have accepted an increasingly marginalized role in educational debates. According to Petrina (2004) they have been essentially theorizing in a vacuum, while instructional designers who have had more access to the curriculum have tended to service the politicians and uphold the traditional curriculum rather than "clutter their heads with theory" (Petrina, 2004, p. 81). So much for the lifespan of a really new idea in today's US classrooms...

Finally, the practice of educational assessment becomes a mutually reinforcing partner of the traditional curriculum. The enforcement and attainment of standards is near impossible without some sort of ongoing formative and summative assessment of learning outcomes – of course evaluating the quality of instruction in schools makes good sense as well, and no one would want to completely dispense with that. However, as Buss (2008) warns, the "prescriptive learning outcomes" which predominate in Western education and are conducive to easy assessment also contribute to a mindset antagonistic to creativity, exploration, and individual interest. These traditional kinds of outcomes depend for their assessment on predictable, measureable results, and thus can work against the pursuit of outcomes such as "appreciation, familiarity, understanding, and insight" which may be "difficult to evaluate accurately and objectively (but) may well represent the more important changes we want the learner to undergo".

The foothold of the jealously guarded traditional curriculum in US education described above creates multiple challenges to the formal integration of interest as a basis of instruction. The traditional curriculum as generally practiced in schools tends to use the same tired subjects regardless of their degree of applicability to students' everyday lives and needs. The pedagogical

methods supporting these subjects often don't easily lend themselves toward tailored, individualized instruction in the same way that an inquiry-based or constructivist approach might. External pressures and standardization demands add to the problem by recasting time and creativity in the classroom as unaffordable luxuries. Whatever the rhetoric used to explain current practices, new and experienced teachers alike are constrained to adopt a "tick-box approach" (Buss, 2008) to instruction and to "teach to the test". Of the current opportunities for new teachers to consistently use inquiry learning in their classrooms, Johnston (2009) writes the following:

The working environment and its needs and expectations take over. What seems to be an overbearing and fixed bureaucratic set of curricular and performance expectations washes away whatever opportunities new teachers have to make meaningful, existential changes in their teaching practices, let alone in the curriculum. To put it bluntly, schools, and the vast, bureaucratic system behind them, block the road to inquiry. To ask teachers, both novice and veteran, what needs to be done to develop children who have a love for learning, an insatiable appetite for inquiry, and a disposition to care about and try to solve social problems, is to receive no shortage of solid answers. These answers, sadly, cannot be enacted. (pp. 1-2)

Within such a system, there seems neither time nor ability for teachers to base significant instruction on students' discovery and cultivation of their interests. If students become interested and stay interested in anything in the curriculum, it is the result of a happy accident and not instructional design. More likely, in the words of Ecclestone, "there is a real danger that uncritical acceptance of increasingly prescriptive, standardized outcomes will create cynical, instrumental attitudes to learning in teachers and students alike" (cited in Buss, p. 305).

Given this treatment of the effects of the traditional curriculum, interest is unlikely to be prominently featured in motivation theories. Many of these theories are grounded in the same assumptions of the traditional curriculum, and are therefore subject to the above-described effects. As such, motivation theorists writing and researching within the traditional curriculum paradigm would be unlikely in many cases to emphasize the usefulness of interest in developing instruction.

Behaviorism's Role

If the content of the traditional curriculum, which disregards the universal or individual interests of students in favor of a fixed body of “essential” knowledge, has been protected from major changes during the bulk of the twentieth century and now during the onset of the twenty-first – insulated by politics, established instructional and assessment practices, and the standards movement – it has also been safeguarded by concurrent predominant ideas within the scientific community. Behaviorism also depends on the idea of a fixed body of knowledge (Forbes, Ross, Salisbury-Glennon, & Strom, 2006). In the classroom, instruction on the behaviorist model is transmitted by the teacher, who assesses learning as a function of repetition, shaping, and reinforcement.

Supported by the prerogatives of positivism, a desire to emulate the predictive powers of the natural sciences, the assumptions of the Standard Social Science Model (SSSM) (Tooby & Cosmides, 1992), and the philosophical writings of Skinner (e.g., 1948, 1953, 1971), the behaviorist conception of education sees people as ultimately malleable and, for all intents and purposes, empty of anything meaningful to learning (such as interests and the ability to be interested) except histories of reinforcement and the ability to have their behavior shaped by further reinforcement. This behaviorist model of learning, although brought into serious question

by a vast, accumulating body of scholarship (e.g., Barkow, Tooby & Cosmides, 1992; Bruner, 1996; Eccles & Robinson, 1983; Pinker, 2002; Robinson, 2008) is perpetuated through the traditional curriculum, standardization, and programs such as NCLB. The impressive research record, which reveals just how much the learner brings with him to the classroom, including inherited skills, unique personality traits and tendencies, and universal core intuitions, has gotten lost in the bureaucratic paper trail of education as practiced.

In the early 1900's the scientific community was poised to produce a rich theoretical and empirical research program on the topic of interest, particularly as it pertains to learning. As early as 1899, James demonstrated in his *Talks to Teachers on Psychology* his recognition of the need to stoke the “native reactions” of young students, reactions that behaviorism was to bulldoze over until neuroscientists, evolutionary psychologists, phenomenologists, and others resurrected them:

Without an equipment of native reactions on the child's part, the teacher would have no hold whatever upon the child's attention or conduct. You may take a horse to the water, but you cannot make him drink; and so you may take a child to the schoolroom, but you cannot make him learn the new things you wish to impart, except by soliciting him in the first instance by something which natively makes him react. He must take the first step himself. He must *do* something before you can get your purchase on him. (p. 39)

In addition to his discussion of native reactions, in the same book James wrote a whole chapter on interest, arguing that teachers can keep a student's attention by beginning with “the line of his native interests, and offer(ing) him objects that have some immediate connection with these” (1899, pp. 95-96). Nevertheless, James was still pessimistic about charging the traditional curriculum with this kind of energy. In the introduction to *Talks*, Dewey and Kilpatrick wrote

that James was resigned to the belief that “study and learning have to be repellant” (p. vii), whereas these scholars implied that James’ ideas on native reactions and interests could be extended as a basis for reforming the entire curriculum. Dewey’s (1913, 1916) and Kilpatrick’s (1918) subsequent work on interest, inquiry learning, and project-based learning testify to their commitment, hinted at in the *Talks* introduction, to large-scale curricular reform along an interest-based model.

Additional works of the time centered on interest included Arnold’s (1910) *Attention and Interest: A Study in Psychology and Education* and DeGarmo’s (1902) *Interest and Education: The Doctrine of Interest and its Concrete Application*. In these works, pride of place was given to interest’s role in generating thinking, learning, and motivation (Silvia, 2006). However, as Silvia has pointed out, a major weakness of these scholarly contributions was the lack of empirical research to back up their theoretical claims. Dewey’s model (1913) had the richest theoretical perspective to offer, but was hard to translate into lesson plans. He insisted that what was immediately engaging to the student must serve as the pathway to learning. Furthermore, these immediately engaging subjects always related to the everyday survival of the student, should extend his native powers and arm him for more effective manipulation of his environment, tend to require minimal artificial or external inducement, and are more important than the hours of tedious recitation and drilling consumed in the course of learning the traditional curriculum. When the student is immersed in such instruction, based on “the child’s native urgencies and needs” (p. 23), the distinction between subject and object blurs, and the self is absorbed in a productive and meaningful “unified activity” (p. 15) foreshadowing Csikszentmihayli’s (1990) much more recently derived concept of “flow”.

Before such promising theories of interest as Dewey's could be verified and developed through empirical research, behaviorist research agendas took the laboratories and research universities by storm, generally discrediting or suppressing most research based on internal or "mental" constructs such as interest for about half a century (Silvia, 2006). Motivation was externalized during this period; only environmentally-based explanations of behavior such as drives and reinforcement were seriously entertained. From teaching machines to programmed instruction (Milhollan & Forisha, 1972), behaviorism profoundly affected educational research and practice as well. Teachers were expected to impose preselected information from the traditional curriculum on students, and students' learning assessed through the kind of prescriptive outcomes later criticized by Buss (2008) and others.

It wasn't until the 1960's and 1970's that interest first trickled back into the literature, and even then it appeared as a smorgasbord of unrelated research studies rather than a coherent branch of motivation research. In the meantime, interest suffered at the behest of biases inherent in the development of research methods and the growth of the educational bureaucracy, both of which tended to favor aggregation versus an individualized focus. These forces may have prompted an automatic disdain for concepts which seemed tied to individual differences and individualized attention and treatment in the classroom, or concepts that were simply foreign to the more popular research programs of the time.

The Aggregation Bias in Research and Education

Eysenck (1976) wrote that "investigators...prefer to relegate individual differences to the error term in their analyses of variance" (p. 75). The recognition among some scholars of the scientific bias against individual differences, of course, significantly preceded Eysenck's comment. Both James (1899) and Allport (1955) disparaged this tendency and its potentially

deleterious effects on scientific progress. According to Allport, when we are investigating a psychological phenomenon that is supposed to pertain to the individual lives of each subject of the sample, who are then intended to be representatives of a larger population, “the elements we employ in our analyses are not true parts of the original whole” (p. 21).

Allport (1955) took his criticism of such tendencies in psychology far enough that he devoted considerable effort to the development of idiographic analyses in studying constructs such as personality, advocating the use of diaries and other tools as a vital supplement to the traditional aggregation-based research methods. Allport’s position, however, is unusual in psychology. Far more common is the view supported by the SSSM, which is captured in the following quotation from Durkheim cited in Tooby and Cosmides (1992): “...individual natures are merely the indeterminate material that the social factor molds and transforms. Their contribution consists exclusively in very general attitudes, in vague and consequently plastic predispositions...” (p. 25). Clearly, research programs influenced by the SSSM would likely emphasize hypotheses seeking generalized abstractions of universal human behavior in favor of those seeking evidence of individual differences.

But Tooby and Cosmides (1992) miss an important point in their critique of the SSSM. Durkheim was a central figure in the development of scientific positivism, and as such provides a link between the erroneous assumptions of the SSSM about human behavior and the attempt of many positivist-minded scholars to treat behavior as if it were completely reducible to tangible physical laws (see Robinson, 2008 for a review). According to Allport (1955):

In keeping with the preference for visible externals, positivism holds that the devices employed in experimentation or measurement shall be specified in the definitions of

every concept. The ideal behind this stringent requirement is to bring psychology into line with physics and mathematics so as to make for a unity of science” (p. 11).

The philosophy of science described by Allport (1955) would seem to have little room for constructs such as interest, which has the double burden of being internally derived and, on the surface anyway, more likely to evoke thoughts of individual differences than of universalities. That positivism, with its shortcomings and now questionable (see Strogatz, 2003) dependence on a worldview of physics-based universal determinism, is still a vibrant force in science and psychology is made clear in the “protestant” writings of neuroscientists Roger Sperry (1977) and John Eccles (Eccles & Robinson, 1983), physicists James Lighthill (1986) and John Polkinghorne (2003), and psychologist Daniel N. Robinson (2008), among others. Lighthill in particular, speaking on behalf of all scientists, wrote the following: “We collectively wish to apologize for having misled the general educated public by spreading ideas about the determinism of systems satisfying Newton’s laws of motion that, after 1960, were proved to be incorrect”. Yet valuable constructs such as interest continue to struggle for wider recognition in theories of motivation and the psychological literature in general, perhaps due in part to the combined influences of vestiges of positivism, the SSSM and the related “modern denial of human nature” (Pinker, 2002), and the deterministic biases inherent in the current practice of science.

The scientific tendency toward aggregation finds its correlate in educational circles. Top down pressure here is exerted through official channels. In two government documents from 2003 recommending guidelines for educational research, randomized controlled trials were noted as research’s “gold standard” for educational topics, indicating a distinct preference for

quantitative studies seeking the central tendency (Ari, Jacobs, Razavieh & Sorensen, 2006). Pressure from within is also extensive.

Class sizes are getting bigger, not smaller, and so are many schools. Solutions to educational challenges that seem directed toward the few rather than the many, such as Individualized Educational Plans known as “IEPs” and research programs oriented toward uniqueness in human nature, are rarely emphasized today in education as practical alternatives for widespread use. Next to managing the academic success of thousands or millions of children, the idea of catering to individual students’ “native reactions” seems a pathetic response. The pressures of size and bureaucracy that breed an emphasis on aggregation are accentuated by a persistent trend in philosophical thinking often attributed to John Locke and alive and well today across the US.

This thinking presumes anyone’s nature (initially barren) to be the result of an assortment of socio-cultural experiences rather than individual genetic predispositions and tendencies. “Blank slate” thinking, as such a philosophical view is referred to by Pinker (2002), has influenced educational professionals and the public to accept the belief that changes in school experiences change children. In this context, students’ diverse interests become irrelevant or even an impediment to the focus on mass changes to redirect legions of school-age kids. The idea that content can somehow be molded or directed by student choice (e.g., Field & Hoffman, 2002) to respond to each student’s immediate interests is recast as foolhardy or elitist. The assumptions of the traditional curriculum play a supporting role in the aggregation bias – the curriculum is acknowledged as “unpleasant stuff” to be made tolerable in the hopes that some students will graduate with a set of skills and the “right” internal library of semantic knowledge.

The Separation of the Act of Learning from the Content to be Learned

Some of the same pressures encouraging the traditional curriculum, behaviorist views, and thinking in the aggregate about educational problems contribute to a strange divorce – the separation of the process of learning from the content to be learned. For one thing, getting bureaucratic control of all educational content taught in schools is a difficult, even preposterous, idea. Until we rid ourselves of human teachers once and for all, we intuitively recognize this goal is out of reach. We have solved this problem by increasing the burden of standardization and government-mandated testing. Then regardless of what teachers actually *do* in the classroom or what they teach, the test scores are supposed to reveal what we need to know – retrain the teachers, can the school, etc.

Prominent theories of motivation seem to reflect these ideas. Most respectable constructs operate independently of any relation to quality or nature of content – self-efficacy, self-determination, goal orientation, expectancy-value theory, and so on. They can be applied to innumerable contexts as long as *something* is being taught or learned. This view extends to the indicators chosen in such research programs to reflect that learning has occurred, such as self-efficacy, grades, and test scores. Intuitively we know that these are indirect measures that are often quite flawed, but we rely on them anyway. They are easy to analyze, leave an impressive empirical trail, conform to the context of the traditional curriculum and standards movement, and are solid representatives of the “hot topics” which most scientific fields tend to collect (Kuhn, 1970).

But after all that research with the above tools, we would still be somewhat in the dark on whether any of the experimental subjects really *engaged* with the material, caught its flavor and not just some of its facts, and would be able to use their learning in productive ways. The truth is that these outcomes are extremely challenging to measure, but as Cowan (2006) warned: “it

serves no purpose to lower our educational aspirations because we cannot yet measure what we think is important to teach. Quite the contrary, measurement and assessment will have to rise to the challenge of our educational aspirations” (p. 27). Until educational professionals *en masse* decide to refresh their outlook on the interpretation and analysis of learning, research will tend to favor aggregation and more easily manageable constructs in the context of the traditional curriculum.

The Specialized Treatment of Interest

The above trends in psychological, educational, and motivational research help to explain interest’s return to the literature, not as a coherent and well-integrated branch, but as an eclectic sampling across a diverse range of sub-disciplines (Silvia, 2006). First re-introduced simultaneously as an emotional state and as a form of physiological arousal in the early 1960’s, interest was also studied as an expression of curiosity and an aesthetic response. From these modest beginnings, interest re-emerged with more considerable force in the 1980’s and 1990’s when a collection of researchers became interested in the effect of interest on learning from text (e.g., Schiefele, 1991, 1999).

But mainstream acceptance still seemed to elude the topic. It didn’t seem to fit anywhere; motivation theory seemed its most likely adoptive parent, but these researchers were immersed in their own constructs, which flourished as the cognitive revolution of the late 1950’s and 1960’s caught on and influenced many other spheres. In educational circles, interest was viewed with some skepticism, since one child’s preoccupation with G.I. Joe dolls (the researcher’s son would follow in his father’s footsteps by insisting on a term such as “action figures” here) and another’s with bottle caps hardly seemed applicable to the fate of an entire school or imbued with predictive power regarding optimal learning.

Interest's Renaissance in the Literature

Not until Silvia (2005a) was the first to revive interest in interest as an emotion was there an opportunity for interest to experience something of a renaissance in the literature. Other researchers (e.g., Renninger & Hidi, 2002) had identified an “affective component” to interest, but resisted the idea that interest was a full-scale emotion with all the rights and privileges of anger, fear, sadness, and so on, probably out of concern for the seemingly obvious role of cognition in the event of interest. Silvia answered these concerns, extending interest’s theoretical basis beyond the contributions of motivation researchers and others who have studied interest by applying the growing body of work on appraisal theories of emotion.

A new conception of interest struggles to emerge

These theories guarantee pride of place to cognition since they depend on cognitive appraisals as antecedents to emotional states. Because Silvia’s theory has the potential to resolve several outstanding debates over the nature of interest, such as the cognition versus emotion split, there is more opportunity for the literature on interest to cohere and more profoundly affect psychological and educational pursuits. Whether Silvia’s conception of interest as an actual emotion will gain acceptance among motivation and education researchers remains to be seen. This research program is still too new.

The arguments of Dewey (1913) and other scholars of decades ago that interest strongly influences our thinking, learning, and motivation have finally begun to receive their due attention in the literature, and consequently we have witnessed some empirical support that validates some of their claims. Many still argue that these ideas are unreachable and impractical in today’s educational context. But if the above scholarship is to be thoughtfully engaged, then perhaps the content in our schools is what needs to be re-evaluated and even altered as opposed to interest

being dismissed as an educational goal. The downplaying of interest as a viable research topic, particularly within the motivation literature, is not hard to explain given the influence of the traditional curriculum, the lingering effects of behaviorism, a bias toward aggregation, the separation of learning from its object, and the scattered nature of interest's revival in the literature. But the cost of this diminution is harder to pinpoint.

The traditional curriculum has been criticized as unmotivating, irrelevant, and self-defeating (Kaminsky & Forbes, 2009). Related research suggests that this curriculum can't be "made interesting" as an afterthought – attempts to dress up the content by tacking information onto the main structure of a lesson can disrupt the coherence of the material, and result in decreased learning of the primary content (Sadoski, 2001). In line with Dewey's and Kilpatrick's early attempts to reform the core of the curriculum along lines responding to the "native reactions and interests" of students, interest should be recognized as a powerful and practicable educational tool that can take us beyond a tired curriculum with dressing on top. One of the current drawbacks to the motivation literature is its failure to have taken full advantage of this tool in its theoretical formulations.

The roots of the new interest in interest: Emotion research, Berlyne, other theories

Only with the re-emergence of emotions as a legitimate research topic in the 1960s and 1970s did interest regain a foothold in scientific study. Key emotion researchers (e.g., Izard, 1977; Tomkins, 1962) cited interest as an important emotion, suggesting a new way to its study by empirical methods. Unfortunately, these researchers' work was primarily theoretical and was not promptly tested by others, stalling the possibility of fruitful empirical progress on interest as an emotion. Nor did researchers at this time seek connections between this work on interest and

the contemporaneously developed appraisal theories of emotion (e.g., Arnold, 1960; Lazarus, 1966), which also could have led to well-defined empirical research programs.

From the perspective of behaviorist learning theory and based on his studies of physiological arousal (Silvia, 2006), Berlyne (1960) proposed a testable model of interest consisting of four variables held to determine the potential interest of an object by managing arousal levels – novelty, complexity, conflict, and uncertainty. According to Silvia (2006), Berlyne termed these variables *collative* “because they involve comparing incoming information with existing knowledge, or comparing several regions of a differentiated stimulus field” (p. 33). Due to his behaviorist roots, Berlyne resisted relating his variables to emotional states, preferring to place them within theories of arousal that subsequent research has rendered obsolete. However, in the years since Berlyne’s death in 1976 empirical research has continually validated the importance of his variables in several fields according to Silvia (2006):

Berlyne’s analysis of the four collative variables remains the most detailed and insightful in the field. Researchers interested in the psychology of emotions, aesthetics, environmental design, music, architecture, and visual perception have relied on Berlyne’s discussions to understand how novelty, complexity, uncertainty, and conflict affect interest and enjoyment. (pp. 43-44)

Three other principal ways to investigate interest were offered by researchers who looked at its effects on text comprehension (e.g., Schiefele, 1991), its differentiation into situational versus individual interest (e.g., Hidi, 1990), and its role in a theory called the person-object theory of interest (e.g., Krapp, 1999). These three research trends established a significant body of empirical data which continues to inform the study of interest in general. However, these

approaches haven't led to any major extensions of our overall theoretical understanding of interest beyond their scope.

Theoretical Basis for the Present Study

Other researchers have recently followed up on these theories and research programs, synthesizing in particular the work of the earlier emotion researchers on interest, Berlyne's (1960) variables, and the growing body of literature on appraisal theories of emotion, which experienced a renaissance in the 1980s and 1990s (e.g., Roseman et al., 1995; Scherer, 1984). This last group of interest researchers (Ellsworth & Smith, 1988a, 1988b; Silvia, 2005a, 2005c, 2008; Smith & Ellsworth, 1985; Turner & Silvia, 2006) has proposed a return to and has investigated the conceptualization of interest as an emotion – this time with its own appraisal structure. Smith and Ellsworth (1985) were the first to suggest an appraisal structure for interest, but their research included theoretical and methodological problems (Turner & Silvia, 2006). Silvia (2005a) presented and tested a new appraisal model of interest – this time based on appraisals of *novelty-complexity* and *coping potential* – that has been investigated (Silvia 2005c; Turner & Silvia, 2006), but awaits further study and validation.

Silvia's appraisal model of interest: Description and theoretical background

With empirical support to back up his theory of interest, Silvia (2005a, 2005b, 2005c, 2006, 2008a) argues the emotion of interest depends on two cognitive appraisals that precede interest, and which he and Turner (Silvia, 2005c; Turner & Silvia, 2006) also suggest (but haven't tested yet) may occur sequentially. First, an observer makes an appraisal of novelty-complexity based on an object in the environment or one mentally represented in his thoughts (Scherer, 2001), and then makes a second appraisal of coping potential, also understood as a determination of the object's comprehensibility (Silvia, 2005c). If the observer makes favorable

appraisals of the object, that is, determines the object to be “new, uncertain, complex, or contradictory” (Turner & Silvia, 2006, p. 671), and at the same time views the object to be comprehensible, then he experiences the emotion of interest.

Silvia’s model is grounded in the previous literature in several additional ways which receive a full treatment elsewhere in the literature review. For now, three of these significant connections to other research are worth noting here – namely the definitions of each of his appraisals and the adaptive value of his appraisal model. First, regarding the definition of the novelty-complexity appraisal, Silvia is clearly drawing on Berlyne’s (1960) four variables to describe the kinds of attributes an object should have in order to be appraised as novel or complex. However, Silvia (2006) also has married these variables to modern appraisal theories, such as Scherer’s (2001) multilevel sequential check model (Turner & Silvia, 2006).

Scherer’s (2001) approach to appraisal, similar to the views of other appraisal theorists, affirms the nature of cognitive appraisals as internal, subjective judgments in which the emphasis is on the perceiver rather than objective attributes of the object. Berlyne, as unwilling to entertain the role of subjective perception as he was to deal with emotional states, didn’t investigate this aspect of how his variables lead to interest (Silvia, 2006). Silvia writes: “for predicting the experience of interest, perceptions of an object’s complexity rather than the object’s ‘objective complexity’ are central” (p. 57). Scherer (2001) also includes a “novelty check” (p. 95) in his model which occurs prior to the elicitation of several different emotions, which can occur on several levels ranging from a low-level detection of “suddenness” (p. 95) to more complex estimates of novelty based on individual differences, prior experience, motivational states, and other factors, and which stimulates the investment of attention. For Scherer, the novelty check supports one of four appraisal objectives – *relevance* of the object for the organism’s survival

and well-being, the other three objectives being (in sequential order after relevance) implications, coping potential, and normative significance. Finally, Scherer (2001) and others (e.g., Smith & Kirby, 2001) have extended Arnold's (1960) description of appraisal as "direct, immediate, intuitive" (p. 172), asserting within their own modern theories that appraisal processes need not be conscious or reflective and on the contrary can be extremely rapid (see esp. Scherer, 2001, p. 102) – an explanation which conforms to Silvia's appraisal model of interest and applies to both of the two appraisals he has included (Silvia, 2006).

This assumption about the rapidity with which appraisals can be made encompasses a key aspect of the present study, namely the follow-on assumption that biological, psychological, and social antecedents in the environment or from a mental representation can be quickly and meaningfully recognized, and thus serve as useful and important influences on appraisals. It may be helpful to note here that the requirement for speed of appraisals is assumed (see Lazarus, 1991, pp. 153-159) to be less demanding for epistemology-based emotions (Keltner & Shiota, 2003) than for emotions designed to minimize physical harm or similar threats. Nevertheless, theories about the functioning of appraisal antecedents for any emotion should be able to resolve theoretical difficulties such as the charge that cognitive appraisals are too slow and cumbersome to account for emotions (Zajonc, 1980), and to correspond to everyday life, in which humans experience rapid changes in their emotions – including interest. A significant body of research (e.g., Geary, 1995; Griner & Smith, 2000; Mauro et al., 1992; Roseman et al., 1995) suggests such antecedents can be rapidly processed in a way that fully supports the overall theoretical assumption that the human emotion system is an effective adaptive means of engaging and navigating through the environment and of achieving important goals (Lazarus, 1991).

Regarding coping potential, Silvia has drawn from more recent appraisal theorists such as Scherer (e.g., Scherer, 2001; Ellsworth & Scherer, 2003), but also from Lazarus, whose decades-long research on appraisal spans the early period of the 1960s (e.g., 1966) through the turn of the century (e.g., 2001). Like Scherer (2001), Lazarus (1991) emphasizes both relevance and coping potential. Lazarus, however, assigns them the roles of “primary” (has something relevant to my well-being occurred?) and “secondary” (what are my coping options regarding the relevant event, including my ability to cope?) appraisals.

An apparent theoretical conflict between Lazarus and Scherer should be mentioned here. Lazarus’ (1991) arrangement appears to be sequential, similar to Scherer (2001), but Lazarus preferred to think of appraisal processes holistically and fought the idea of any sort of strict order: “we must not see the appraisal process...as scanning the components in any fixed order. Very rapidly, perhaps even simultaneously, we draw on a variety of stored information...we must indeed automatically do something...or else the emotion process would not be adaptive” (1991, pp. 151-152). Lazarus conceived of appraisal sets for each emotion as “core relational themes” (1991, p. 39) in which the different appraisals are blended to more closely approximate emotions as actually experienced. For example, the core relational theme of anger, which depends on appraisals of an event relevant to a goal, the event’s ability to thwart this goal, a threat to one’s status, and assignable blame (Silvia, 2006), becomes “a demeaning offense against me and mine” (Lazarus, 1991, p. 222).

Scherer (2001), well aware of Lazarus’ and others objections to the idea of a sequence, wrote the following:

...the apparent speed of an emotional reaction to an event does not rule out a sequential model, given the rate with which these evaluations can occur. It is quite

probable that massively distributed parallel processing, as emphasized by much of cognitive psychology and artificial intelligence is at the root of the appraisal process”.

(p. 102)

Silvia, in his writings, appears to side somewhat with Scherer on the possibility of a more structured view based on sequential checking, given that he and Turner state that Silvia’s model is “rooted in” Scherer’s theory and that the novelty-complexity appraisal is “followed by” an appraisal of coping potential” (Turner & Silvia, 2006, p. 671). At the same time, Silvia has acknowledged the value of synthetic or thematic approaches to appraisal process such as Lazarus’, and has implied that both sides, a structured view and a more holistic approach, have much to offer: “Thematic and structural descriptions of appraisals complement each other. Expressing appraisals as abstract themes highlights the coherent, subjective meaning generated by the appraisal process; expressing appraisals as a set of judgments highlights an emotion’s subtle cognitive architecture” (Silvia, 2006, p. 56). In any event, both Silvia and Scherer readily admit that while each has presented empirical evidence to support their views, much research remains to be done on their theories about appraisal structure and sequential checking – which is one of the objectives of this dissertation.

Regarding the second appraisal of coping potential, Lazarus defined it across several emotional states as “an evaluation by a person of the prospects for doing or thinking something that will, in turn, change or protect the person-environment relationship” (1991, p. 150). Like other appraisal theorists, though, Lazarus was most likely thinking of this appraisal in the context of a demanding event such as preventing harm (Silvia, 2005c). It must also be noted here that Lazarus didn’t include interest in his list of emotions (Turner & Silvia, 2006). Silvia (2005a, 2005c, 2006) therefore took several steps to modify the concept of coping potential as an

appraisal of “comprehensibility”. First, he referred to a significant body of research from several fields which supports the classification of interest as an emotion (see esp. Silvia, 2005c), and also included interest as a member of the family of “epistemology-based emotions” identified by Kelter and Shiota (2003). In the context of interest as epistemology-based but nevertheless an emotion, and based on research on metacognition and self-regulation (e.g., Carver & Scheier, 1981), Silvia (2005c) then argued that:

if a goal is primarily epistemological, such as learning something new or closing a gap in knowledge, then people can appraise resources, skills, and opportunities for achieving the goal...it seems reasonable to speak of appraisals of coping potential in regard to goals associated with learning, comprehension, an understanding. (p. 99)

Hence, Silvia (2006) proposed a year later that “for interest, coping potential probably refers to people’s appraisals of whether they can understand the ambiguous event” (p. 57) posed by a positive appraisal of novelty-complexity.

By basing his interest model on appraisal theories of emotion, Silvia has granted *adaptiveness* a leading role in his conception of interest. According to Forgas and Smith (2007), appraisal theorists think of emotions as “modes of action readiness” which are responses to adaptationally relevant situations, and of appraisals as levers to “call forth the appropriate emotion(s) when the individual is confronted with personally adaptationally relevant circumstances” (p. 149). Roseman and Smith (2001) agree, asserting the role of appraisals in selecting the emotions “most likely to help attain important needs and goals” (p. 8). In establishing this connection between the emotion of interest and adaptiveness, Silvia has also effectively tied modern appraisal research to earlier emotion research on interest and other emotions, since both bodies of work have stressed the ability of emotions to help us achieve

“fundamental life-tasks” (Ekman, 1992, cited in Silvia, 2006, p. 21). Based on this lineage, Silvia’s (2008b) characterization of interest as designed to “motivate learning and exploration”, and to ensure that “people will develop a broad set of knowledge, skills, and experience” (p. 57) is logically consistent with previous research.

Silvia’s appraisal model of interest: Support from evolutionary research

Silvia’s conception of interest as an adaptive emotion and his choice of appraisals find additional support within evolutionary psychology, specifically Kaplan’s (1992) research on landscapes as evolutionarily significant informational patterns. According to Kaplan, there is “reason to believe that selection pressures in early humans favored acquiring new information about one’s environment while not straying too far from the known” (p. 585). Kaplan also asserts that the experiencing of this process of landscape preference to be affective, since “if it is adaptive to make such choices, one would expect them to be part of the human affective makeup” (p. 585). In order to operationalize his theory of landscape preference, Kaplan has offered a model in the form of a 2X2 “preference matrix” which he has developed from an analysis of previously collected empirical data, and which he has validated through subsequent empirical research.

The matrix is based along one axis on an observer’s estimates of his need to *understand* a landscape (coping potential) and his desire to *explore* a new landscape (novelty-complexity). The other axis represents two levels of processing required to analyze the landscape – *immediate* if the required data is easy to hand and *inferred* if the data is more elusive. Kaplan reported that one of the strongest preference sets among his subjects was for a combination of a high degree of understandable elements along with a high degree of “mysterious” elements in the same landscape (both registered as inferred along the level of processing axis) – a combination

remarkably evocative of the favorable appraisals of novelty-complexity and coping potential both required to elicit interest in Silvia's model. Kaplan's emphasis on the affective nature of landscape preference, along with his conclusion stated here, strikes very close to home as far as Silvia's model and the theoretical framework of this dissertation: "It is now quite clear that there is more to experimental aesthetics than optimal complexity...Both the acquisition of new information and its comprehension turn out to be central themes underlying the preference process" (p. 595).

Silvia's appraisal model of interest: The empirical record, new possibilities

Thus far, Silvia and Turner have shown that their two appraisals strongly predict interest in a variety of experimental conditions including self-report, forced choice, behavioral measurement and *in vivo* manipulation, and at the between-person and within-person levels of analysis (Silvia, 2005a, 2005c, 2006a, 2008; Turner & Silvia, 2006); that interest is distinct from other emotional states such as enjoyment (Silvia, 2005c) and independent of appraisals of pleasantness (Turner & Silvia, 2006); and that Silvia's model is robust to individual differences along constructs such as affect, openness to experience, and trait curiosity (Silvia, 2005a, 2005c, 2008a). However, much still needs to be done in terms of extending and expanding on their work, particularly if we are interested in how this research program applies to education.

In an educational context, the following new research avenues are suggested by Silvia's and Turner's efforts, and when considered collectively represent a possible synthesis of the disparate research programs on interest of the past: (a) how the emotion of interest affects academic learning from text or from other sources; (b) how this interest affects educational outcomes such as deep-level processing, intrinsic motivation to learn, academic self-efficacy, test performance, grades, and other forms of achievement; and (c) how this interest can be effectively

manipulated in the classroom to enhance such educational outcomes. These three avenues offer researchers numerous opportunities to gather together the contributions of the best work done so far on the concept of interest, emotion research, interest in text, motivation, and appraisal theory. Future research must contribute to our existing knowledge by developing hypotheses that are both testable by empirical methods and able to produce results useful to educators.

A third appraisal? Testing for appraisals of goal relevance

In his previous research on interest's appraisals, Silvia (2005c) suggested the possibility there is a third appraisal in addition to novelty-complexity and coping potential. He proposed three candidates – pleasantness, goal congruence, and expected reward, but followed up these suggestions with reasons why these may not be central to interest. One of the experiments in this study showed people are interested in unpleasant objects (Experiment 1), and subsequent research (Turner & Silvia, 2006) has validated this finding, indicating the experiencing of pleasantness and enjoyment belongs to a different appraisal-emotion set. As for the other two possibilities, Silvia argued that interest's functional basis – to promote a search for new information – belies the need for confirmation that the search will conform to personal goals or lead to rewards. In other words, the need for such confirmation would end up discouraging exploration. He also noted that these appraisals might have covaried with measures of coping potential in his study if he were to have measured them, but contended that his design kept coping potential clear of the possibility that other appraisals would have created confounds in this instance.

The researcher has introduced *goal relevance* (Lazarus, 1991) – an evaluation of an event's personal importance – as another contender for third place in interest's appraisals. It is possible that in the context of interest, goal relevance would covary with either novelty-

complexity or coping potential in predicting interest. In other words, someone's evaluation of an event's personal importance is tied up with his appraisal of the event's degree of ambiguousness or comprehensibility. Or goal relevance could be unrelated to these appraisals, which is similar to Silvia's (2005c) suggestion that a focus on goals or rewards is not functionally relevant to explorations of the unknown. A third possibility is that goal relevance serves as an independent third appraisal potentially eliciting interest. It is worth noting that, as previously mentioned, Scherer (2001) included the appraisal objective of relevance in his definition of a cognitive novelty check related to the elicitation of several different emotions.

In one study (Griner & Smith, 2000), people were asked to report their appraisals of *motivational* relevance, whose definition closely resembles Lazarus' (1991) concept of goal relevance, and interest along with boredom levels in a complex task. The task required subjects to teach someone else how to use complicated computer graphics software. They were also measured on a scale of affiliative orientation, because it was hypothesized that more affiliative people would report higher motivational relevance and higher interest than people with a weaker affiliative orientation. Results indicated higher interest and lower boredom covaried with higher motivational relevance in line with hypothesized predictions, supporting the idea that personality-based constructs moderate appraisals as well as the possibility of an appraisal-emotion connection between relevance and interest. Regressions will assist the researcher in assessing *goal* relevance as a potential third appraisal.

Threads to other branches of the literature: Objections, connections

Objections from the literature to various components of Silvia's model and how it is applied within the present study deserve some attention. Reaching back to psychology's early period, the James-Lange theory of emotion (Pintrich & Schunk, 1996) disputed the idea that perception of a stimulus led to an emotional response which prompted adaptive action tendencies. These thinkers asserted that perception led directly to a combination of autonomic reactions and behavior, and that awareness of these reactions produced an emotion – emotion thus became the consequence rather than the precipitator of reactions to the environment. Clearly, this theory would not be reconcilable with appraisal theory.

James-Lange Theory of Emotion: Physiological Causes

While the James-Lange theory is still given some attention in psychology texts, much research beginning with Cannon (1927) has rendered its presumptions obsolete. Earlier research such as Cannon's demonstrated that emotions do not require bodily changes in order to occur (Pintrich & Schunk, 1996), while more recent research has shown appraisals to have a causal role in producing emotions (e.g., Roseman & Evdokas, 2004; Smith & Kirby, 1999; Smith & Lazarus, 1993) and postulated that appraisals can include low-level cognitive processing such as automatic priming and even a more basic processing of the sensed properties of an event or object (Roseman & Smith, 2001). This latter contribution of appraisal research suggests a possible synthesis between appraisal theory and James' and Lange's position on causality of emotions. Earlier appraisal theorists such as Arnold (1960) also suggested reconciliation on this order was possible, arguing for example that James' writings on perception include an evaluative component resembling key aspects of appraisal theory.

Objections from behaviorist and learning theories: The black box

Radical behaviorists such as Skinner also would have resisted appraisals as a viable construct – thinkers operating from this perspective rejected the scientific value of anything proposed as a dispositional property of an organism that mediates reactions (Lazarus, 1991). However, it has been noted that except for Skinner, behaviorists and learning theorists such as Hull and Berlyne typically had to alter their original models to account for “all sorts of additional mental variables” (Lazarus, 1991, p. 8) to improve their ability to explain and predict behavior (Pintrich & Schunk, 1996).

While Skinner insisted that it was fruitless to speculate about dispositional properties, most of psychology has embraced the value of mental constructs such as emotional states in accounting for human behavior (Lazarus, 1991; Solomon, 2002), moving past radical behaviorism’s rejection of the “black box”. It is an oddity of educational psychology that such behaviorist theories have lingered on in greater strength than in other branches of psychology, perhaps due to the success – though very limited in scope – of behavioral “mods” and related techniques in a classroom setting. Thus it is important merely to point out that an appraisal-based approach to classroom instruction runs counter to remnants of the behavioral strain within educational circles.

Zajonc and colleagues: Cognition as unnecessary cause

A more contemporary criticism of appraisals comes from Zajonc and colleagues (e.g., Zajonc, 1980, 1984, 2000; Izard, Kagan, & Zajonc, 1984), who have built an extensive research program in support of what is sometimes called the “primacy of emotion” (Lazarus, 1991, p. 178). At the heart of this program is the assumption that emotion can, and often does, operate as a stand-alone system, so that sensory inputs are transformed directly into emotion without the need for cognitive activity. This emotion theory is a serious challenge to the concept of

appraisals. According to Lazarus (1991), this program relies on three tenets: 1) assigning cognition a central role leaves emotion cold and heartless; 2) infants and higher-order animals can experience emotion but lack the complex cognitive skills appraisals require, and drugs or bodily changes can induce emotions without a need for these skills to be engaged; and 3) emotions are generated too rapidly for appraisals to intervene.

Lazarus (1991), among others, has responded to these specific objections. He has argued that to propose emotion has cognitive antecedents or components is not the same as portraying emotion is just a type of cognition – therefore emphasizing a role for cognition need not take away any of the “heat” from emotional states. As for the second objection, he noted that in young children lack of verbal ability in no way presupposes an inability to form cognitive appraisals, and that likely the capacity for such appraisals grows in a curve with increased understanding “about self and world” (p. 183), as evidenced by the developmental pattern of infants’ appraisal of the danger of height (Bertenthal, Campos, & Barrett, 1984). Similarly, Lazarus points to evidence indicating higher-order animals have far more of an ability to cognitively evaluate situations than is generally thought. Additional studies covering a wide range of topics, such as Pepperberg’s (e.g., 2006) work with grey parrots’ visual recognition skills, add support to this view about animals’ cognitive abilities.

The proposal that bodily conditions cause emotions seems to match what we recognize from our daily lives. Everyone has become grouchy at some point under the grip of hunger or exhaustion. But the influence of bodily states on emotions, whether induced by drugs or symptoms of fatigue and illness, can be accounted for in other than causal terms when one considers them as offering the *potential* for – but not initiating the occurrence of – an emotional state. The generation of the actual emotion still requires evaluations of harm or benefit within the

person-environment relationship (Lazarus, 1991). For instance, Lazarus suggests that when one is awakened from sleep too early and with feelings of anxiety considers the number of tasks facing him later that day, his fatigue and lack of alertness had predisposed him to make appraisals of vulnerability – which are likely to change with more rest.

Finally, Lazarus (1991) has thoroughly addressed the third claim of Zajonc and colleagues that cognition is too cumbersome to cause emotions, which so often express themselves as near-instantaneous reactions to a stimulus event. Citing neuroscientific research on the existence of different modes of meaning making (e.g., LeDoux, 1989), he has argued for the proposition that there is more than one level of cognition responsible for emotion generation, and that adaptational demands aid in the management of these levels. Thus, adaptive emotional responses requiring extremely rapid processing are still supported by certain, albeit low-level, forms of cognitive activity. As previously cited in Chapter One, modern appraisal research on cognitive processes such as parallel processing, automatic priming, and memory priming (e.g., Roseman & Smith, 2001; Scherer, 2001; Smith & Kirby, 2001) has supported Lazarus' claims here.

Ortony and colleagues: Disqualifying interest as an emotion

Ortony and colleagues (e.g., Ortony, Clore, & Collins, 1988) have written a body of work which raises objections to the present study from a different quarter. These researchers do not share the same concerns as Zajonc and colleagues regarding a cognitive basis for emotions – indeed, their research strongly supports the role of cognition, and specifically appraisals, in emotional responses. Instead, they have objected to the classification of interest as an emotion. Their theoretical perspective, an extension of Mandler (e.g., 1984), is that emotions consist of appraisal and arousal, which so far is consistent with Lazarus and colleagues (e.g., Lazarus,

Averill, & Opton, 1970), but that arousal includes a postulated mechanism that registers *valence*, e.g., a leaning toward or away from a stimulus event.

Interest, in the view of Ortony and colleagues, isn't an emotion because it doesn't require valence to occur. In other words, someone can momentarily experience interest in, say, a piece of news without necessarily experiencing feelings of attraction or revulsion. They have attempted to support their valence-based classification system with empirical research using "emotion words" (e.g., Clore, Ortony, & Foss, 1987). A primary technique in this research program (see Ortony et al., 1988, p. 174) was to ask participants to report on whether they believed certain words represented emotions when required to think about these words in terms of "feeling x" and "being x" – e.g., "feeling interested" and "being interested". Words scoring well in both the feeling and being categories were judged to be better representatives of true emotional states than words with less consistent scores. Their findings led them to conclude that certain states such as interest or surprise were actually cognitive states that became affective "only if feeling is imported through the use of a linguistic context, as in the phrase "feeling abandoned" (p. 174).

There are serious questions that need to be addressed regarding this type of research, and the researchers' claims. Such data have the potential for some useful implications, but hardly seem suited to operate as a sole basis upon which to make claims about whether one state or another deserves to be classified as a *bona fide* emotion. For one thing, it has long been recognized that people's conscious awareness of what they are experiencing, while useful and important in many areas of research, rarely qualifies as a complete account of a psychological phenomenon, particularly emotional states – conscious awareness is not a necessary condition for the generation of emotions or the appraisals that precede them, nor even for the sensory

perception of the precipitating stimulus event (Arnold, 1960; Kihlstrom, 1987; Lazarus, 1991; Lazarus & McCleary, 1951; McGinnies, 1949).

So relying on this conscious awareness for the sake of making certain claims about the fitness of various states to qualify as emotions seems an unwarranted enterprise. Ironically, Ortony himself belongs to this list of scholars who acknowledge the inability of conscious awareness to account for the full range of emotional experience: “our claim that emotions always involve some degree of cognition is not the same as asserting that the contribution of cognition is necessarily *conscious*” (Ortony et al., 1988, p. 4). These data also consist of self-reports of people’s attitudes about words, which are subject to errors of memory, current moods, and other thoroughly researched inaccuracies stemming from self-reports, especially in lieu of corroboration with behavioral measures or other alternative data sources.

Second, other factors than valence must be considered if one is to advance an emotion classification system. Admittedly, theorists have been debating taxonomies of emotions for a long time. It is doubtful the literature will ever converge on an exclusive master list of seven, nine, or fourteen emotions – this is probably a good thing for scientific progress. Ortony’s point is worth considering that the establishment of such a hard and fast set of basic emotions is also problematic and unproductive without an objective means of choosing one theorist’s set over another’s (Ortony et al., 1988).

However, it seems equally problematic and unproductive to downplay other characteristics of emotional states established through significant theory and empirical research. For example, Scherer (2001) has identified the following components: experiential, expressive, cognitive (e.g., appraisals), physiological, and motivational. Similar lists of the components of emotions have been around for decades (e.g., Drever, 1952). Research justifying interest’s

inclusion as an emotion on the basis of components such as Scherer's has been reviewed elsewhere in this dissertation (see Silvia, 2006, Chap. 1 and 3); although often viewed as less intense or "hot" than anger or fear, Silvia (2005c, 2006; Turner & Silvia, 2006) stands by his claim that interest is an emotion, suggesting along with Keltner and Shiota (2003) that it belongs to a group of epistemology-based emotions.

Ortony and colleagues appear to have separated their judgments about interest from a consideration of the above components of emotions and relied on the sole factor of valence to justify exclusion – although some of the relevant research on these other components (e.g., Reeve, 1993; Silvia, 2005c) wasn't available in 1988. These researchers clearly believed their exclusion of interest was merited – indeed, their position and Silvia's may be irreconcilable. It should be pointed out, however, that Ortony's viewpoint would require him to refute or at least respond to the consistency of findings such as Reeve's (1993) regarding facial expressions (e.g., widened eyelids) and interest or Silvia's (2005a, 2005c, 2006, 2008; Turner & Silvia, 2006) on interest appraisals. Ortony would also need another way to account for the demonstrated convergence of research on "self-reported interest, physiological engagement, expressive markers of interest, and behavioral measures of exploration" (Turner & Silvia, 2006, p. 670; see Langsdorf, Izard, Rayias, & Hembree, 1983; Reeve, 1993; Silvia, 2006, Chap. 1).

Assuming that Ortony and colleagues would not be moved by studies such as those referenced above, the issue of valence can still be addressed as a separate challenge to their position on interest as a cognitive state. One of their examples of a non-valenced cognitive state registering surprise or interest is an incident in which somebody (not a Fairbanks resident) reads in the newspaper that the temperature reached 90 degrees Fahrenheit in Fairbanks, Alaska

(Ortony et al., 1988). The person takes note of the unusual occurrence, but isn't necessarily "moved" – no valenced reaction, no emotion.

While the researcher can readily agree that it is almost certain the newspaper reader didn't fly into a rage or passionately embrace the newspaper, otherwise this example demonstrates almost nothing. It is of little value to make a case against a state qualifying as an emotion based merely on the low-intensity nature of the experience. Research shows that intensity varies significantly across and within emotions (e.g., Lazarus, 1991; Roseman & Smith, 2001) depending on the circumstances of the event and needs of the person. Applying Silvia's (2006) model to the example suggests an alternative account: the reader appraised the news snippet as novel and comprehensible and therefore compelling enough to cause brief interest, but the easy digestion of the one fact without subsequent favorable reappraisals of novelty or complexity led to a diminishment of interest – the event remained comprehensible but was no longer novel. Everybody has felt emotional "blips" before – extremely brief flashes of anger or sadness that fade just as quickly, likely due to rapid reappraisals of the situation and personal needs. But people (and scholars) are probably less likely to disqualify extremely brief sensations of anger from the ranks of the emotions for a simple reason – anger is more commonly recognized as an emotion than interest.

So is it really justified to argue the newspaper reader didn't experience valence? To the contrary, a functional account of emotions and of interest suggests valence did indeed occur, but in a manner Ortony and his colleagues weren't looking for. If emotions serve adaptational needs, and the survival function of interest is to promote engagement with the environment, exploration (Izard & Ackerman, 2000), and the collection of new, potentially useful information (Silvia,

2008b), then *comprehensible novelty* ought to be enough to call up valence in response to the stimulus event.

The research supports this view that interest includes a valence component. Theoretically, interest needs to be able to attract an investment of focus and concentration that is strong enough to persist when the sensory inputs and other available information are unpleasant or even disturbing, or its functional purpose won't be met. Think of a loud, disturbing noise occurring at home that can't be immediately explained. We may react to this event with feelings of fear *and* interest. We want an explanation for the noise, we want to understand the new event, but we are also prepared to avoid harm caused by the event. *Valence* supports both action tendencies – without valence sustaining our investigation of the noise and its aftermath (interest), we might recoil and unconsciously block out additional information (fear), perhaps to the detriment of our well-being. Similarly, our need for information even in less demanding situations nevertheless contributes to our survival and well-being, and has to be able to push through inputs that may be unpleasant. This approach to interest is consistent with a functional view of interest which imbues much interest research (e.g., Izard, 1977; Tomkins, 1962), and supports Silvia's (2006) appraisal model of interest – it also supports a conception of interest as a valenced emotion.

Within a functional, emotion-based account of interest, the emotion of interest is adaptive because it maintains commitment to follow through on action tendencies to explore in challenging (e.g., disturbing) situations. Silvia's research clearly demonstrates, for example, that unpleasant and disturbing qualities don't diminish interest (e.g., Turner & Silvia, 2006). Furthermore, an attraction component of interest has also been successfully measured in terms of behavioral outcomes – people are pulled toward interesting objects, texts, etc. in favor of uninteresting ones (Ainley, Hidi, & Berndorff, 2002; Silvia, 2005c). Interest, therefore, seems to

have a unique functional calling – to cause people to be attracted to new events whether or not they are disturbing or unpleasant so that they engage with them enough to understand them. This attraction, when considered in combination with empirical evidence of interest in the context of behavioral measures such as people concentrating on an object, persisting in looking at it, and wanting to know more about it (Silvia 2005a, 2005c, 2006, 2008), sounds a lot like valence.

Based on the above, there is no longer a substantial reason to eliminate valence as a possibility for our newspaper reader simply due to level of intensity. What about the question of duration? Was our reader's reaction non-valenced because he didn't dwell on the new information for very long? The researcher disagrees. After all, the reader was attracted enough to take particular note of the temperature in Fairbanks, and even to consider, albeit briefly, its implications as a remarkable event. Are we to conclude valence didn't occur because whatever was experienced was too short in duration, and the reader didn't linger passionately over the information? How long is enough? Thirty seconds? Thirty minutes? This seems to the researcher an impoverished means for judging whether or not valence occurred. The newspaper reader certainly experienced something, even felt something, no matter how brief, and probably demonstrated a few simple expressions of that something, such as movements of the mouth and eyes or other gestures suggestive of concentration.

Cognition and emotion are not completely distinct systems

Ortony's research program may suffer from a particular theoretical problem – an artificial separation of cognition and emotion. It may seem strange that a researcher would argue for their separation when he has proposed a cognitive theory of emotion, but this idea of distinct systems has received scattered support in the literature (e.g., LeDoux, 1989). As one of the foundational thinkers behind cognitive theories of emotion, Lazarus (1991) has made clear his view that this

separation is untenable: “emotion and cognition are each so complex, and their mechanisms spread so widely over the central and peripheral neural pathways that, in my opinion, it is difficult to argue convincingly for separate systems as though there were a special brain organ for each” (p. 179).

Of course, theorizing that cognition and emotion are separate systems may be a useful aid in theory formulation, but it becomes problematic when the distinction leads one to stray too far from actual human processes. For instance, it allows one to propose that a thought or reaction can be completely unemotional, or non-valenced as Ortony has claimed (Ortony et al., 1988). Such a proposal is helpful if one wishes to classify certain reactions such as surprise or interest as devoid of emotion, but the researcher doubts in the ultimate utility of this practice if one’s goal is to discern what really happens inside people.

Can a thought totally devoid of emotion ever occur? Wouldn’t this require somebody to be able to hold one and only one thought in their head to the exclusion of every other mental and environmental input? Do our thoughts, even simultaneous ones, exist in isolation of each other? Finally, is it more productive to force a distinction between completely unemotional reactions and clearly emotional reactions, or to suggest emotional responses are a function of personal involvement, e.g., when there are “stakes” in the event (Lazarus, 1991), and that they are always on hand (appraisal theorists might say they are “waiting” to be elicited by relevant appraisals) to prompt action tendencies tailored to meet the adaptational needs of changing situations?

In the latter view, cognition and emotion are integrated systems to some extent that influence each other (Forgas & Smith, 2007), cognition can range from “relatively cold” (e.g., when personal stakes are low) to “hot”, and emotion is generated by different levels of cognitive processing from rapid and automatic to slow and deliberative (Lazarus, 1991). Support for the

integrated view has increased over time. Earlier thinkers such as Spencer and Piaget (both cited in Greenberg & Safran, 1987) have now been joined by modern neuroscientists and other scholars (e.g., Gray, Braver, & Raichle, 2002; Greenberg & Safran, 1987; Lane & Nadel, 2000) in the growing assertion that, simply put, there is really no such thing as emotion without cognition or cognition without emotion (at least in the healthy person: see Lazarus, 1991). But supporters of the integrated approach have had to contend with centuries of a deeply embedded opposing strain of thought.

The idea of separating cognition and emotion has a long history attributable to cultural and philosophical traditions – in these formulations, cognition was often the “rational” process and emotion the “animal” part of our nature (Lazarus, 1991). Earlier psychology from James through the behaviorists, with their emphasis on comparative psychology, made a similar distinction in which cognition was the higher-order process involving cortical brain activity and emotion the primitive, survival-oriented response which tapped “lower”, autonomic structures (Leeper, 1970). A more balanced, synthetic, and likely more informed view is that cognitive *and* emotional functions benefit from “higher-order” structures (Lazarus, 1991; Leeper, 1970) – this newer perspective marries with an integrated view of cognition and emotion, with the tenets of appraisal theory (e.g., Roseman & Smith, 2001; Scherer, 2001) and with the recent proposal that there are “epistemological” or knowledge emotions like interest (Keltner & Shiota, 2003) that are disposed to tackle situations that are more information-rich and low-threat than situations eliciting the traditional emotions people are more used to, such as fear and anger.

Intriguing empirical neuroscientific research appears to validate the insights of the above researchers. Gray, Braver, and Raichle (2002) used multiple resonance imaging (MRI) to measure the neural activity of people watching videotaped films chosen to induce various

emotional states and then performing memory tasks. The researchers were looking for “crossover effects”, and found that activity predicted task performance in an Emotion x Stimulus interaction with no main effects: “This highly specific result indicates that emotion and higher cognition can be truly integrated, i.e., at some point of processing, functional specialization is lost, and emotion and cognition conjointly and equally contribute to the control of thought and behavior” (p. 4115). In their research, Gray et al. focused their use of MRI on the lateral prefrontal cortex. In summary, these empirical data strongly suggest the cognition and emotion systems are inseparable at some point and strongly cooperate at higher levels of brain function.

Interest as newcomer: An information-intensive emotion

The establishment of cognitive-emotional integration in the lateral prefrontal cortex (Gray et al., 2002), in a sense, paves the way for a recent proposal by Keltner and Shiota (2003) that there is a family of “epistemology-based emotions” (p. 89) defined by a person’s understanding or state of knowledge regarding the environment. No longer should the processing of complex information, even semantic or “academic” knowledge, be regarded as a cold, emotionless affair, nor should emotion be automatically limited to primitive, animalistic survival responses absent from higher levels of brain function, if weight is to be given to the contributions of Gray et al. and Keltner and Shiota. Family members recommended by Keltner and Shiota include amusement, awe, concentration, confusion, and interest as “information-intensive” emotions. Part of the reason why such emotions were so often excluded from most taxonomies of emotions may be that other, much more well-known and well-researched emotions have been found to disrupt attention, such as happiness and sadness (e.g., Gray, 2001), or to constrict information flow (e.g., Ohman, 2002), perhaps in an attempt to block out extraneous data (Grossman, 1996), such as fear. Therefore, an inappropriate, unfounded, and misleading line may

have been drawn between certain low-threat, less demanding, information-rich activities such as reading and studying and the occurrence of emotional experiences.

Keltner and Shiota (2003) based their proposal in part on a study by Rozin and Cohen (2003), whose findings included the initial validation of newly identified facial expressions (e.g., specialized eyebrow movements) as emotion “tags” associated with non-standard emotional states – including interest – often left off of traditional taxonomies of emotions. Rozin and Cohen’s findings and Keltner and Shiota’s conclusions are consistent with previous research on physiological correlates of interest (e.g., Reeve, 1993) and other investigations of interest as an emotion (e.g., Evans & Day, 1971; Langsdorf et al., 1983; Silvia, 2005c). Together, the above theoretical approaches, corroborated by significant research, suggest there is little reason to accept the idea (Ortony et al., 1988) that completely non-valenced interest can occur.

Even the major proponents of non-valenced interest have had a hard time articulating this position: “Since such states [e.g., interest or surprise] can be valenced, they can be affective, but since they are not necessarily valenced...they are not emotions” (Ortony et al., 1988, p. 32). The concept of non-valenced interest based on this literature review and the above quotation starts to look less like a valid assertion and more like an absolutist view of an idealized state that diverges from an accurate account of lived behavior. How many occurrences of interest that are valenced – and therefore affective – need to occur in a person before the definition of interest as a non-emotional cognitive state begins to fall apart? Ortony et al.’s aversion to defining interest as an emotion may have stemmed, in the end, from an unwillingness or inability to fit epistemology-based emotions into their theory. The current research record indicates that a denial of epistemology-based emotions, particularly when it is based on an outdated and unvalidated separation of cognition and emotion, is unwarranted.

The challenge from EVT: Interest as the weaker partner

An interesting challenge, not to the idea of cognitive antecedents of emotion, nor of interest as an emotion, but to the interest-learning connection comes from recent educational research. Wigfield and Eccles (e.g., 2000, 2002) have been key researchers of expectancy-value theory (EVT). Briefly, EVT suggests a student's motivation to perform academic tasks depends on his expectations of success and the value placed on succeeding. The emphasis in EVT is directed away from appraisals of the content itself and direct emotional experience, and toward a more generalized motivational construct influenced by affective reactions. EVT also implies interest is the weaker partner in its connection with competence beliefs.

Basing their assumptions on two previous studies (Eccles, Wigfield, Harold, & Blumenfeld, 1993; Wigfield, et al., 1997), Wigfield and Eccles (2002) argue that "competence beliefs appear to take some causal precedence" (p. 105) over interest, when interest is considered a component of students' valuing of academic tasks. The implication is that resources devoted to enhancing students' beliefs that they can perform academic tasks provide a better payoff than resources spent on enhancing students' interest in content. But Wigfield's and Eccles' argument raises several difficulties.

First, these authors have not established clear boundaries in their research for generalized and domain-specific competence beliefs, e.g., whether these two types of beliefs can really be separated. In other words, when a student reports low competence in math or reading, is he reflecting only his impressions of competence in the one domain or a sense of overall competence in academic tasks? Research reveals differential competence beliefs across domains (Bandura, 1997; Eccles et al., 1993), suggesting domain-specific competence beliefs are a valid and useful construct. But the possibility that another phenomenon is behind this differentiation

hasn't been properly ruled out, e.g., exposure, levels of interest, social goals, other affective experiences.

For instance, Wigfield and Eccles wrote that “as children accumulate more experience in a domain, perhaps they also develop a general sense of competence (or incompetence) in that domain” (2002, p. 112). According to other empirical research by Silvia (2004), people’s desires to learn more about a task or topic are enhanced by positive, momentary feelings of interest and follow-on attributions that the task or topic itself was responsible for these feelings (note: this study is part of the empirical base for Silvia’s theory on the development of enduring interests). Is the more educationally relevant factor high ratings of competence beliefs, then, or is it actually varieties of domain experience characterized by positive attributions? Which factor is more likely to spur a desire for continued engagement with the material? When such research is considered, ratings of competence beliefs appear to more closely resemble markers of comfort-level with a task or topic rather than direct causes of valuing of or engagement with academic content. Wigfield and Eccles (2002) have also admitted that research is lacking on how generalized competence beliefs develop in the first place, indicating more work needs to be done if competence beliefs are to be incorporated into curriculum and instruction in practical, meaningful ways.

There is another reason to qualify the role of high ratings of competence beliefs in academic performance. When an unqualified increase in competence beliefs is framed as an educational goal, these beliefs are being treated as linearly related to desirable academic outcomes – an increase in students’ competence beliefs will lead directly to higher performance. Yet significant research belies this assumption of linearity, indicating that the goal of keeping tasks and topics reasonably challenging (and interesting) may be more productive. Many authors

have contributed to the body of work on *optimal challenge* (e.g., Csikszentmihalyi, 1975; Danner & Lonky, 1981; Harter, 1978), a motivational construct which assumes that intrinsic motivation is facilitated by tasks just above one's current level of ability (Grolnick, Gurland, Jacob, & Decourcey, 2002).

Findings in support of optimal challenge's effects on intrinsic motivation have been explained by proponents of self-determination theory (SDT; e.g., Deci & Ryan, 1985; Ryan & Deci, 2000) as resulting from the ability of optimal challenges to enhance positive feelings of competence *and* autonomy. Specifically, Ryan and Deci have emphasized that feelings of competence are insufficient to enhance intrinsic motivation "unless they are accompanied by a sense of autonomy, or in attributional terms, by an internal perceived locus of causality" (2000, p. 58). Other research in this area has stressed the quadratic effects of competence on task engagement (e.g., Csikszentmihalyi, 1975; Harter, 1978) – too much competence leads to task aversion, and lack of optimal challenge fails to engage intrinsic motivation (Grolnick et al., 2002).

Since intrinsic motivation has been found to strongly correlate with higher academic achievement, lower school-related anxiety, and higher perceptions of competence (Gottfried, 1985, 1990), attempting to increase intrinsic motivation for academic tasks is a worthy educational goal. But these findings and conclusions from the optimal challenge and self-determination literature suggest that high competence beliefs alone are not enough to enhance intrinsic motivation and its follow-on achievement-related behaviors, nor are they enough to necessarily contribute fully to the EVT equation if they are too high to be motivating. In spite of Wigfield's and Eccles' (2002) claim that there is a stronger causal link from competence beliefs to valuing than the reverse, interest – whether conceived as a component of valuing or in its own

right – no longer seems the weaker partner in light of competing research. Instead, interest becomes a potential tool for managing levels of competence beliefs to promote, rather than deter, continued task or topic engagement.

Research by Silvia (2003) on interest and self-efficacy, a construct closely linked to competence beliefs, explores the above relationship further. Silvia found that the uncertainty of a task's outcome produced by moderate self-efficacy enhanced interest, while very low and very high self-efficacy reduced interest – in other words, there is a zone of “optimal incompetence” (p. 237). There is a striking resemblance between these findings and Silvia's research (e.g., 2005c) on interest-based appraisals of novelty-complexity and coping potential. While he has recommended treating these two appraisals as independent (Silvia, 2006), it is still possible to acknowledge the theoretical connections among uncertainty as a function of self-efficacy, optimal challenge in the SDT literature, and interest-based appraisals. It appears that objects or events that promote personal engagement must be perceived as neither too easy nor too difficult to comprehend and pursue – this finding runs across empirical research into all three areas of theory. This finding is also highly consistent with an adaptive, functional view of interest as well as basic SDT. Within these two branches of the literature, functional emotion theory and SDT, an organism's well-being is enhanced by an inborn intrinsic motivation to explore aspects of its environment that are *unknown but knowable*.

In this context, the competence beliefs which EVT emphasizes as crucial to motivation and achievement may at the same time reflect interest-based appraisals of comprehensibility, or coping potential. So, rather than highlight expectancy of success in an educational model, it may be that the components of EVT fold quite neatly into Silvia's (2006) appraisal model of interest, returning scholarly attention onto how to enhance student interest rather than trying to directly

enhance competence beliefs apart from content or other considerations. It is one of the overall contentions of this literature review that the boiling point of educational intervention is the intersection of person and object, observer and observed, student and content, and that the focus on learning apart from content is a misguided trip to a research cul-de-sac.

And it is the point of this dissertation that while isolated internal qualities of the learner are important, it is also important to test hypotheses that can be readily and practically applied to curriculum and instruction. While theories such as EVT have value, they have limitations, such as the aversive effects of too much competence and the limited contributions of EVT to curricular reform. An appraisal model of interest seems to have more to offer by incorporating not only EVT's emphasis on the importance of valuing information and perceived ability to cope with it, but also by highlighting the attractiveness of novel or complex information that creates uncertainty and offsets an aversive excess of competence, and by offering empirical means for testing changes in content that can be practically applied to curriculum and instruction.

There are many continuities between Silvia's appraisal model of interest and other theories and research programs offering possibilities for synthesizing the literature. Above all what these diverse areas of research have in common with the model is a deep appreciation of the unique genetic contributions to human development which create both important shared universals that are species-wide and individual differences that also strongly influence perceptions and behavior. The personality and powers of the human learner are both hard-wired *and* flexible, as opposed to the assumptions of the SSSM.

The obsolete SSSM, which still influences many areas of psychology including educational psychology, has characterized the human in *tabula rasa* terms as far more malleable, even somewhat empty except for what culture and experience have inserted (see Tooby &

Cosmides, 1992 for a telling critique of the SSSM). This view sees the learner as a vessel to be filled, whereas this dissertation, its supporting theoretical model, and its complementary literature suggests the optimal educational model works with the deeply ingrained universality and diversity of the learner and seeks to extend his natural powers.

Three additional lines of research: Functionalist, SDT, and BPS perspectives

Before this literature review is complete, and it is possible to conclude by demonstrating how the review leads directly to the researcher's research question and hypotheses, there are three complementary strains in the literature that need a little more elaboration. First are the collective contributions of the evolutionary and functionalist literature. While there are significant reasons to be cautious about *all* of the claims coming from this branch (Eccles & Robinson, 1983; Robinson, 2008), these researchers have offered tremendous insight into the nature of the learner. Research in support of posited evolved psychological mechanisms (Cosmides & Tooby, 1992; Geary, 1995; Kaplan, 1992; Pinker, 2002; Zull, 2002) continues to accumulate (Bailey & Geary, 2008), and is powerful enough to suggest a major revision of the curriculum (Kaminsky & Forbes, 2009). In this view, education must be designed to tap what is already present in the learner – attempts to transmit a complete body of fixed information to the learner in ignorance of these mechanisms will fail because they address neither what the learner is already driven to learn nor how he is designed to learn it (Dewey, 1913; Kaminsky & Forbes, 2009; Pinker, 2002).

Silvia's model works well within these evolutionary and functional programs. His adaptive view of interest is present in all his writings and research (e.g., 2001, 2006, 2008b). Within his model, too little coping potential to understand a stimulus and too much familiarity with it are both aversive because a continued expenditure of investigative resources would be

wasteful. Similarly, his work on self-efficacy (2003) indicates a complementary view – only moderate self-efficacy is linked to interest, whereas too little or too much self-efficacy promotes task closure and searches for new stimuli, suggesting an inborn structure to conserve investigative resources.

Second are the contributions of SDT and related research. The heart of SDT is the influence of the innate organismic needs of autonomy, competence, and relatedness on motivational behavior (e.g., Deci & Ryan, 1985; Ryan & Deci, 2000). The application of SDT's main ideas leads effortlessly to a learner-centered educational orientation – it can't be helped. Consequently, SDT sees the primary thermometer of meaningful learning as residing within the learner, not in the material or in a fixed body of standardized content.

Understanding – and building content based on – the underlying psychological structure of student interest is perfectly consistent with an SDT perspective. Curriculum and instructional design that run contrary to the three needs become aversive. Knowledge that consistently strikes students as imposed from above, unrelated to their internally-driven reward structure, and sharply divergent from what is personally interesting and meaningful to the student becomes distasteful, or at a minimum unworthy of deep processing (Dewey, 1913), especially when it thwarts one's sense of autonomy (Ryan & Deci, 2000).

Also, the SDT approach to autonomy and competence is developmental, e.g., supportive of organismic growth (Allport, 1955). Satisfaction of these needs seems contingent on the conquering of intriguing new challenges just beyond one's abilities, giving rise to the optimal challenge branch of SDT literature. The resulting engagement with the stimulus providing the challenge is strong enough establish a sense of identification in which the boundaries between person and object begin to blur and deep processing ensues; the suggestion here is that SDT,

intrinsic motivation, and meaningful engagement with an object of study are heavily linked (Csikszentmihalyi, 1975; Dewey, 1913).

This aspect of SDT, which converges strongly with the driving assumption of Silvia's (2006) model that we seek to understand what is unknown but knowable and derive significant internal, emotional rewards from the process, finds several close cousins in related literature, including Vygotsky's zone of proximal development (Vygotsky, 1978), Csikszentmihalyi's concept of flow (1975), and Silvia's "optimal incompetence" (2003). Together, these perspectives back up the researcher's claim that Silvia's appraisal model of interest properly identifies interest as an emotion that is strongly supportive of meaningful learning and organismic growth.

The third strain of supportive literature benefits from and extends the first two. The innate structure of the learner and his motivation to satisfy organismic needs operate simultaneously in three contexts – biological, psychological, and social. Lazarus' (1991) treatment of these three components of human life in terms of classes of appraisal antecedents has been thoroughly reviewed in this chapter. But these components are far more meaningful in psychology than just describing classes of antecedents. A bio-psycho-social perspective in which these components are theorized to co-exist and continually interact has been a rich tradition on the literature (Forbes et al., 2006) as one method of ensuring one's analysis spans the important spheres of human life and behavioral processes. For example, in an extensive mixed-design study employing multiple quantitative and qualitative techniques of data collection and analysis Morris (1956) employed this perspective to reveal underlying factors related to the causes and development of human values. Within his study of the psychological factors, he used several measures including Allport's and Vernon's (1931) *Study of Values*.

A bio-psycho-social approach imbues the work of several prominent psychologists, such as Allport (e.g., 1937, 1955) and Bruner (e.g., 1983, 1996). One of Allport's most significant contributions to the approach was his emphasis on the importance of individual differences in psychological constructs – for him, biological universals and shared cultural experiences were important but never obscured the role of individual psychology's contributions to attitudes and behavior. When Lazarus (1991) asserted the role of personality and individual values in moderating the appraisal inputs people pick up from biological and social factors, he reflected a view very close to Allport's position on the impact of personality as a crucial evaluative lens, contrary to the views of other scholars that behavior is largely dictated by environment and histories of reinforcement (e.g., Skinner, 1957), impersonal drives (e.g., Hull, 1952), or strong situations (e.g., Zimbardo, Maslach, & Haney, 2000). The significance of individual psychological influences has received a lot of support from subsequent research. Of course, much research continues to rely on assessments of differentiated psychological constructs, but Seligman's (1975) work on *learned optimism* and other examples of research on mental causality (e.g., Beauregard & O'Leary, 2007; see Robinson, 2008; Schwartz & Begley, 2002 for reviews) strongly suggest that theories which disregard individual psychology in favor of environmental causes fail to provide a complete behavioral account.

Bruner's emphasis in psychology was on the role of cultural meanings and how they become the building blocks of thought, but his theories perfectly complemented Allport's on individual psychology (they were long-time colleagues at Harvard together; see Bruner, 1983). For Bruner, human expression, communication, and psychological growth stem from each person's interactions with culture to such an extent that culture becomes a necessary cause of

thinking and helps create the mental vocabulary which we rely on to learn new information (1983) – it can also reinforce or inhibit learning of academic content (1996).

Both of these psychologists, like Lazarus (1991), accepted the role biological universals have in mediating behavior, but each respectively emphasized the power of individual psychology (e.g., Allport, 1937) and cultural meanings (e.g., Bruner, 1983) to moderate the promptings of these universals. To avoid an impoverished account of appraisal theory and the emotion of interest, the researcher has chosen to follow these scholars and adopt an interactive bio-psycho-social perspective to inform his theoretical extension of Silvia's (2006) model and dissertation research design. Like Lazarus (1991), the researcher seeks to "provide enough room to accommodate the obvious biological, social, and individual contributions to the emotion process" (p. 190), to the experiencing of interest, and to behavioral outcomes relevant to academic learning. The era of viewing the learner as an empty mind that is not profoundly affected by his genetic inheritance, individual psychology, and social context is over.

Conclusion: Developing a Good Research Question and Testable Hypotheses

A review of the literature indicates that an appraisal approach can inform us about many aspects of interest's effects on learning and other educational goals. Certainly, the present study cannot cover such a wide swath of territory. However, in the area of the appraisal of coping potential and its possible biological, psychological, and social antecedents, hypotheses may be developed that are at once subject to verification, educationally relevant, and are of an appropriate scope for a dissertation. Such hypotheses should also lead to a study whose results might be immediately and practically applied to curriculum design and classroom instruction – pending further validation. A possible research question to consider is: Can biological, psychological, and social antecedents influence appraisals of coping potential when students are

confronted with new or complex content, such that the emotion of interest is able to be manipulated on the basis of these antecedents in a direction supportive of academic learning?

Final theoretical concerns: Appraisal antecedents, control variables, method choice

Three additional concerns need clarification before the appropriateness of this question can be ascertained and testable hypotheses formed to address it. First, how can the three classes of antecedents be operationalized in a manner consistent with previous theory and research, and at the same time be made applicable to students' appraisals of their ability to cope with academic content? Second, can the occurrence of interest be sufficiently isolated to control for the influence of potential confounds? Third, appraisal models of interest have been previously tested with both retrospective and experimental techniques, and with visual and text materials – which methods are best suited to the present study?

Biological antecedents in the literature

Regarding the first concern, Lazarus (1991) has made a convincing case, reiterated by many others, for biological universals in the elicitation of various emotions through the appraisal process, and on a fairly complex level: “Phylogenetically more advanced species, such as humans, are in a position to make deliberate, complex, abstract, and symbolic evaluations” (p. 191). What is intended by this argument is not just a claim for universality in the experiencing of anger, fear, and other emotions, but for a biologically inherited set of universal human mechanisms designed to seek out certain environmental stimuli as a basis for making evaluative judgments – including cognitive appraisals. Many researchers have established research programs to uncover these mechanisms (e.g., Boulton & Smith, 1992; Buss et al., 1990). Pinker (2002) argues, for example, on the basis of a large body of research that among several “core” human biologically-based

intuitions is a sense of what constitutes a fair exchange of goods and an intuitive grasp of math calculations involving small numbers.

These ideas, if they are indeed basic to humans' phylogenetic inheritance and universally experienced, can inform curriculum design and instruction on several academic subjects, including math, science, history, and literature. They can also explain why, for instance, statistics is such a challenging subject for most students in higher education (Pinker, 2002) – statistical methods extend human powers in math beyond our intuitive grasp of simple calculations, and can be very frustrating to students during the learning process. Additional research supports Pinker's argument for the role of inherited core intuitions in human mental processes, such as Cosmides' and Tooby's (1992) review of studies on phylogenetic "problem-solving machinery" (p. 193) such as conceptual knowledge of the rules of basic social contracts and ability to detect "cheaters" (p. 220). Some examples of these universal human mechanisms have been used in the treated portion of the present study's experimental text.

Psychological antecedents in the literature

A similar reading of the literature can inform curricular reform to respond to the call for psychological and social antecedents. Lazarus (1991, 1999) and others (e.g., Arnold, 1960; Roseman & Smith, 2001; Smith & Kirby, 2001) have emphasized that appraisals include an evaluative process which is partly driven by the individual psychological makeup of a person, that essentially psychological aspects such as personality moderate the "genetic-biological contribution to universals in the emotion process" (Lazarus, 1991, p. 191). Lazarus carves out a clear role for such ontogeny (e.g., beliefs, attitudes, personality traits; see Lazarus, Averill, & Opton, 1970, p. 219) in the elicitation of emotions: "Similarly, ontogenetically more advanced or

developmentally older individuals will depend on more complex modes of meaning generation” (p. 191).

Other research supports this idea that individual differences in personality moderate appraisals (e.g., Silvia, 2008a; Smith & Pope, 1992). In a study by Griner and Smith (2000), affiliative orientation was validated as a “dispositional antecedent” (p. 727) of appraisals. In particular, according to Lazarus (1991, 1999; Lazarus, Averill, & Opton, 1970), value and goal hierarchies figure into this personality-based moderation of emotional responses. What is needed, then, is an appropriate assessment tool by which to measure such constructs.

Allport and Vernon’s (1931) venerable *Study of Values*, a personality measure ably revised for the new century and demonstrating continued strong psychometric properties (Kopelman, Rovenpor, & Guan, 2003; Kopelman, Prottas, & Tatum 2004), offers such a means of empirically testing for people’s hierarchy of values. Its results could be easily translated into adjustments of the curriculum. For example, in studying the life of George Washington, students scoring high on the political value would be more inclined to learn about his role in key battles and leadership challenges, whereas those high on the social value would more likely engage with stories about his concern for the welfare of his soldiers and other people. Since there are six values in the theoretical formulation that gave rise to Allport’s and Vernon’s instrument, images or ideas associated with all six are included in the treated portion of the experimental text.

The Study of Values can also be used as a posttest measure of personality in follow-up studies. For example, the topic addressed in the experimental and control texts is expected to elicit interest differentially in the participants regardless of the treatment, according to their values hierarchies. Specifically, people high in the theoretical, political, and religious values would be expected to have higher interest in the article on free will versus determinism than

those high in the economic, social, and aesthetic values, even though all six values are tapped by the inclusion of certain images and ideas.

Social antecedents in the literature

Social antecedents, generally associated with culture, are thoroughly addressed by Lazarus in his appraisal theory. He and colleagues (Lazarus, Averill, & Opton, 1970) had written that culture influences the emotion process in several significant ways, and that “one way...is through the perception or *appraisal of emotional stimuli*” (p. 215). He later argued (1991) for two categories of social influences on the appraisal process: *culture*, which provides a “set of internalized meanings that people carry with them into transactions with the social and physical environment”; and *social structure*, which offers a “set of immediate demands, constraints, and resources” (p. 355). Lazarus is drawing on the work of Schneider (1976) here, who wrote that “culture constitutes a body of definitions, premises, statements, postulates, presumptions, propositions, and perceptions... Where (social) norms tell the actor how to play the scene, culture tells the actor how the scene is set and what it all means” (pp. 202-203). Both authors are emphasizing the roles of culture and social rules in providing contexts which influence people’s evaluations of the environment – hence their appraising of the environment.

More words of Lazarus’ spell out the connection between the mediating role of biological antecedents and moderating role of social antecedents: “Culture influences the meaning, hence appraisal itself. The biological rules always operate, but the substance of relationships on which the meaning of the encounter depends is often defined culturally” (1991, pp. 359-360). Or to put it another way, “phylogenesis may provide the ingredients for the emotional pie, but culture determines how the pie is cut” (Lazarus, Averill, & Opton, 1970, p. 216). Recent research has upheld the assignment of a mediational role to social antecedents of appraisals. In a study by

Roseman and colleagues (1995), college students from India reported significantly different appraisals and emotional states in response to emotional stimuli than US students in directions consistent with previous theory and research, indicating these results were based on cultural distinctions. Additional research has accumulated in support of the role of culture as a supplier of meanings which, as social antecedents, can alter emotion-eliciting appraisals (e.g., Ekman & Davidson, 1994; Manstead & Fischer, 2001; Mesquita & Ellsworth, 2001; Mesquita & Frijda, 1992).

But some caution is required here. It should be recognized that if too strong a role in the appraisals of emotional stimuli is ascribed to culture, than appraisal theories would be poorly equipped to address the “biological principle” (Smith & Lazarus, 1990) which emphasizes the vital importance of universally inherited phylogenesis in appraisal-emotion connections. In fact, Lazarus (1999) warned about the tendency of “culturists” (p. 68) to over-emphasize culture to the point at which it appears as if the sum of all the attributes of and variance in emotional experience is a function of culture. Other researchers have shared this concern about the extreme downplaying of biological universals in favor of culture (e.g., Cosmides & Tooby, 1992).

Modern appraisal theory has given much attention to this issue. According to Roseman and Smith (2001), contemporary appraisal theorists all agree on the importance of biological universals in emotional experiences, as expressed by Lazarus (1991, 1999; Smith & Lazarus, 1990) and others. At the same time, they generally uphold the ability of shared cultural meanings to add to the variance in appraisal making. Citing earlier research by the senior author (Roseman et al., 1995), Roseman and Smith (2001) argue that appraisal theory supports a moderating role for culturally based social antecedents, and can be an effective tool for measuring such variances: “Because cultures can vary widely in belief systems, as well as in the meanings that

individuals ascribe to various events, it is to be expected that people from different cultures will systematically appraise seemingly similar events quite differently” (p. 18).

A useful example of recent educational research illustrative of the influence of social antecedents on interest-based appraisals is a recent study by Mortimer and Wertsch (2003), which suggested that success in classroom learning can depend on how cultural symbols play out in the learning environment. In the observed classrooms, the Brazilian eighth-grade science students displayed a clear facility in expressing culturally relevant ideas and images, and to the degree that the teacher failed to appreciate the power of these images and incorporate it into his teaching, he was unable to help the students identify with the basic concepts of the lesson. In fact, the teacher displayed a preference for literal, technical language and examples consistent with his scientific discipline, but at odds with the students’ self-proclaimed “language of the street”:

(Student #1) Here, just between you and me, here below (Student #1 lowers his voice to avoid being recorded by the camera), I think that glass is a solid [as opposed to a liquid]. If I’m in the street, there’s no way I would use particles to define [glass].

(Student #2) Neither would I.

(Student #3) Solid outside, in the laboratory I use “particles”. (p. 241)

The study makes a case for the idea that student engagement and interest in educational concepts are promoted by what is personally meaningful to the student, and what is personally meaningful is, in part, informed by the culture of the student (Bruner, 1990, 1996). Direct challenges to culturally relevant ideas, especially when students are expected to put aside or contradict everyday experience (Mortimer & Wertsch, 2003, pp. 241-242), prompted the students to devalue the concept they were being taught, which led to resistance as opposed to

engagement. A contrasting and potentially more useful approach in this case would be to simply melt the glass, and allow students to integrate their concrete observations of the event with their everyday experience as opposed to fighting this experience with scientific language alone, which would tend to whet student disengagement. The overall implication of the study is that, in line with Bruner's (1990, 1996) emphasis on the role of culture in learning, educators have an obligation to inform curriculum and instruction with social and cultural meanings to enhance student engagement, interest, and learning.

In summary, the literature here has suggested that social antecedents are an important, but not final, influence on appraisals that interact with potentially very strong biological universals and are also filtered by one's individual psychological structure (Lazarus, 1991, 1999; Lazarus, Averill, & Opton, 1970; Roseman & Smith, 2001). Cultural information derived from the above research will be used in the treated portion of the experimental text to serve as social antecedents designed to enhance interest – and consequently – learning.

The need to eliminate alternative explanations: Three control variables

Now that a way has been found to operationalize the three classes of appraisal antecedents, potential confounds must be addressed to be certain that these do not prevent us from isolating the effects of these antecedents on interest and on learning. A few confounds have been identified in the literature, that depending on the study design, could be mistaken for interest. Some have argued (e.g., Schiefele, 1992) that people reporting higher interest could be simply reflecting more *prior knowledge* of the target topic than those reporting lower interest. But Schiefele's work on interest has been from a cognitive, information-processing perspective which is essentially unrelated to appraisal theory or models of interest derived from emotion research.

Silvia's (2006) appraisal model incorporates prior knowledge as conducive to interest (provided there isn't a perception of too much redundancy) by contributing both to appraisals of coping potential (which includes an assessment of personal resources such as prior knowledge; see also Lazarus, 1991) and of novelty-complexity. Research has established experts' likelihood to recognize "subtle differences and contrasting perspectives that aren't apparent to novices" (Silvia, 2008b, p. 59) and to rate complex objects as more interesting (see Silvia, 2006, chap. 2 for a review of research), which feeds appraisals of novelty-complexity. Since prior knowledge is fundamental to Silvia's conception of interest and his appraisal model, there is no longer a reason to control for it – "In a sense, interest is self-propelling: it motivates people to learn, thereby giving them the knowledge needed to be interested" (Silvia, 2008b, p. 59).

Research (Mayer & Gaschke, 1988; Watson, 2000) has demonstrated that the experience of interest is associated with feelings of positive affect, so unsurprisingly it has been blurred in meaning and associated with or held as synonymous to happiness, enjoyment, and perceptions of pleasantness in popular usage (Silvia, 2006) and sometimes in research (e.g., Chen, 2001; Smith & Ellsworth, 1985). There is a need to separate interest from other kinds of "feeling good" or just feeling good in general if the present study is to be able to substantiate the researcher's claims of actually measuring interest. But a long research record (see Silvia, 2006, chap. 1 for a review) has helped here, clearly distinguishing interest from these other positive affect states in their antecedents, expressions, and functions (e.g., Day, 1967; Reeve, 1989). So selecting appraisals for the study that are empirically associated with interest should eliminate confusion between interest and these confounds.

Of particular note regarding curriculum and instruction are the related findings that "interesting things needn't be pleasant" (Turner & Silvia, 2006, p. 670), and that enjoyment

diverges from interest in its dependence on appraisals of familiarity (Silvia, 2008b), while interest is instead driven by the new, the complex, and the uncertain (Iran-Nejad, 1987). Above all, regarding educational goals, interest's functional value directly contributes to learning by pushing people to engage with novel stimuli and increase their skills, while enjoyment, which promotes attachment to familiar objects and rewards goal attainment (Silvia, 2006; Tomkins, 1962) would seem to be supportive of educational goals but only indirectly related to learning.

In related studies, researchers have also introduced and attempted to control for the effects of three individual-difference personality constructs – openness to experience, positive affect, and trait curiosity. Of the three constructs, only trait curiosity has been shown to complicate the measurement of interest (Litman & Silvia, 2006; Silvia, 2005a, 2005c, 2008b). While openness to experience (McCrae, 1996) and positive affect (Watson, 2000) are theoretically related to interest (Silvia, 2005c), two experiments (Silvia, 2005c, Experiments 1 and 3) demonstrated that these constructs didn't affect the ability of appraisals of novelty-complexity and coping potential to predict interest.

Regarding trait curiosity, one study (Silvia, 2005a) found that people high in the trait, on average, reported higher interest in complex visual art ($p < .007$). However, the within-person effects of appraisals on interest were not affected by trait curiosity scores. Furthermore, another study (Silvia, 2008a) indicated a likely explanation for the between-person effects of trait curiosity on interest – the effects of trait curiosity were fully mediated in this study by appraisals of coping potential. This suggests trait curiosity has an appraisal basis similar to interest, and that curious people tend to be more interested in things on average because they tend to have higher appraisals of their ability to cope with new information (Silvia, 2008a). The more recent study also found, similar to the earlier one, that at the within-person level the two interest appraisals

but not trait curiosity strongly predicted interest. Taken together, this research supports the following conclusion, that “in short, the appraisals predicted interest regardless of one’s level of trait curiosity” (Silvia, 2008a, p. 110). For the purposes of the present study, which includes a measure of trait curiosity, the researcher expects to find that curious people display higher interest, but that at the within-person level, effects of trait curiosity will not affect the ability of appraisals to predict interest, nullifying trait curiosity as a potential confound.

One final individual difference has been associated with confounds to interest but in terms of its effects on learning – short-term memory (Schiefele, 1992). It has been suggested that when interest’s effects on learning are being assessed with text materials and measures of text comprehension, short-term memory could confound performance on the achievement measure, which would not affect findings on interest but might weaken attributions of higher comprehension to interests’ effects. Thus far, a reliable measure of short-term memory capacity which can be practically included in the present study hasn’t yet been found, implying a limitation in the study design. As a partial measure of control, the achievement test to be employed will rely on items that require deeper-level processing. Thus, it is intended that individual differences in short-term memory capacity will not be a significant player compared to a study design employing text comprehension items only requiring surface-level comprehension.

Two ability-related individual differences related, not to interest this time, but to evidence of learning, will also be included as control variables – learning-style preference, and verbal ability. These variables have been included to attempt to control for students whose natural preferences and abilities might lead them to higher achievement scores regardless of interest or appraisal levels. Previous research (e.g., Schiefele, 1992) has included verbal ability as a control

measure when attempting to ascertain interest's effects on text comprehension. The researcher has added modal learning style preference (auditory, kinesthetic, visual) to try to further minimize effects related to learning preferences and their relationship to previous academic experiences and successes.

Choice of methods to address appraisals of interest: Retrospective v. experimental, text

Appraisal models of interest have been tested empirically through one of two methods – retrospective self-reports (e.g., Smith and Ellsworth, 1985) and *in vivo* experimental manipulations (e.g., Silvia, 2005c). Turner and Silvia (2006) have addressed several handicaps created by the use of retrospective methods for such a study, including the inability of people to accurately remember past emotional states and appraisals, the difficulty in remembering the experience of interest versus higher-intensity emotions such as anger, and the lack of suitability of retrospective methods for investigating a single emotion versus a range of emotional states. Finally, since the present study seeks to uncover methods for manipulating academic content to affect appraisals and emotional states, an *in vivo* design would be greatly preferable to asking students to recall memories of previous academic experiences.

Another question central to research design is the medium chosen for transmitting academic content. The present study relies on text for its experimental and control versions of academic content. Lecture or discussion-oriented oral presentations and visual content such as slides or video are all valid media in an educational context. However, problems can crop up with such media in an experimental setting. Oral presentations, which would more closely approximate many traditional instructional forms, cannot be offered in experimental and control versions simultaneously in the same room. Therefore, these versions would need to be replicated in every detail with the exception of some sentences from the first portion of text, and presented

in different rooms or at different times. Other variables would be to be strictly controlled, such as speaker volume, inflection, and body language. It is unlikely this level of control could be achieved over both versions.

Videos of such oral presentations could be edited and reshot until they come close to such parity, but then the study would be reverting to a medium rarely used in the classroom – videos of teachers lecturing. Slides, with or without voice-overs, or instructional films are also rarely the entire instructional method for most learning experiences. Also, these approaches could not be used in the same room or at the same time, and differences in the settings could be hard to mitigate. It is worth noting the above methods may be a little more common today in some distance learning programs, but the present study is not designed to investigate the experiencing of interest exclusively in this type of setting. When all these media are considered along with educational text, text seemed the best choice.

Experimental and control versions of text can be easily managed, and identical portions of each text – an important aspect of the present study design – will precisely match each other. These versions can also be administered simultaneously in the same room with little to no concern of contaminating the design, provided the administrators of the measures don't influence treatment or control subjects differentially. Finally, there is an extensive, well-established body of research investigating text-based interest (e.g., Hidi, 2001; Sadoski & Paivio, 2001; Schiefele, 1991, 1992, 1999; Schraw & Lehman, 2001; Wade, 1992, 2001). Collectively, this research strongly supports the idea that interest facilitates people's selections, processing, and memories of what they read (Silvia, 2006), all of which are related to academic skills. It has also been suggested that text-based interest is a function of the same appraisals already identified in previous research when people observed polygons, viewed paintings, or read poems (see Silvia,

2005c; Turner & Silvia, 2006). Silvia (2006), after reviewing the text-based interest research, speculated that the various sources of such interest identified in these studies, such as vividness and coherence (Schraw & Lehman, 2001), all fit neatly under appraisals of novelty-complexity and coping potential – this idea finds some support in the literature (Sadoski, 2001) but awaits further investigation. These factors suggest text is the best-suited medium for the present study.

The Present Study: Research Question and Hypotheses

So to reiterate our research question now that final theoretical concerns, potential confounds, and a crucial method issue have been addressed, can biological, psychological, and social antecedents influence appraisals of coping potential when students are confronted with new or complex content, such that the emotion of interest is able to be manipulated on the basis of these antecedents in a direction supportive of academic learning? By asking the research question stated above, the researcher does not at all intend to suggest that B-P-S antecedents have no impact on appraisals of novelty-complexity or motivational relevance – assuredly they do. However, there are specific reasons for concentrating on coping potential.

The educational process assumes a multitude of experiences with content that is either novel or familiar but introduced at increasingly complex levels over time and across grades. Teachers are responsible for arranging and mixing up classroom content so as to avoid the pitfall of repeating the same statements and lessons *ad nauseam* (and consequently driving their students crazy). This appraisal is also to some degree a function of students' prior knowledge, which is at once completely within the teacher's control (he or she knows what was taught and learned in class last week, last month, etc.) and completely beyond such control (what science teacher could have predicted a student would be an expert on a certain species of tree frog, what teacher should be expected or able to know every book, every lesson, every TV show each

student has been exposed to, etc.?). This range of possibilities is likely to prove difficult to bound and manipulate in an educational research design, and perhaps less meaningful when it comes to practical questions of curriculum design.

Also, it was necessary to limit the scope of the dissertation study. For example, the novelty-complexity appraisal as described by Turner and Silvia (2006) includes the experience of uncertainty and contradiction, which are educationally fruitful and promising as research directions in the context of interest as an emotion, but such pursuits would widen the dissertation study beyond manageable boundaries. So while the novelty-complexity appraisal is important, it is not the primary focus of the experimental manipulation. The present research question leads to the following seven hypotheses:

Hypothesis 1: Subjects exposed to text with a manipulated set of biological, psychological, and social antecedents (treatment text) will report a significantly higher level of the appraisal of coping potential for this text than subjects exposed to the same text but without this set of antecedents (control text), while controlling for trait curiosity.

Hypothesis 2a: Subjects exposed to the treatment text will report a significantly higher level of interest than subjects exposed to the control text, while controlling for trait curiosity.

Hypothesis 3: Subjects exposed to the treatment text will report a significantly higher rate of change in the appraisal of coping potential across time as compared to subjects exposed to the control text, while controlling for trait curiosity.

Hypothesis 4: Subjects exposed to the treatment text will report a significantly higher rate of change in level of interest across time as compared to subjects exposed to the control text, while controlling for trait curiosity.

Hypothesis 5: Subjects exposed to the treatment text will demonstrate a significantly deeper level of learning than subjects exposed to the control text, while controlling for learning style preference and verbal ability.

Hypothesis 6: Goal relevance is a significant predictor of interest.

Chapter Three: Methodology

Introduction

For the present study, the researcher used a quantitative experimental design. Treatment and control participants read slightly different versions of an article on the topic of free will versus determinism. Participants then reported their appraisals of and level of interest in the text at two different times. Finally, participants completed a comprehension test of the identical latter portions of both versions.

While the sample as a whole came from preselected undergraduate classes attending Auburn University, within each class individuals were randomly assigned to the treatment and control groups comprising the study's primary independent variables. Preselection for this sample was based on considerations of access granted by professors of these classes. While convenience sampling was necessary due to the practical needs of access to a sufficient number of subjects, this sample also works well according to the needs of the study. The subjects have attained sufficient psychological and social ontogenetic development and a reasonable potential for some ability in formal mental operations. These choices regarding the sample are linked to the study's target population.

For several reasons, the target population is primarily adolescent, young adult, and adult learners who have, in a Piagetian sense, attained at least a small measure of ability in formal mental operations. The theoretical assumptions supporting the study apply to all human learners.

However, conscious decisions of the researcher as to how these assumptions are operationalized for educational contexts have narrowed the scope of the study. The researcher proposes, based on the work of Lazarus (1991), that biological antecedents would play a more dominant role in influencing cognitive appraisals in the very young, and that over time psychological and social antecedents would increase in their ability to moderate those appraisals as a function of ontogenetic development. This conclusion in no way damages the theory supporting the study – such interplay among the antecedent classes is anticipated. However, the researcher is using all three classes in the treated text with the expectation that the combination will enhance appraisals of coping potential.

Consequently, the manipulation within the present study is best suited for learners who have had consistent exposure to shared cultural forms and symbols, and whose personalities are developed enough to have considerable influence on their appraisals of the environment. The researcher has also chosen academically-oriented text on a somewhat abstract topic as the instructional mode for the study. Therefore, the most appropriate target population is beyond twelve years of age, and which is capable at least of limited formal operational thinking in a Piagetian sense. Such skills are likely to be necessary also for some assurance that responses on the instruments being used, which require self-reports of interest and its appraisals, are accurate.

The benefits of a somewhat homogeneous sample are due to the significant variance in ontogenetic development across participants that could create potential differences in the functions of appraisal antecedents. The ontogenetic nature of the psychological and social antecedents, which is partly based in age and partly in shared cultural symbols, requires some controls on subjects' demographic statistics and cultural environments. The study also uses only one article, in which the treatment text includes a set of culturally-based social “triggers”

intended to contribute to the elicitation of coping potential on a within-subjects level. For the purposes of the present research, it is best to test one “culture” at a time, both from the standpoint of the triggers’ intended combined effect on each subject and the need to avoid testing subjects with widely divergent cultural experiences within one sample.

The study investigates the applicability of Silvia’s (2006) appraisal model of interest to learning in an academic setting. The researcher’s objectives, based on a thorough review of the literature, are to provide further validation of the model, to extend the model, to ascertain its relevance to the functioning of interest in academic content, and to measure its relationship to achievement and learning. Finally, the researcher hopes the findings will suggest immediate practical applications to the classroom in the form of tools for curricular reform in educationally fruitful directions.

The research question driving the present study was formulated to directly respond to these objectives. The study’s seven hypotheses have been specifically chosen to answer the research question by addressing these objectives in a manner subject to verification and consistent with the principles of the scientific method. The researcher also selected these hypotheses so that several quantitative and qualitative lines of inquiry can follow up this initial investigation of the effects of cognitive appraisals on the elicitation of interest in and learning of academic content.

Research question and hypotheses

The following research question generated the hypotheses for this study: can biological, psychological, and social antecedents influence appraisals of coping potential when students are confronted with new or complex content, such that the emotion of interest is able to be

manipulated on the basis of these antecedents in a direction supportive of academic learning?

The following testable hypotheses were developed to respond to the above research question:

Hypothesis 1: Subjects exposed to text with a manipulated set of biological, psychological, and social antecedents (treatment text) will report a significantly higher level of the appraisal of coping potential for this text than subjects exposed to the same text but without this set of antecedents (control text), while controlling for trait curiosity, at Time 2.

Hypothesis 2a: Subjects exposed to the treatment text will report a significantly higher level of interest than subjects exposed to the control text, while controlling for trait curiosity, at Time 2.

Hypothesis 3: Subjects exposed to the treatment text will report a significantly higher rate of change in the appraisal of coping potential across time as compared to subjects exposed to the control text, while controlling for trait curiosity.

Hypothesis 4: Subjects exposed to the treatment text will report a significantly higher rate of change in level of interest across time as compared to subjects exposed to the control text, while controlling for trait curiosity.

Hypothesis 5: Subjects exposed to the treatment text will demonstrate a significantly deeper level of learning than subjects exposed to the control text, while controlling for learning style preference and verbal ability.

Hypothesis 6: Goal relevance is a significant predictor of interest.

Overview of Methodology

A strength of the present study design is random assignment to treatment and control groups. Instruments measured subjects' interest in, and three appraisals of, the featured topic at two separate times – pretest and one-third complete. The independent variable on two levels was the treatment versus control groups, and the experimental manipulation through the use of the treatment text was the primary focus of the study.

This overview also needs to address the researcher's expectations about the use of B-P-S antecedents to manipulate appraisals of novelty-complexity, coping potential, and a third hypothesized appraisal of goal relevance. First, it is anticipated that these classes of antecedents would affect any or all of these appraisals to some extent. The literature supporting the influence of these three classes (e.g., Lazarus, 1991, 1999) does not assign them only to certain emotions, but incorporates them into a general appraisal theory which explains emotional states in general. Coping potential has been specified as the manipulated appraisal in the present study because it is the most relevant to manipulations of academic content already assumed to be new or at a higher level of complexity than previously introduced.

The point here is to investigate the possibility that adding or changing content to heighten coping potential appraisals increases interest because people who are about to become interested are looking for evidence of new information that is still within their resources to comprehend, e.g., to identify with stimuli that are *unknown but knowable*. Choosing to shape new content with contexts in which people feel comfortable and capable – core intuitions, resonant values, or cultural images – is both possible to measure in the research lab and to implement in the classroom. Appraisals of novelty-complexity can be manipulated, but first and foremost

curriculum designers and teachers would manage this appraisal by avoiding tedious and unnecessary repetition, rather than adding content related to students' perceptions of psychologically or socially-oriented emotional stimuli.

Appraisals of goal relevance might also be subject to manipulation, but would require significant investigation of people's differential motivations beyond constructs such as personal values, and would again reach beyond the scope of the study. Goal relevance will be measured, though, at both time periods, to ascertain if it closely matches coping potential or novelty-complexity, or if it corresponds to an increase in interest as an independent appraisal. It is possible that this third appraisal is a different term for one of the other two appraisals, e.g., what is new and complex or comprehensible is the definition of what *is* relevant to one's goals when interest is at stake.

Participants

The participants in the present study were sixty-five undergraduate psychology students enrolled in the Spring semester, 2010. These students came from various sections of the same required core course – Psychology 2020. Sample selection was not random. The choice of which classes to approach for volunteers was based on access to these classes granted by their professor – hence this was a convenience sample that fit the theoretical requirements of the study. However, assignment of the subjects within the sample to treatment and control groups was random.

The study used a larger sample ($N = 65$) than either of the pilot studies described later in this chapter. The sample included 41 females and 24 males, of which 32 received the treatment text and 33 the control. Five additional packets were handed out but not returned. Demographic

data showed a mean age of 20.03, with the following percentages: Caucasian (93.8), African-American (3.1), and Asian-American (3.1). On the basis of chi-square analysis, the sample regarding sex was shown to be quite different than the general Auburn undergraduate population ($\chi^2 = 7.843; p = .005$), but very similar to the College of Liberal Arts population that includes these psychology majors ($\chi^2 = .042; p = .837$). In the school as a whole, men slightly outnumber women (51% to 49%) while in the sample and the College of Liberal Arts men comprise a much lower percentage of the total (37% and 38% respectively). When the sample was compared to Auburn undergraduates and the College of Liberal Arts regarding race, the sample was shown to be divergent in both cases: $\chi^2 = 9.869; p = .020$ and $\chi^2 = 9.558; p = .023$. This is explained by the higher percentage of Caucasians in the sample (93.8%) as compared to the undergraduates and the specific college (83% in both cases).

The researcher followed the guidance of Gall, Gall, and Borg (2003) on sample size. These researchers specified a minimum of fifteen subjects for each predictor variable in a multiple regression. Since the hypothesis with the largest number of predictor variables (Hypothesis 6) includes three such variables, the conclusion is that the sample size ($n > 45$) sufficiently covered the needs of all six hypotheses.

Participants were primarily white and middle-class, and are anticipated to have grown up in the southeast region of the United States. These participants are expected to have only a very limited exposure to the topic of the article used in the study (the scholarly debate over free will v. determinism), but perhaps slightly more exposure than the typical non-psychology undergraduate to the degree that their introductory coursework may touch on issues such as differences in theoretical interpretations of the contributions of person and environment to attitudes and behavior.

A critical issue regarding choice of participants is how they were expected to appraise the target stimulus before and during treatment, and at the same time periods for the control group. Given their background, all participants were still expected to appraise the topic as novel or complex rather than familiar or simple at both time periods. Text will increase in complexity across time periods for both groups in a way that is natural to written text and written academic content, e.g., the first third of the text is more complex than the pretest topic introduction, the final two-thirds of the text are more complex than the first third, and no text is repeated. Both treatment and control groups were expected to continue appraising the article as somewhat novel and/or complex throughout the study.

Participants were also expected to report varying degrees of coping potential on between and within-person levels across time periods, rather than all participants reporting zero coping potential at any of the time periods. These undergraduates, in spite of their common exposure to their coursework, were expected to reflect individual differences such as personality factors that would play out, as anticipated in the study's theoretical framework, in their reported appraisals and interest levels. Coping potential is expected to be higher at Time 2 for the treatment group, and to reflect a higher rate of increase for this group across time periods.

Instruments

Experimental documents for the study include an identical 3-sentence topic introduction administered in at Time 1 (pretest), and treatment and control versions of an academically-oriented short article on the topic of free will versus determinism in which only the first third of the experimental text is altered with B-P-S antecedents. Selected instruments measured levels of interest and three appraisals (coping potential, novelty-complexity, and goal relevance) at the

pretest and posttest time periods, and three control variables (trait curiosity, modal learning preference, and verbal ability). A comprehension test covering the identical final two-thirds of each text indirectly measured learning.

Instrument 1: Measures of interest and appraisals

A single form containing eight total items was used to combine measures of interest and three appraisals adapted from previous research (Silvia, 2005a, 2005c, 2008a) for the two time periods. The text of these items was changed only slightly across time as needed to accommodate the tense of the relevant actions of the participants. For instance, interest was measured at Time 1 with two items employing a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree): “This text will be interesting”; and “I am curious about this topic”. At Time 2, the first item read “This text is interesting”, etc. Appraisals of coping potential were measured with two items on the same scale as before: “I feel I will be able to understand this text”; “I have a sense of what will be written about in the text”. Two semantic differential items (Berlyne, 1974) on a 7-point scale measured appraisals of novelty-complexity: SIMPLE – COMPLEX and FAMILIAR – UNFAMILIAR.

Following previous research (Smith, Novacek, Lazarus, & Pope cited in Lazarus, 1991), appraisals of goal relevance were measured with two items modified to fit the present study: “There is something important to me about the topic of this text” and “The topic of this text includes important things to think about”. For these items, the researcher also used a 7-point scale, this time ranging from the anchor points “not at all” to “extremely”. Silvia (2005c) has reported high alphas for his items measuring interest ($\alpha = .88$) and coping potential ($\alpha = .89$ and $\alpha = .92$). The two semantic differential items measuring novelty-complexity have been used

extensively in previous research (e.g., Berlyne, 1960, 1974; Evans & Day, 1971), although no alphas have been reported. It is noteworthy that Berlyne (1974) reported very high intercorrelations for these items (as high as $r = .94$ and $r = .96$). According to Lazarus (1991), Smith et al. reported an acceptable alpha for their items measuring goal relevance ($\alpha = .64$). Regarding the present sample, reliability analysis determined a relatively high Cronbach's Alpha statistic ($\alpha = .80$) for Instrument 1 as a whole. When items were separated by variable the following alphas were obtained: interest ($\alpha = .94$), novelty-complexity ($\alpha = .28$), coping potential ($\alpha = .95$), and goal relevance ($\alpha = .88$). The low alpha for novelty-complexity appraisals confirms the analysis presented in Chapters Four and Five that this variable was inadequately measured.

Regarding the measurement of novelty-complexity appraisals as pertaining to a single construct, previous research (e.g., Berlyne, 1971, Evans & Day, 1971) has indicated that novelty and complexity, while they differ in meaning as independent terms, belong to the same family of collative variables (Berlyne, 1971). Significantly, both identify the same psychological process when these variables are related to the experiencing of interest: "a disruption in processing and a subjective feeling of surprise or uncertainty" (Silvia, 2006, p. 57). Therefore, the researcher opted to extrapolate from Silvia's (2005c) advice to view this appraisal "broadly" (p. 99), and to focus on novelty-complexity as one construct.

To ask the same person if a text is novel and complex is contradictory; participants are likely to report conflicting ratings, e.g., the person would appraise the text as complex but not necessarily novel. Such ratings could not be averaged and still fit the study's theoretical framework, because they are independent terms that refer to the same "disruption in processing". Moreover, in previous research (e.g., Silvia, 2005a, 2005c, 2008a), this appraisal was either not

measured at all on the basis that the stimulus object was shown or designed to be complex to most people, or was measured with one semantic differential employing the anchors SIMPLE and COMPLEX.

Instrument 2: Deeper-level text comprehension test

A text comprehension test consistent with supporting theory indirectly measured learning. Since the measurement needs of the researcher are highly specific, some explanation is needed on the researcher's perspective regarding this test. Many studies have shown based on comprehension test scores that interest enhances text comprehension – age of subjects, style of text, style of presentation, and format of comprehension tests don't diminish these effects (Schiefele, 1992). Therefore, it appears valid within interest research, and within the present study specifically to answer Hypothesis 3, to measure text comprehension with test items. But comprehension isn't the terminal objective – the researcher wishes to relate interest to learning, and to seek evidence that meaningful learning has occurred as opposed to surface-level recall.

This is an important distinction. The type of learning that the researcher intends to measure is a meaningful understanding of academic content and the ability to apply this understanding, and not a surface understanding that is an all too common outcome in many current US educational settings (Johnston, 2009). Such a surface processing of academic material is, unfortunately, both a goal of many students as a means of easy achievement of desired scores or grades and an instructional goal as well. Curriculum is often designed such that surface understanding is the most likely outcome, while inquiry-based and other instructional approaches more suited to deeper processing are eschewed (Johnston, 2009) for the sake of time, cost, effort, lack of training, standardized test demands, and other practical considerations.

Consequently, the comprehension test used in the present study is a *deeper-level* test designed to show indirect evidence of learning through a measure of academic achievement. This type of test has been used in previous research to measure interest's effects on learning (e.g., Schiefele, 1992). Its signature feature is an emphasis on comprehension of themes and implications rather than easy-to-remember facts. Based on research by experts in text comprehension (e.g., Kintsch, 1986), people use three models of text representation to process text – verbatim, propositional, and situational – and only the situational model, in which the knowledge in the text combines with the reader's overall knowledge base, reflects meaningful learning (Schiefele, 1992). Accordingly, the researcher followed and modified the test development practices of other scholars who have investigated the effects of the situational model (Perrig & Kintsch, 1985; Schiefele, 1992; Schmalhofer & Glavanov, 1986) to produce the study's text comprehension test.

The test contained eighteen multiple-choice items in which responses were one of two types. Correct responses known in the literature as “meaning-changed” are valid inferences from the text which can only be identified as correct based on a reader's use of the situational model of processing as opposed to acts of simple recall or grouping of facts. “Correctness-changed” responses either directly contradict text in the article or are unsupported by the text and should be perceived as incorrect according to the situational model readers would form of the article.

Use of the theory-based situational model (e.g., Kintsch, 1986) to test for deeper-level comprehension as a function of interest appears valid based on additional research. According to Schiefele's (1992) review of research on interest's effects on deeper-level text comprehension, interest promoted deeper processing, more connections between the new text and one's overall knowledge base, more independent thinking about the text topic, greater conceptual

comprehension, and increased engagement with the content (e.g., Benware & Deci, 1984; Entwistle, 1988; Fransson, 1977). Low-interest subjects in these studies reflected “superficial and mechanical” (Schiefele, 1992, p. 159) learning. Schiefele’s (1992) own research on different levels of text processing revealed that, based on a test including items tapping simple recall, fact-grouping, and application-level activities, high-interest subjects displayed more meaning-oriented text processing but the same level of rote memorization as low-interest subjects. Taken together, this research on interest and text comprehension suggests that interest promotes deeper-level processing of text but has little effect on rote learning and leads to more meaning-oriented engagement. Also inherent in this research is the requirement for items that tap these deeper levels to be included in a comprehension test if interest is to be connected to the kinds of meaning-oriented processing activities that are associated with higher levels of learning (Schiefele, 1992).

Instrument 3: Measures of three control variables

To measure trait curiosity as the sole covariate of interest, the researcher turned to the revised version of the Trait Curiosity and Exploration Inventory (Kashdan et al., in press), also known as the CEI-II. One of the strengths of this instrument reflects the original authors’ (Kashdan, Rose, & Fincham, 2004) wish to develop a concise measure adaptable to laboratory and survey research that was global in nature, as opposed to domain-specific. One of these authors’ key criticisms of other measures of trait curiosity is that their items explore domains of knowledge, e.g. science and technology, in effect predisposing subjects who favor these interests to become “high-curiosity” subjects. The revised version has so far shown strong internal, external, and construct validity, and a high reliability coefficient (Cronbach’s $\alpha = 0.83$).

Valid instruments were also required to measure the two covariates of academic achievement. Text processing and verbal ability were simultaneously measured by The Quick Word Test (Borgatta & Corsini, 1964). The Quick has performed well as a measure of verbal ability, and has been shown to highly correlate ($r = 0.83$) with scores on the Wechsler Adult Intelligence Scale (Meyer & Rice, 1983). Modal learning preference was measured with the Barsch Learning Style Inventory (BLSI; Barsch, 1991) to identify dominant preferences for visual, auditory, or kinesthetic learning. This covariate was operationalized by visual learning scores according to the BLSI.

Procedures

Instrument 1 included a very brief (three sentences) introduction of the article topic, followed by assessments of expected interest and three appraisals (novelty-complexity, coping potential, and goal relevance). Two versions of the first-third of the text followed: a text segment (treatment) that includes carefully selected biological, psychological, and social antecedents related to the selected topic intended to enhance the appraisal of coping potential, and a control version of this segment in which these referents are missing. After completing the first text segment, interest and its appraisals were measured again (Time 2). Then people finished the final two-thirds of the text. Again, it should be noted that this final two-thirds contains identical text for both treatment and control groups. After finishing the article, people completed a text comprehension test only covering the identical portion (Instrument 2), and complete final questionnaires. This last set of documents includes measures of the three control variables (Instrument 3).

Statistical Analysis and Variables

To test Hypotheses 1, 2, 3, and 4 ANCOVA and ANOVA designs will be used to measure interest and its appraisals at both between and within-person levels. These designs will be used to analyze variables at Time 2 (one-third complete), and then will be used again within a repeated measures design specifically for Hypotheses 3 and 4 to compare rate of change across time. Treatment and control groups comprise one independent variable on two levels. ANCOVA will be used for the dependent variable of coping potential, and ANOVA for interest. There are two dependent variables, coping potential and interest, and one covariate of trait curiosity to be used only with coping potential. Coping potential was shown to be moderately related to trait curiosity ($r = .250$), justifying ANCOVA analysis, but interest's weak relationship to trait curiosity ($r = .086$) indicated ANOVA analysis as the better choice for Hypotheses 2 and 4. On the basis of these observations, the researcher's original plan to use a (2) x 2 MANCOVA design for these hypotheses was dropped.

To test Hypothesis 5, an ANCOVA will be used. The ANCOVA includes treatment and control groups as one independent variable on two levels, and deeper-level learning as measured by achievement scores on the comprehension test as one dependent variable, and two covariates: 1) modal learning preference and 2) verbal ability. Scores on the comprehension test will be tabulated as number of correct responses on an 18-item multiple-choice test, in which participants are being tested on the extent to which they used a situational model (Kintsch, 1986) to process the text.

To test Hypothesis 6, multiple regressions will be used. The multiple regressions include three cognitive appraisals as predictors (coping potential, novelty-complexity, and goal

relevance), and interest levels (from Time 2) as one dependent variable. The influence of goal relevance on the dependent variable will be measured based on an analysis of the semi-partial correlations and changes in the R^2 statistic. The best option for regression procedure here is sequential, in which the R^2 statistic for novelty-complexity and coping potential are computed first (Step 1), followed by the R^2 for goal relevance (Step 2) to facilitate analysis of the change in R^2 produced by goal relevance.

Overall, the study includes three control variables all chosen for theoretical reasons. Based on a review of the literature, the following are controlled for: learning style, trait curiosity, and verbal ability. Trait curiosity is included as a control regarding the generation of interest and its theorized appraisals. It is possible that some people in the treatment and control groups may find their texts more interesting than others because they are more curious people in general. Therefore, the occurrence of this trait must be included in the analysis.

It does not appear to be possible to completely isolate the effects of trait curiosity from the experience of interest. Research has indicated that trait curiosity is generated by the same appraisals (novelty-complexity and coping potential) as interest, suggesting that “curious people are more often interested because they tend to make the appraisals that cause interest” (Silvia, 2008a, p. 96). Yet, several studies (e.g., Silvia, 2005c, 2008a) have successfully controlled for trait curiosity. In particular, Silvia (2008a) demonstrated that while people higher in trait curiosity were more likely to be interested, the two appraisals predicted interest regardless of individuals’ level of trait curiosity. In summary, trait curiosity is (not surprisingly) likely to always have some effect on interest, but previous research has so far upheld the strength of Silvia’s appraisal model – trait curiosity is not sufficient as a complete explanation of the experience of interest.

Modal learning preference and verbal ability have been chosen to avoid potential confounds of the relationship between interest and enhanced academic performance. Previous research has identified these variables as significant possible contributors to academic performance and text processing (e.g., Dunn & Dunn, 1972; Pintrich & deGroot, 1990; Salisbury, 1994), requiring the researcher to partial out their effects from any hypothesized effects of interest. Prior knowledge has been used before as a control variable when assessing interest's effects on learning, but was excluded from the present study because under Silvia's (2006) model, prior knowledge of the stimulus object's knowledge domain is subsumed and reflected in appraisals of coping potential, e.g., when people assess their informational coping resources and appraise a stimulus as knowable.

Results of Pilot Studies

Two pilot studies were completed to test the functioning of the instruments and procedures chosen for the present research. As with the actual study packets, packets were handed out and completed by participants at home or in other outside locations. Students turned in their packets at the next class meeting. In several cases, changes in the procedures and instruments were made to the actual study on the basis of the pilot studies' findings. These findings are summarized below in some depth since they had a significant bearing on the final results reported in Chapter Four and on the implications reported in Chapter Five.

The first pilot study included a sample of 30 undergraduate students in education, 17 females and 13 males. Sixteen of the participants received the treatment version of the article, while 14 read the control version. The covariate of verbal ability was excluded from the data due to scoring problems associated with one version of the Quick Word Test (Borgatta & Corsini,

1964; the final study employed an easily scored version of the instrument). The most important decision behind the instruments used in this study that relate to the present research and its implications was to compose a coherent control text first, then to base the treatment text on this control version. The treatment text included several new ideas and topics based on the definitions from Chapter Two of B-P-S triggers that, while they related to the main topic, also contained significant meaning and vivid imagery that made them stand out in their own right. One example is a reference to Holocaust survivors and psychologists Viktor Frankl and Bruno Bettelheim, who asserted the possibility of free will based on their experiences and their belief in a conscious choice one has on how to respond to even the most horrible conditions.

Results contradicted the researcher's expectations. Means for coping potential (5.64 compared to 5.58) and interest (5.46 compared to 4.97) were higher for the control group. Both dependent variables were non-significant based on results of a MANCOVA analysis ($F = .014$; $p = .908$; partial eta sq. = .001 for coping potential; $F = .839$; $p = .368$; partial eta sq. = .03 for interest). Control participants also scored two points higher on the comprehension test, with a mean of 13.29 compared to 11.25 for the treatment group. ANOVA results were non-significant ($F = 1.984$; $p = .17$; partial eta sq. = .068), but of course in the opposite direction from what was expected. Other results included evidence of a moderate relationship between interest and learning ($r = .271$) and a strong relationship between coping potential and interest ($r = .675$).

Analysis of the results from the first pilot suggests that while the treatment text did contain B-P-S triggers as described in Chapter Two's review of the literature, the addition of these triggers to an already coherent text created incoherence, which led to lowered ratings in coping potential and interest by treatment participants. These responses appear to be linked to evidence of lower learning as well, given the results of the comprehension test, although the two-

point difference was non-significant. These inferences are consistent with Silvia's (2006) appraisal model, and with the extensive literature on interest's connection to learning. There is also additional research in the literature on text coherence to support the conclusion that the treatment text was unintentionally rendered less coherent than the control version.

Sadoski's (2001) review of a previous study from the *seductive details* interest literature (Harp & Mayer, 1997) included a salient warning that the adding of additional "idea-units" (e.g., ideas described in a sentence or more that are part of a larger text but are somewhat self-contained as well) to a text used comparatively creates incoherence by tinkering with readers' ability to identify the main theme of the text (see Silvia, 2006, pp. 75-77). A thorough review of both texts found the treatment text contained several more such idea-units than its counterpart. Given the body of research on coherence's strong effects on interest (Rawson & Dunlosky, 2002; Schraw, 1997; Schraw et al., 1995; Schraw & Lehman, 2001; Wade et al., 1999) and Silvia's (2006) explanation for coherence's relationship to coping potential appraisals – a view supported by similar research (e.g., Schraw, 1997; Sadoski et al., 2000) – it is strongly suggested the lack of coherence in the first third of the treatment text led to comparatively lower coping potential, interest, and possibly learning.

For the second pilot, both texts were revised. Idea-units were evenly balanced between the two versions, and the story of Oedipus was taken out of the identical portion to become a central feature of the treated text in the treatment version. The decision regarding Oedipus was based on the research of Steiner (see Pinker, 2002), who asserted that Greek myths embodied primal cultural themes of Western civilization. According to Steiner, "Greek myths encode certain primary biological and social" themes (cited in Pinker, 2002, p. 266), arguably making Oedipus a perfect vehicle for inserting a combined bio-social trigger into the treated text. The

assumption was that its employment in the identical portion of the text was a poor use of this resource for the study. This change required slight revisions of the comprehension test items as well.

The second pilot used a larger sample ($N = 53$), and additional data were recorded. The sample included 36 females and 17 males, of which 29 received the treatment text and 24 the control. Seven additional packets were handed out but not returned. Demographic data showed a mean age of 21.07, with the following percentages: Caucasian (90.5), African-American (3.7), and other (5.8). Once again, the covariate of verbal ability was excluded, and all the participants were undergraduate students in the education field.

Analysis of the MANCOVA procedure this time yielded very different results. Although both dependent variables showed non-significance again ($p = .56$ for coping potential; $p = .477$ for interest), treatment means were now higher than control means for both coping potential (5.15 compared to 4.89) and interest (4.60 compared to 4.27). Results for learning also swung in the opposite direction, revealing a mean score of 10.14 for treatment participants and 8.80 for the control group. Interest and learning were a little more strongly related this time ($r = .350$), while the coping potential–interest relationship was slightly less strong, but still significant ($r = .522$).

This second pilot study led to several important implications. First, in spite of the non-significant findings, alterations to the texts appear to have impacted interest, its appraisals, and learning. Manipulating text features as a means of enhancing interest in academic material and subsequent learning seems justified as a research endeavor. Second, these results appear to confirm the conclusions generated by the first pilot regarding the effects of coherence. When certain triggers create incoherence in the text (Pilot 1) they adversely affect interest and learning,

but when coherence is maintained (Pilot 2) such triggers may contribute to higher interest and learning. Third, the role of *concreteness* as a text feature must be addressed.

The assumed positive effect of the primary change to the treated portion of the treatment text – the story of Oedipus – on ratings of coping potential and interest might be attributable to the concreteness of the story’s text rather than the text’s presumed function as bio-social trigger per se. Concreteness is a characteristic of text that is more capable of calling up mental imagery (Sadoski, 2001). Oedipus’ parricide, self-mutilation, and incestuous marriage are powerful, even disturbing images capable of creating this text feature. Additionally, according to Silvia (2006), research (e.g., Sadoski et al., 1993, 2000) has repeatedly shown that manipulations of text concreteness significantly enhanced both ability to understand the text and interest. This research and Silvia’s conclusion both confirms his appraisal model of interest and strongly suggests concreteness modifies appraisals of coping potential. Conversely, the stripping of these images should help to create a more abstract text and adversely affect coping potential and interest. Taken together, the results of the second pilot indicate that when coherence is balanced between two texts, higher concreteness contributes to higher ratings of coping potential and interest (see Rawson & Dunlosky, 2002). Another implication of Pilot 2 is that, given the confines and desired outcomes of the study, more features of the treatment text required manipulation to generate the appropriate mean differences required for statistical significance. As an ancillary comment due to the disturbing aspects of the Oedipus story, it should be noted that previous research has shown objects of study need not be pleasant to be interesting (Turner & Silvia, 2006).

Due to the results of both pilot studies, additional changes to the final study were made. The identical portion of both texts was slightly revised to make it a little more abstract. It was

intended that this portion not prove so interesting that control participants received an unintended boost to their interest with subsequent positive unintended effects on their learning. Lower test scores from Pilot 2 led to a slight revision of the test – two difficult and low-scoring items were removed and others rewritten to make the test a little easier. Finally, several participants in both pilots displayed a “response set” approach to the reverse-scored items from Instrument 1, which measured interest and its appraisals. To avoid a repetition, four items were removed from the instrument, leaving two items for each of the four constructs.

Chapter Four: Results

Introduction

The previous chapters included the background of the present study including the research question and hypotheses that generated it, the study's purpose, a comprehensive review of the literature, and an explanation of the methodology supporting data collection and statistical analyses of the data. This chapter presents the results of these analyses. Included are the results of analyses to respond to the study's six hypotheses as well as the results of additional analyses suggested by the nature of the study and the original findings.

The overall purpose of the study was to test a new theory of interest (Silvia, 2006) in an educational context, in pursuit of educational goals, and in which interest is manipulable. Many previous theories of interest (e.g., Hidi, 1990; Schiefele, 1991, 1999) have centered on educational goals and have repeatedly demonstrated the strong connection between interest and learning, but have stopped short of validating practicable manipulations of interest. Instead, these studies have tended to accept student interest-levels in academic material as a given.

In contrast, Silvia's (2006) approach presents interest as a manipulable variable by placing it the framework of appraisal theory. However, his research program has only hinted at, and not yet tapped, interest's effects in an educational context. Can interest's universal appraisals be manipulated in educationally fruitful directions? Is there another appraisal of interest that belongs in the theory?

The below results are intended to at least begin to address these general questions, while specifically addressing the following research question: can biological, psychological, and social

antecedents influence appraisals of coping potential when students are confronted with new or complex content, such that the emotion of interest is able to be manipulated on the basis of these antecedents in a direction supportive of academic learning? The following testable hypotheses were developed to respond to this research question:

Hypothesis 1: Subjects exposed to text with a manipulated set of biological, psychological, and social antecedents (treatment text) will report a significantly higher level of the appraisal of coping potential for this text than subjects exposed to the same text but without this set of antecedents (control text), while controlling for trait curiosity, at Time 2.

Hypothesis 2: Subjects exposed to the treatment text will report a significantly higher level of interest than subjects exposed to the control text, while controlling for trait curiosity, at Time 2.

Hypothesis 3: Subjects exposed to the treatment text will report a significantly higher rate of change in the appraisal of coping potential across time as compared to subjects exposed to the control text, while controlling for trait curiosity.

Hypothesis 4: Subjects exposed to the treatment text will report a significantly higher rate of change in level of interest across time as compared to subjects exposed to the control text, while controlling for trait curiosity.

Hypothesis 5: Subjects exposed to the treatment text will demonstrate a significantly deeper level of learning than subjects exposed to the control text, while controlling for learning style preference and verbal ability.

Hypothesis 6: Goal relevance is a significant predictor of interest.

Results

Hypothesis 1: The mean difference in coping potential at Time 2 between groups while controlling for trait curiosity failed to reach significance by a narrow margin ($F = 3.368$; $p = .071$; partial eta sq. = .052). Estimated marginal means (see Table 1) for both groups were 5.93 (SD = .223) for the treatment participants and 5.36 (SD = .219) for the control participants. The covariate of trait curiosity appeared to covary with the dependent variable ($F = 3.991$; $p = .050$).

	Interest (T1)	Interest (T2)	Novelty-Complexity (T1)	Novelty-Complexity (T2)	Coping Potential (T1)	Coping Potential (T2)	Goal Relevance (T1)	Goal Relevance (T2)
Control	4.62	4.48	4.67	4.21	4.77	5.35	3.94	4.00
Treatment	4.94	4.97	4.69	3.97	4.75	5.95	4.25	4.60

Table 1: Group Means for Interest and Its Appraisals

This covariance at the between-person level is consistent with previous research. Silvia (2008a) showed that at this level trait curiosity is tightly linked to appraisals of coping potential. He explored whether an emotion trait such as trait curiosity displays an appraisal basis in a similar manner to emotional states such as interest. In his study, coping potential (but not novelty-complexity) fully mediated the effects of trait curiosity on interest in poetry (Experiment 1) and in paintings (Experiment 2). He concluded that trait curiosity has a single-appraisal basis – coping potential – and that, as a consequence, curious people are curious because they have an increased tendency to appraise their coping potential as high.

So while it appears on the basis of this research and the present study that trait curiosity affects ratings of coping potential between persons, this is because consistently high appraisals of coping potential are the basis for the presence of trait curiosity itself. Moreover, additional analyses by Silvia (2008a) of the same data in his study (Experiment 2) indicated that trait curiosity's impact on the appraisal structure of interest is weaker at a within-person level.

Multilevel analyses of within-person slopes revealed that trait curiosity failed to predict variance in within-person relationships between appraisals and interest. Therefore, within-person analysis (e.g., Hypotheses 3 and 4) as well as between-person analysis is warranted for this kind of appraisal research, especially when the methodology calls for manipulation of the appraisals.

Trait curiosity may indeed predispose someone to higher or lower ratings of coping potential compared to other people. However, as the person engages with an object, what happens that affects their own appraisal of coping potential over even a short span of time may not be as strongly tied to their trait curiosity level. As is suggested by the only moderate correlation between trait curiosity and coping potential ($r = .250$), features of the object may cause this appraisal to turn up or down independently – this is relevant to the outcomes for Hypothesis 3.

Hypothesis 2: Participants in the treatment group did not differ significantly in their interest ratings from the control participants ($F = 1.906$; $p = .17$; partial eta sq. = .029). The treatment group mean was 4.969 (SD = .250) and the control group mean was 4.485 (SD = .246). As noted in Chapter Three, the covariate was dropped because trait curiosity was shown to be only weakly related to the dependent variable of interest ($r = .086$; $p = .497$). Results were taken from the ANOVA procedure, and suggest that in the context of appraisal theory, interest's appraisals were not sufficiently manipulated, were not completely identified, or both.

In light of the above uncertainty about interest and its appraisals in the context of the study's specific manipulation, the following pattern may be significant regarding the relationship among trait curiosity, coping potential, and interest. In Silvia's study (2008a), trait curiosity showed a moderately strong correlation to coping potential and interest when participants read complex poems ($r = .332$; $r = .318$) or viewed complex paintings ($r = .344$; $r = .242$). However,

when people in the same study viewed simple paintings, the correlations somewhat diverged. Trait curiosity's correlation to coping potential was in a similar range ($r = .270$), but its correlation to interest was weak ($r = .066$). These last correlations approximate the correlations for the same variables from the present study at Time 2 ($r = .250$; $r = .086$). Both sets of correlations here suggest that for the curious, something was missing – coping potential was not enough to generate high interest levels.

In Silvia's (2008a) study, the missing ingredient seems apparent – high appraisals of complexity. After viewing the simple paintings, people gave much lower ratings of appraised complexity as compared to ratings for the complex paintings ($M = 5.51$ to $M = 2.53$ on a seven-point scale). In the present study the answer is less clear. Ratings for complexity at Time 2 were moderate rather than low across the sample ($M = 4.09$), reflecting a consensus that the first half of either version of the experimental article was somewhat complex, as one would expect for that kind of expository text. (As will be seen later in the dissertation, there is also the possibility that ratings for this appraisal would have been higher with altered items.) Yet the correlation to interest remained weak. An inference worth considering is that while for imagery-oriented material such as poetry and paintings high appraisals of complexity and coping potential may be enough to generate interest, interest in expository text may be strongly affected by another appraisal. Or it may be that another appraisal was always there in interest's appraisal structure but has yet to be identified – these possibilities are addressed in the results for Hypothesis 6.

Hypothesis 3: The repeated measures ANCOVA revealed that coping potential was successfully manipulated in the treatment version to a statistically significant degree while controlling for trait curiosity ($F = 5.315$; $p = .025$; partial eta sq. = .079). The rate of change (see Figure 1) in coping potential rating means for the treatment group was 1.2 points (4.75 to 5.95)

as opposed to less than 0.6 for the control group (4.77 to 5.35). In this analysis, in contrast to the results for Hypothesis 1 the covariate no longer appeared to covary with the dependent variable of interest ($F = .403$; $p = .528$; partial eta sq. = .006).

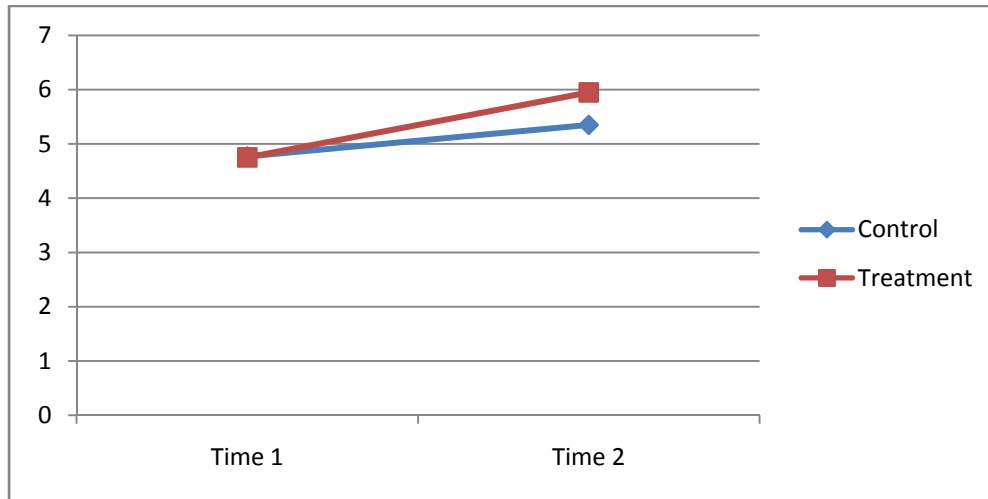


Figure 1: Rate of Change in Coping Potential Across Time

Consistent with previous research (Silvia, 2008a), while trait curiosity affected between-person ratings of coping potential (Hypothesis 1) it did not significantly affect within-person variance on coping potential. Bivariate correlations point in a similar direction. Trait curiosity's correlation to coping potential at Time 1 was reasonably strong ($r = .384$; $p = .002$), while its correlation to this variable at Time 2 was moderate ($r = .250$; $p = .044$). Trait curiosity's weaker tie to coping potential at Time 2 suggests that the covariate may prompt a predisposition toward higher or lower ratings, in this case motivated by the identical three-sentence topic introduction, but that engagement with the actual treatment or control texts lessened trait curiosity's effects over time.

How can coping potential's successful manipulation by the treatment at a within-person level be explained? Taken together with the results of Hypotheses 1 and 2 in the context of appraisal theory, it appears that while alterations to the text did not provide sufficient changes in

appraisals to generate high enough mean differences between groups on coping potential or interest, the treatment participants found something in the text which caused their coping potential appraisals to jump to a statistically significantly greater degree relative to pre-treatment levels. These results could be attributed to the effect of the experimental B-P-S triggers. It is also possible objective features of the text such as coherence (Rawson & Dunlosky, 2002) and concreteness (Sadoski, Goetz, & Rodriguez, 2000) strongly influenced appraisals of coping potential for this group. In turn, the B-P-S triggers could have affected these appraisals by contributing to the impact of one of these features rather than by changing the appraisals in their own right.

Hypothesis 4: On the basis of a one-way repeated measures ANOVA, significance was not found in group differences in the rate of change in interest ratings from Time 1 to Time 2 ($F = .435$; $p = .512$; partial eta sq. = .007). As with Hypothesis 2, the covariate was dropped since it was shown to be only weakly related to the dependent variable of interest ($r = .086$; $p = .497$). Interest ratings flatlined across time (see Figure 2) for the treatment group (4.94 to 4.97), while control participant ratings at Time 1 started lower than treatment participants (4.62) and declined at Time 2 (4.48).

This decline could be due to the manipulated absence of B-P-S triggers in the control text. It is also possible the removal of these triggers contributed to the creation of a control text that was more abstract than its counterpart, and thus less capable of calling up mental imagery (Sadoski, 2001). A significant body of research indicates abstract texts are less interesting to readers (e.g., Sadoski, Goetz, & Fritz, 1993; Sadoski et al., 2000).

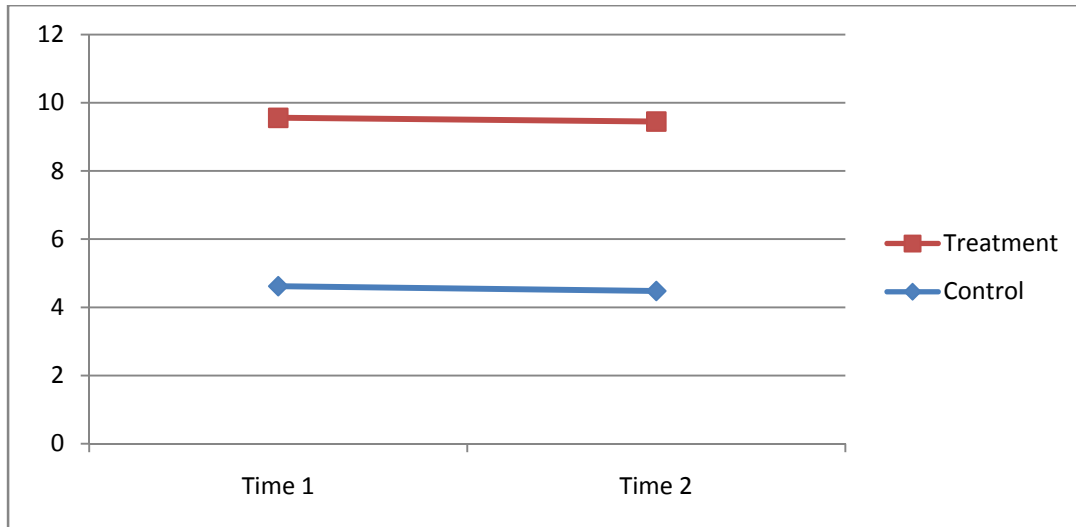


Figure 2: Rate of Change in Interest Across Time

Given the results observed for Hypotheses 2 and 3, these data suggest that while a significant within-person change in coping potential occurred for treatment participants, something was missing from the manipulation that would otherwise have generated a similar change in interest. To remain consistent with the theory supporting the present study and previous research, the change in appraisals of coping potential wasn't enough to "carry the vote". Something noteworthy regarding coping potential occurred in the treatment group, but one or more appraisals must not have been appropriately handled to produce enough of a difference in interest itself.

Hypothesis 5: A one-way ANCOVA did not result in statistically significantly higher test scores for the treatment group ($F = .519$; $p = .474$; partial eta sq. = .008). The treatment group mean was .59 points higher than that of the control group (12.44 to 11.85). The covariate of learning mode did not appear to covary with the dependent variable ($F = .215$; $p = .645$; partial eta sq. = .004). However, data indicate the second covariate of verbal ability did covary ($F = 10.108$; $p = .002$; partial eta sq. = .142).

If the present study's results were to reflect the connection between interest and learning confirmed in Chapter Two's coverage of the literature, a non-significant finding here would be expected. In fact, the mean differences in interest at Time 2 and learning were near-identical in favor of the treatment group (.49 for Time 2 interest compared to .59 for learning). The results for Hypotheses 2 and 4 show interest at Time 2 was above average (4.72 on a seven-point scale across the sample) but diffused between the treatment and control groups, indicating interest, and therefore learning in an indirect sense, were not optimally manipulated. It is possible that the correct triggers were not precisely tuned and employed in the treatment version. It is also possible that interest's appraisals were not manipulated enough as a whole to show the expected effects on interest and learning.

A closer inspection of the interest-learning connection shows they were moderately related across the sample ($r = .311$; $p = .012$). The significant covariate, verbal ability, was also related to learning ($r = .374$; $p = .002$). These correlations were not very strong, allowing the researcher to examine moderator effects without concern over multicollinearity (Frazier, Tix, & Barron, 2004) to test these relationships further. A non-significant interaction term (Unstandardized $\beta = .383$; $t = 1.029$; $p = .307$; semi-partial $r = .116$) showed that verbal ability did not moderate interest's effects on learning across the sample, indicating that interest's and verbal ability's effects on learning were independent of each other. These results indicate that although verbal ability may have steered test scores somewhat, this effect shouldn't interfere with the statistical assessment of the interest-learning relationship provided verbal ability is accounted for as a covariate.

A deep-level comprehension test such as the one used in the present research still may not be the optimal tool for measuring interest's effects on learning from text. However, in light

of the above findings, the weaknesses in using this kind of test are not due to any confounding effects of verbal ability. Indeed, it would be very surprising if verbal ability had no effect at all on these kinds of academic performance measures, but with the proper methodology it appears that its influence can be accounted for appropriately. A question worth considering for future research is whether alternative measures of academic performance would provide better gauges of interest's effects on learning from text, such as oral recall, open items requiring synthesis of information or other evidence of higher-order conclusions, and other behavioral measures.

As can be seen in the results from Hypotheses 2 and 4, the most likely explanation for the findings from Hypothesis 5 is that one or more of interest's appraisals were insufficiently tapped or manipulated to either generate interest or to enhance learning. The treatment text was designed only to manipulate coping potential, which occurred to a statistically significant degree at the within-person level (Hypothesis 3). Novelty-complexity was not manipulated, but was expected to be present in roughly equal measure for both text versions at a reasonably high level.

Across the sample novelty-complexity means actually dipped from Time 1 to Time 2 (4.68 to 4.09). The dip over time (see Figure 3) was even bigger for the treatment group (4.69 to 3.97; .72 points) than for the control group (4.67 to 4.21; .46 points). These changes in the means suggest treatment participants found the treated text comparatively less complex. While this result fits with the researcher's assessment that appraisals other than coping potential were insufficiently tapped by the treated text, it is also possible people reading the treated text found it more coherent and/or concrete and not necessarily simpler, and provided ratings that reflected a "tighter" text – not a simpler text. The higher mean for the control group in novelty-complexity at Time 2 contradicts the general direction in mean differences for the two other appraisals measured, in which treatment means exceeded control means by .5 (coping potential) and .6

(goal relevance). This inversion is either atheoretical, because interest's appraisals should tend to move in the same direction, or evidence of a degree of mis-measurement of novelty-complexity.

Therefore, questions remain about whether this appraisal was accurately measured.

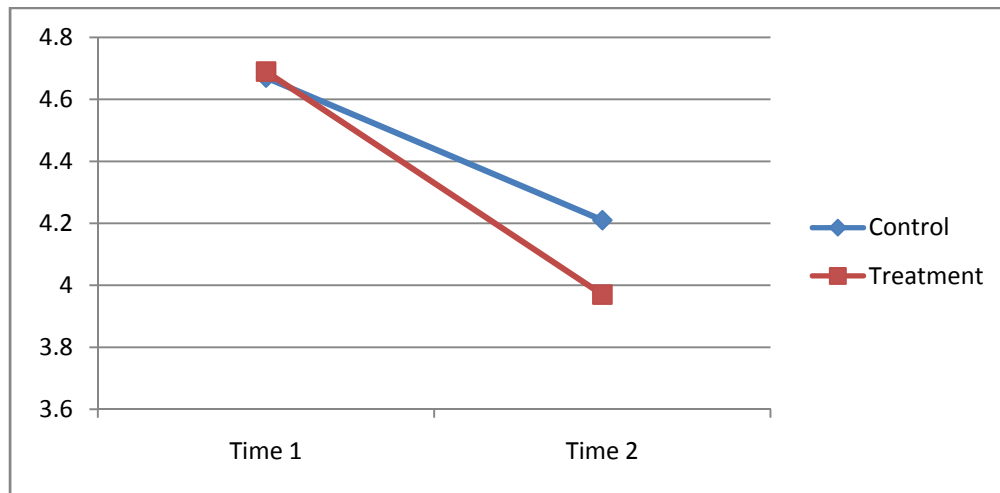


Figure 3: Rate of Change in Novelty-Complexity Across Time

In summary, it appears that coping potential appraisals can be successfully manipulated by altering text, but that high coping potential can nevertheless coexist with feelings of lower interest. More attention must be given to *the rest of interest's appraisal basis* for a treatment text to do its job. It is unclear whether novelty-complexity was appropriately tapped. While the manipulation did not target this appraisal, the use of devices such as the story of Oedipus may have made reading the treated text a more novel or complex experience. However, the scales measuring this appraisal may not have reflected this response. Moreover, if a third appraisal is essential to interest's appraisal structure, its failure to be included in the treatment would certainly help to explain the findings for Hypotheses 2, 4, and 5. It is possible subjective judgments of a text feature such as *vividness* (the intensity of mental images stirred by text; see Silvia, 2006, pp. 80-82) provide a better approximation of appraisals of novelty-complexity than the scales used in the present research, and that elements such as the story of Oedipus would

influence ratings of this feature such that statistical results would better showcase the role of this appraisal in generating interest.

Hypothesis 6: Multiple regression analysis across the sample showed that a third appraisal not previously tested or identified, goal relevance, is a strong predictor of interest (Unstandardized $\beta = .567$; $t = 6.258$; $p < .001$). There was also a significant r^2 change for this variable ($r^2 \Delta = .33$; $F = 39.16$; $p < .001$), reflecting that while appraisals of novelty-complexity and coping potential explained 15.6 percent of the variance in interest, when goal relevance was added in the three variables accounted for 48.6 percent of the variance. That so much of the variance in interest was accounted for by goal relevance strongly suggests that the extent of the non-significant findings for interest (Hypotheses 1 and 3) and learning (Hypothesis 5) are due to the presence of this third variable in interest's appraisal structure.

Additional statistical procedures were compiled to uncover more about goal relevance's possible role in generating interest. To replicate the significant within-person finding for coping potential (Hypothesis 3), a repeated-measures ANCOVA was used to measure differences in the rate of change in goal relevance while controlling for trait curiosity. Results were non-significant for both the within-person rate of change ($F = .913$; $p = .343$) and the effect of the covariate ($F = 2.815$; $p = .098$), indicating goal relevance was not unintentionally manipulated at a within-person level for the treatment group. Another ANCOVA at a between-person level revealed that although this appraisal at Time 2 was higher for the treatment group (4.6 to 4.0), the mean difference was not significant ($F = 2.358$; $p = .13$; partial eta sq. = .037).

Together these findings suggest that, had goal relevance been intentionally manipulated in the treatment version, statistical analysis of both interest and learning might have yielded significance. Finally, analysis of moderator effects (Frazier et al., 2004) revealed that neither

coping potential (Unstandardized $\beta = -.156$; $t = -1.254$; $p = .215$) nor trait curiosity (Unstandardized $\beta = -.028$; $t = -.256$; $p = .799$; semi-partial $r = -.023$) moderated goal relevance's effect on interest. So not only does this third appraisal appear to be a strong predictor of interest given the conditions of the present research, but its effects are independent of other related variables.

Chapter Five: General Discussion

The present study sought to validate and extend Silvia's (2005c, 2006) appraisal model of interest, establishing a branch of this research program dedicated to educational goals. Silvia's model, which hinges on cognitive appraisals of coping potential and novelty-complexity, is a promising step in the evolution of interest research. This model's success in combining the fruits of appraisal research and the emotion literature offers new opportunities for a richer understanding of how interest functions – and for its ethical manipulation. The absence of educational research using the model provided the necessary unexplored terrain to give substance to the contributions of this dissertation.

The heart of this project is the claim that interest is an emotion that is open to manipulation that recognizes and *at the same time transcends* individual differences, and that what is universal about this experience can inform curricular and instructional practice. The heart of this claim is the somewhat controversial belief, vigorously defended by some (e.g., Dewey, 1913; Herbart, 1816/1891; Hidi, 1990; James, 1899; Renninger, 2009), that interest in academic material is neither accidental, nor is it incidental or peripheral to the pursuit of educational goals. An appraisal theory perspective such as that offered by Silvia (2006) provided the perfect theoretical framework within which to address this claim.

Summary of Key Findings

Given this claim and the project's reliance on appraisal theory for its theoretical basis, how did the present research most contribute to the literature? First, interest in academic material appeared to be manipulable rather than simply present or not present in the student without

attributable cause. When the results of both pilot studies and the present research are taken together, adjustments to the texts and subsequent swings in ratings suggest alterations in interest and its appraisals occurred that are related to causes beyond the functioning of individual differences, including personal idiosyncracies, habits, experiences, etc.

Second, this manipulated interest appeared to affect learning such that higher interest leads to higher learning. Much research supports this conclusion, but in the case of the present research, specific alterations to the text raised or lowered interest and learning in the same direction. Therefore, an educational professional can go beyond the realization simply that interest and learning are related and consider that, with the proper know-how, conscious choices in curriculum and instruction can drive interest and learning up – or down.

Third, specific manipulations of the treated portion of the treatment text enhanced appraisals of coping potential to a statistically significant degree at a within-person level (Hypothesis 3; $F = 5.315$; $p = .025$; partial eta sq. = .079). Finally, two additional contributions specifically address extensions of Silvia's (2006) interest model. A previously untested third appraisal, goal relevance, was shown to predict interest across the sample to a statistically significant degree (Hypothesis 6; $p < .001$). Finally, hints of a new appraisal model of interest in a broad sense have emerged. A new model would include goal relevance alongside novelty-complexity and coping potential as interest's appraisals, and would identify vividness, coherence, and concreteness as key objective features strongly affecting the original two appraisals. Vividness, or the intensity of mental imagery during an activity such as reading (Sadoski & Paivio, 2001), works well as a text feature related to novelty-complexity appraisals (Silvia, 2006), and coherence and concreteness are the qualities assumed to directly influence coping potential appraisals – a view supported by empirical research (e.g., Sadoski et al., 2000;

Schraw, 1997). All three of these variables were listed in Silvia's (2008b) review of emerging interest research as being among the strongest predictors of interest in text – vividness grouped under “a cluster of novelty-complexity variables” and coherence and concreteness under “a cluster of comprehension variables” (p. 59).

It is unclear whether this model extends to all objects of study, or whether it is merely suited to expository text, or perhaps to other academic topical matter in general. According to Silvia (2006), his two-appraisal model of interest appears to encompass all classes of objects. On the basis of his research, paintings, polygons, and poems have all been empirically validated so far. The present research represents a novel step in this program in that expository text in an academic setting was used, and a third appraisal was tested and validated. Until this three-appraisal model is tested on a variety of objects, its range of applicability will remain uncertain.

Additionally, new conclusions about the triggers of interest and how they affect its appraisals have added to the utility of Silvia's model in an educational context. Knowing that coping potential appraisals affect interest is important, but not as helpful in knowing what text features to adjust if one desires to enhance interest in text-based academic material. Based on previous research and the results of both pilot studies and the present research, vividness, coherence, and concreteness become triggers of interest that are easily incorporated into curriculum and instruction. Due to the crucial role of appraisal theory in the present research, and to the importance of interest's appraisal structure specifically, more attention must now be given to what has been learned regarding each appraisal.

Conclusions Regarding Interest's Appraisals

The overall conclusion regarding interest's appraisal structure is that Silvia's (2006) model remains sound, and does apply to expository text in an academic context, but that two

extensions of the model are called for, pending further research. First, a step back from the point at which cognitive appraisals are formed is recommended, such that subjective judgments of three text features be highlighted as important triggers of the two appraisals. Vividness is emphasized as the most likely trigger of appraisals of novelty-complexity and as the most appropriate alternative source of scales with which to measure these appraisals accurately, while coherence and concreteness are identified as influential triggers of appraisals of coping potential. Viewed in this manner, the appraisal perspective which depends on subjective judgments as opposed to objective features of an object of study is not violated, but at the same time these three text features are identified as crucial players in generating interest in expository text. Silvia himself (2006) recommends looking at these text-based sources of interest as consistent with appraisal theory. Hence the model is now more useful in contributing to the understanding of how interest in such text occurs, as well as to the task of text writers to generate interesting bodies of work for students.

Second, a third appraisal of goal relevance is recommended as a possible addition to interest's appraisal structure. Its significance across the sample in predicting interest (Unstandardized $\beta = .567$; $t = 6.258$; $p < .001$) is indicative of a strong effect, but this appraisal has yet to be validated by further research or employed with alternative objects of study. It may be that goal relevance's effect is a function of a personality aspect, of time spent on task, or of the nature of the object of study. Previous research has shown these kinds of differences are possible within the appraisal structure of an emotion (e.g., Smith & Pope, 1992; Watson, 2000), and this addition to appraisal theory has been tested on interest itself (Silvia, Henson, & Templin, 2009).

Novelty-complexity best understood as vividness

Based on supporting theory, the researcher understood appraisals of novelty-complexity were likely to be factors in generating interest in academic text, but these were not targeted in the present study's experimental manipulation. It was assumed under a two-appraisal model of interest that, having chosen a complex topic and a somewhat novel stylistic approach to the content for the texts, this appraisal would be present to a fair degree across the sample, and that the expected jump in coping potential in the treatment group at between and within-person levels would be enough to account for the expected statistical significance in mean differences in interest ratings. Manipulation of this appraisal was not attempted because the researcher concluded that accounting for individual differences in the experiencing of novelty-complexity, given people's diverse prior experiences, would add an unnecessary layer of complexity to the study design.

Results confirmed novelty-complexity was indeed present to a reasonable degree across the sample (4.68 at Time 1 and 4.09 at Time 2), and roughly equivalent between groups (mean difference at Time 1 = .02; mean difference at Time 2 = .24). However, coping potential ratings showed a statistically significant difference only at a within-person level, and interest rating mean differences were non-significant at the between and within-person levels. At the within-person level, where significance *was* found in coping potential, one possible preliminary conclusion might be that novelty-complexity appraisals were not present to a sufficient degree in the treatment group to combine with coping potential and generate the necessary difference in interest. Two statistical findings indicate this preliminary conclusion is flawed, requiring an alternative explanation.

First, multiple regression analysis showed that novelty-complexity appraisals across the sample seem to have had little influence on ratings of interest. In the two-model regressions

computed to respond to Hypothesis 6, when novelty-complexity and coping potential were analyzed without goal relevance (Model 1), novelty had low significance (Unstandardized $\beta = .223$; $t = 1.241$; $p = .219$). Once goal relevance was added to the regressions, novelty-complexity's influence dipped even further (Unstandardized $\beta = -.045$; $t = -.303$; $p = .763$). This finding strongly suggests that novelty-complexity appraisals – *as measured by the scales employed in the study* – failed to significantly contribute to interest. Before questioning the role of novelty-complexity in interest's appraisal structure, however, a second finding must be considered.

As was noted in Chapter Four, ratings of novelty-complexity dipped for both groups over time, *and even more so* within treatment participants, resulting in lower treatment group scores compared to control participants at Time 2. This downward turn and the comparatively lower treatment group scores at Time 2 run counter to the results for the other two appraisals – both rose slightly to moderately over time and rose at a higher rate within the treatment group, resulting in higher means for the treatment group in both appraisals at Time 2. The researcher suggests that the apparently atheoretical performance of this appraisal actually reflects that something positive occurred within participants, and that this positive trend was hidden by the inaccuracy of the scales employed. Reliability analysis of Instrument 1 confirms this assessment of inadequate measurement. Items measuring novelty-complexity appraisals produced a distinctly low Cronbach's alpha ($\alpha = .28$) compared to those generated by the items measuring interest ($\alpha = .94$), coping potential ($\alpha = .95$), and goal relevance ($\alpha = .88$).

The scales measuring novelty-complexity appraisals in the present research have been used effectively in studies in which the objects of study were polygons, paintings, or poems. Despite poetry's reliance on text, all three forms are highly visual media – they communicate

through images. Readers of expository text, however, have to work harder to generate memorable or meaningful images, and according to dual coding theory (Sadoski, 2001), are already dual-tasked. These readers must simultaneously process verbal data and non-verbal data (images evoked by text) in their search for the text's meaning and value. Text that is coherent (clear in its causal relations and contributing to an overall "big picture"; see Lehman & Schraw, 2002) and concrete (able to evoke mental images) – two features previously emphasized by the researcher – aids readers in these processing efforts (Rawson & Dunlosky, 2002; Sadoski et al., 2000). Therefore, a text rich in these features would be rated as easier to read.

The design, findings, and implications of the pilot studies and the present research, and specifically the statistically significant within-person changes in coping potential ratings for the treatment group (Hypothesis 3), suggest that both texts in the present research were coherent, *but also that the treated portion of the treatment text was more concrete*. The strong connections in the literature between coherence and concreteness on one side and ease of processing and comprehensibility on the other (e.g., Lehman & Schraw, 2002; Sadoski, 2001) lead to the conclusion that from Time 1 to Time 2 the coherence of both texts reduced confusion across the sample, and that the concreteness of the treated text further cut down on confusion for the treatment group. This conclusion would account for both the overall drop in novelty-complexity ratings in contrast to results for the other appraisals, and for the bigger drop and lower Time 2 ratings found for the treatment group.

In summary, the researcher concludes that raters mistook, for example, the scale SIMPLE – COMPLEX for easier versus more difficult to process. In effect, what occurred may have been a confound between appraisals. When raters chose lower novelty-complexity ratings and did not reflect a strong influence of this appraisal on interest, it is because they were reacting to

relatively strong appraisals of coping potential, which led them to interpret SIMPLE as easier to understand.

With this alternative explanation in mind, the results for novelty-complexity ratings are now consistent with supporting theory and specifically with Silvia's (2006) appraisal model of interest. What remains is to offer a related construct which provides a more accurate measure of novelty-complexity appraisals that won't be confused with judgments of the level of processing ease – hence appraisals of coping potential. The researcher suggests *vividness*, a subjective judgment of a text feature defined as the level of intensity of the mental images evoked by a text (Silvia, 2006). Vividness has been shown to enhance interest in text (Wade et al., 1993) and to correlate with ratings of text complexity, coherence, and ease of comprehension (Schraw, 1997; Schraw et al., 1995). In Schraw's and Lehman's (2001) meta-review of text-based interest research, they found the effects of vividness, along with coherence, on interest to be uniformly positive across the studies: “that is, they always increase interest to some extent” (p. 36).

Silvia himself submitted this quality among others as a facet of the novelty-complexity appraisal based on previous research: “An appraisal interpretation of these text factors is straightforward – most of them are synonyms of *novelty* and *complexity*, and they are measured like these appraisals are measured in appraisal research” (p. 81). Vividness is especially ideal for academic-oriented or expository text because it is easier to distinguish from difficulty of processing than novelty or complexity, and because other text qualities offered by Silvia as reflecting novelty-complexity appraisals (e.g., *suspensefulness*) appear more suited for fictional works. *Surprisingness*, another suggestion by Silvia (2006, 2008b), might work reasonably well for literary and for expository text. Further research is needed to resolve these questions about measurements of novelty-complexity appraisals of prose texts.

Coherence and concreteness are behind coping potential appraisals

The most significant implication of the findings regarding coping potential appraisals is that subjective judgments of certain text features appear to have been highly influential. When the findings of both pilot studies and the present study are considered together, the researcher suggests text coherence and concreteness had the largest impact on this appraisal's ratings. This line of reasoning is consistent with much previous research confirming the correlation of these features to coping potential and establishing their ability to predict interest (e.g., Schraw, 1997; Sadoski et al., 2000). Coherence's effect on interest has been well documented (see Schraw & Lehman, 2001 for a review), and has been shown to be especially influential for expository text (Schraw et al., 1995). The role of concreteness has been even more rigorously established through mediational analyses and manipulations. Two studies manipulated concreteness and found that its effect on interest was significant and mediated by appraisals of comprehensibility (Sadoski et al., 1993, 2000). In another study by Sadoski (1999), concreteness was the strongest predictor among several variables of ratings of comprehensibility of expository text.

Notably, the above research has special significance regarding the effect of coping potential appraisals on educationally relevant goals, as highlighted by the present study. In the Sadoski et al. studies concreteness was directly manipulated, and this alteration of text led to changed appraisals of comprehensibility, which then led to changes in interest. If future research establishes a similar relationship among coherence manipulations, coping potential, and interest, as one study on coherence's effect on performance predictions indicates is likely (Rawson & Dunlosky, 2002), then academic text writers have two powerful means at their disposal for increasing interest.

In the first pilot, the treatment text included at least nine additional idea-units embodying biologically, psychologically, and socially relevant “triggers” intended to boost coping potential appraisals of a complex text and thus lead to greater interest. The counterpart section of the control text was approximately the same length, but with consequently much fewer distinct idea-units. The researcher has concluded this manipulation unintentionally fractured the coherence of the treatment version. The relative incoherence of this version appears to have found expression in the results of the first pilot study in lower coping potential and interest ratings as well as in lower comprehension test scores. As explained in Chapter Three, this interpretation is supported by Sadoski’s (2001) and Silvia’s (2006) reviews of the seductive details literature, which identified the confounding effects of unintended incoherence on measurements of interest and recall. Therefore, it seems the triggers had an impact here, but in the wrong direction and not due to their nature as biologically, psychology, and socially relevant information, but due to their effects on the flow of the text.

In the second pilot, idea-units were evenly balanced in order to equalize coherence. The method behind this balancing act deserves special attention because of its connection to the text feature of concreteness. Many of the idea-units that would tend to call up distinct mental images *not directly bearing on the main theme*, e.g., the concentration camp experiences of Viktor Frankl and Bruno Bettelheim, were replaced with one longer idea-unit containing a brief account of the story of Oedipus. As noted in Chapter Three, it was included due to research asserting Greek myth’s ability to tap our biological and social nature at a primal level (Pinker, 2002). This story even in condensed form is resonant with imagery that is both easy to call up mentally and probably disturbing to many people. The control version was rechecked to make sure no such evocative idea-units were present. It is likely readers found the section of the text with Oedipus

highly vivid, although the results cannot account for this since vividness wasn't measured. Given the turn-around in group means, in which the treatment means now exceeded those of the control group in coping potential, interest, and comprehension test scores, the researcher also suggests the inclusion of Oedipus in the treatment version and revision of the control text had the effect of employing a manipulation of concreteness versus abstractness similar to the Sadoski (Sadoski et al., 1993, 2000) studies. This effect would help account for the switch in ratings and scores between groups. Therefore, once again adjustments in the B-P-S triggers influenced ratings not due to their nature as such, but apparently due to their contribution to the comparative concreteness of the treatment text.

Results of the present study appear to confirm these implications of the two pilot studies. With texts of equal coherence and a more concrete treatment version, coping potential was affected such that treatment means over time at a within-person level were statistically significantly higher ($F = 5.315$; $p = .025$; partial eta sq. = .079). Vividness (thanks to Oedipus) was probably present to a higher degree in the treatment version, but that cannot be ascertained without additional data. However, the lack of a statistically significant difference in interest at between or within-person levels must be explained. In the context of appraisal theory, either vividness was not present to a sufficient degree in the treatment version, or a third appraisal accounted for the results of the text manipulation.

Goal relevance – how to characterize interest's third appraisal

Silvia, recommending further research should examine whether interest has a third appraisal, put forth the option of goal congruence, a construct related to goal relevance (2005c). Shortly after mentioning this possibility, however, he suggested that if one adopts a functional view of interest, then for a percipient the act of determining congruence in an object with one's

goals would thwart the adaptive benefits of exploration. However, the functional approach does not consider the possible effects of personality on interest. Therefore, the researcher introduced *goal relevance* (Lazarus, 1991) – an evaluation of an event’s personal importance to the percipient – as another contender for third place in interest’s appraisals.

In one study (Griner & Smith, 2000), people were asked to report their appraisals of *motivational* relevance, whose definition closely resembles Lazarus’ (1991) concept of goal relevance, and interest along with boredom levels in a complex task. Results indicated higher interest and lower boredom covaried with higher motivational relevance in line with hypothesized predictions, supporting the idea that personality-based constructs moderate appraisals as well as the possibility of an appraisal-emotion connection between relevance and interest.

In the context of the present research, appraisals of goal relevance were shown to be strong predictors of interest across the sample ($N = 65$; $p < .001$). Additional statistical analysis indicated goal relevance’s effects were independent. Given this statistical significance, the above possibilities regarding personality, relevance, and interest should be considered. It may be that while the functional account of interest is useful, it is incomplete since it cannot easily explain the independent influence of appraisals of goal relevance. The operation of some feature of personality could fill in the gap left by functionalism in the explanation of interest’s causes.

Notably, Silvia’s growing research program on interest and other knowledge emotions has recently expanded its investigation of the role of personality in the appraisal process. Early in this program, he used personality traits such as trait curiosity and affect (PA-NA) as checks on the strength of his two appraisals in predicting interest, and found the appraisals predicted interest across the sample for all personalities (Silvia, 2005a, 2005c). In one of the studies, trait

curiosity did predict the average within-person interest intercept ($p < .007$), but did not predict the within-person appraisal – interest slopes (2005a). These findings indicate people higher in the trait found the pictures used in the study more interesting on average, but the appraisals' within-person effects were independent of trait curiosity. This between-person effect of trait curiosity is not surprising, and fits Silvia's continued research.

In a follow-up study on trait curiosity's relationship to interest, Silvia (2008a) concluded the trait is related to interest because it shares one of interest's appraisals as its own appraisal basis – coping potential. In other words, people high in trait curiosity are more likely to make appraisals that they can understand an object of study. This study also found that for people high and low in trait curiosity, the same appraisals still generated interest – novelty-complexity and coping potential – leading Silvia to conclude that “curious people differ in the amount of appraisal rather than in the kinds of appraisals relevant to interest” (p. 94).

In a more recent study, Silvia and colleagues (Silvia et al., 2009) further examined the role of personality in appraisal structures. Using multilevel mixture modeling, the researchers found that for two-thirds of the sample novelty-complexity appraisals had a stronger effect on interest, while for one-third coping potential had a stronger effect. The larger group turned out to be significantly higher in several “appetitive” (p. 1389) personality traits: sensation-seeking, openness to experience, and trait curiosity. The researchers concluded novelty-complexity has a larger weight in generating interest for people whose personalities are high in appetitive motivation.

Silvia and colleagues described their findings as demonstrating a quantitative difference in interest's appraisal structure. Citing other recent research along with the findings from their own study, the researchers argue that appraisal structures, thanks to certain personality variables,

may include quantitative and qualitative differences. Quantitative differences are those in which one or more appraisals may have a larger weight for certain populations, while qualitative differences signify changes in which appraisals generate the emotion. For example, in a related study exploring anger's appraisal structure (Kuppens, Van Mechelen, Smits, & Ceulemans, 2007), researchers found that appraisals of "other accountability", e.g., a judgment that an event was deliberately caused, were necessary to generate anger for only part of the sample. Some participants experienced anger only on the basis of anger's other two appraisals – goal incongruence and unfairness – judgments of deliberate cause were unnecessary for them.

How does the above research relate to the present findings on goal relevance? It is possible, within the context of personality differences, that the role of this appraisal in generating interest represents *a qualitative or a quantitative difference in interest's appraisal structure*. For a qualitative difference to be present, goal relevance would be present in the appraisal structure only for some people, depending on a certain feature of their personality. In other words, certain populations would only require novelty-complexity and coping potential to experience interest, while for others, relevance to one or more personal goals is needed as well. The highly curious represent a suitable population for such research. On the one hand, this interpretation seems to fit common observation. It makes sense that people who are very curious by nature would experience continual stirrings of interest in a variety of objects and events regardless of their relevance to a particular personal goal. However, three pertinent statistical findings from the present research show mixed results regarding this question.

Trait curiosity exhibited a significant, moderate relationship with goal relevance at Time 2 ($r = .384; p = .002$). Also, ANCOVA analysis of goal relevance appraisals at Time 2 showed trait curiosity significantly covaried with this variable ($p = .002$). However, at a within-person

level, a repeated measures ANCOVA revealed trait curiosity did not covary significantly with goal relevance ($p = .098$). In the final analysis regarding the possibility highly curious people do not need goal relevance, the present research is not an adequate measure. Since the study relied on only one object of potential interest, people high in trait curiosity could have experienced interest and found the article topic relevant to personal goals, while not requiring this relevance to be interested. Since the study only sampled psychology majors, the experimental article's discussion of free will and determinism may have been rated as relevant to personal goals to a higher degree than if other majors were sampled, which would reinforce this idea. Additional research using multiple objects of study and a more suitable statistical technique such as multilevel mixture modeling are required for initial validation of such a qualitative difference in interest's appraisal structure.

Until a solid empirical basis exists for concluding that goal relevance is unnecessary for some populations, the possibility of a quantitative difference in interest's appraisal structure must also be considered. This interpretation suggests that goal relevance belongs in the structure across populations, but is present to greater or lesser degrees depending on certain personality features. Constructs such as *achievement need* (McClelland, 1965) offer possibilities for testing the variability of goal relevance across populations. Similar research to that recommended above, involving multilevel mixture modeling and multiple objects, is needed before judgments can be made about the possibility of a quantitative difference as well.

Other explanations for the results regarding goal relevance worthy of consideration are variability in the classes of objects of study or in task duration. The first possibility exists because Silvia's appraisal model has only been tested so far with polygons, paintings, and poems, not with expository text or other additional objects. However, his research has shown the

model to be robust to a reasonable degree of variability in object characteristics so far (e.g., polygons and poems share few of the same features beyond a reliance on visual imagery as a means of comprehension). Also, on the basis of his synthesis of the interest literature reviewed in Chapter Two, the researcher has argued for a reductive and parsimonious explanation of the experiencing of interest as opposed to theories which propose multiple types of interest. Therefore, variability in task duration seems the more likely of these two explanations.

At first glance, this explanation's reliance on time may make it seem related to the situational (e.g., momentary) versus individual (e.g., enduring) interest literature, which would represent a return to theories allowing for multiple types of interest. That is not what is being proposed here, however. Instead, the researcher proposes goal relevance may represent *a qualitative and quantitative difference in interest's appraisal structure on the basis of task duration*. Simply put, for objects and events prompting or requiring only a sudden response for some sort of conclusive judgment, novelty-complexity and coping potential are enough, e.g., walking past a photograph on the wall or driving past the scene of a construction site. Goal relevance would play perhaps no role at all given the circumstances of one's appraisal process. When instead the percipient is reading a challenging expository text over a span of, say, twenty minutes, the extended appraisal process would allow for continual references to the relevance of the text to one's personal goals as a contributing factor in the experiencing of interest.

Scherer's (2001) work on appraisals provides partial support for this proposed interaction among interest's appraisals. He describes several different varieties and intensities of novelty checks on a stimulus, but argues that novelty-checking begins with sensory-driven *suddenness detection* as an initial check that is especially triggered by the abrupt onset of a reasonably intense stimulus (novelty-checking may become more complex in character and mental output

with more time invested). Significantly, he places novelty-checking as occurring (or beginning) in the first of four sequential phases of appraisal checks. In the second phase, Scherer places a *goal conduciveness* check, which is described as a subjective judgment that a stimulus event will facilitate “further goal-directed action” (p. 96). This definition is similar to both goal congruence and goal relevance, and resembles the researcher’s third appraisal in that the act of reading text and finding it “personally important” could also be construed as finding the text related to “goal-directed action”. The most significant points in intersection with the above research by Scherer is his placement of goal conduciveness in a timeline after at least initial novelty checks, and his articulation of the appraisal process in general as one in which “appraisal components are loosely and dynamically coupled”, e.g., goal relevance would not need to occur in every instance in which a stimulus event generates interest for it to still be included as a *bona fide* appraisal (Scherer cited in Silvia et al., 2009, p. 1401).

Interest must endure throughout the twenty minutes for ratings to reflect high interest at the end of this period. How is this interest maintained? Silvia’s previous research cannot completely address this question. His research with polygons and paintings required momentary visual scans, not sustained reflection. The task of reading a poem is closer to the demands of reading challenging expository text, but one of the poems used in Silvia’s previous research (2005c) was only 117 words long and specifically composed and organized in short, choppy sentence fragments to emphasize the text’s highly evocative, image-laden character. What may happen is that *goal relevance appraisals occur as the demands of the task of observing and comprehending increase and extend over time*. In this manner, goal relevance contributes to positive engagement and a reason to persist in studying an object, pushing past initial impressions contributed primarily by appraisals of novelty-complexity and coping potential.

This view fits with existing theory in several aspects, two of which deserve mentioning here. Conceiving of the appraisal process as heavily influenced by time fits with Scherer's (2001) theory of appraisals occurring both as a process of multilevel sequential checking (see Chapter Two) and as a dynamic process in which a wide range of individual differences in the appraisal process is possible. Second, the aspect of the proposed appraisal process that involves positive engagement over time resembles Silvia's (2006) emotion-attribution theory, in which positive emotional responses to objects, when attributed to the object itself rather than peripheral factors create favorable attributions which lead to sustained engagement and interest over time. Relevance to personal goals could create positive feelings which in turn contribute to favorable attributions and sustained engagement.

The main point of departure between the above proposed appraisal process and Silvia's emotion-attribution theory is that the former can occur over repeat sessions of engagement or one extended session, while the latter was specifically intended to address separate sessions with the same object. A point of intersection for both versions is that they both appear to be self-propelling, a theme also asserted by Silvia (2008b) when he suggested that interest motivates people to explore, increasing the flow of new knowledge which in turn regenerates the basis for continued interest. In the interest of searching for a parsimonious treatment of interest, the researcher speculates that appraisals of goal relevance could serve as a bridge between momentary interest characterized more by the sudden novelty or newly perceived complexity of an event (Scherer, 2001, p. 95) and long-term interest characterized by sustained engagement over one or more sessions.

This view conceives of interest not as having two types – momentary and long-term – but as a singular construct operating on a continuum of time along which quantitative (and perhaps

qualitative when the event is perceived very suddenly and/or lends itself to rapid evaluation) differences in appraisal structure account for variability in the relative weights of the three appraisals at a particular point on the continuum. Goal relevance serves as the bridge uniting both ends of the continuum into a singular construct by fading into relative obscurity as one travels toward the momentary duration end of the line, and increasing in prominence as one heads in the opposite direction toward extended duration. This continuum, which relies on a three-appraisal structure of interest indicated by the present research, also offers the beginnings of an outline of interest's appraisal process, in which appraisals change in their relative weights according to task duration.

This process can encompass Silvia's emotion-attribution theory of extended interest because appraisals of goal relevance are conceived as the staying power of long-term interest over one or more sessions of engagement. Relevance to one's personal goals justifies the heavier investment of resources necessary for extended engagement, and can contribute to positive feelings which create opportunities for positive attributions and a reason to stick with or return to the assumed source of the positive feelings. Significantly, Silvia reports that his emotion-attribution theory can account for the stability or change in enduring interests because it depends on the effects of emotional feedback from continued experience with the object, which may or may not change. The feedback is a product of the level of interest in the most recent engagement with the object, and of the attribution formed about the cause of this emotional response of interest. In the researcher's proposed appraisal process, lowered goal relevance weakens interest levels, lessens the positive feelings associated with the object, and if attributions point to the object as the source of the emotional downturn – enduring interest is likely to dissipate. Of course, changes in novelty-complexity and coping potential appraisals will affect momentary

interest levels and resulting attributions as well. It may be that the three appraisals share additional connections to each other beyond just being independent contributors to interest.

Silvia (2006) warned against imposing a zero-sum relationship on novelty-complexity and coping potential, e.g., an “inverted-U function” (p. 63) in which higher novelty-complexity automatically lowers coping potential. His advice to conceive of the two as independent appraisals is well-taken based on his review of the research, but it is also surely the case that jumps in novelty or complexity *could* contribute to lowered appraisals of coping potential. The researcher would like to suggest another, collaborative relationship in which high levels of goal relevance could sustain interest when novelty-complexity and coping potential dip, and even cause the percipient to create conditions in which the appraised novelty-complexity or comprehensibility would bounce back.

An Extended Appraisal Model of Interest

The researcher’s extended model of interest (see Figure 4) retains as its core Silvia’s (2006) two-appraisal model, which relies on appraisals of novelty-complexity and coping potential for the generation of interest. Added to this basic appraisal structure is a potential third appraisal of goal relevance, defined as an evaluation of an event’s personal importance. Goal relevance’s effects were shown to be strong and independent of other appraisals. However, since the present research was designed only to measure interest in expository text in an educational context, the applicability of this third appraisal to various classes of objects is unclear.

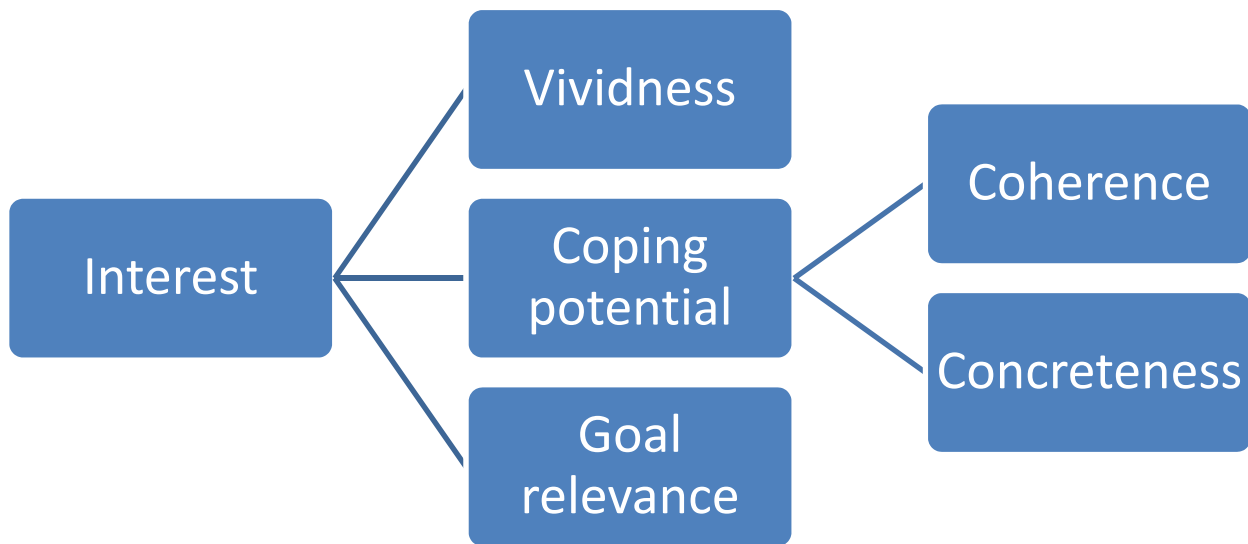


Figure 4: Extended Appraisal Model of Interest

It may be that goal relevance appraisals only predict interest in related tasks of engagement with similar objects. Of course, even if its applicability is limited, its discovery within the present research appears to contribute to a better understanding of interest in academic-oriented text at the least. Across the sample, readers who found the first third of the text highly relevant to personal goals were also highly interested in the text, to a greater degree than the other appraisals combined. The researcher also speculates that goal relevance’s explanatory power may be increased if one considers interest’s appraisal process, and not just its appraisal structure.

Given recent research on the influence of personality on appraisal-emotion relationships, the possibility is opened that one or more of interest’s three appraisals may not be present for all people, or may differ in their relative weights. Research has identified that trait curiosity affects

coping potential appraisals, but only to the degree that highly curious people are more likely to provide high ratings of coping potential than the less curious. Silvia and colleagues (Silvia et al., 2009) demonstrated that people high in appetitive motivations are likely to put greater emphasis on novelty-complexity than coping potential in the generation of interest. Goal relevance provides another opportunity for personality to modify the experiencing of interest. Achievement need has been offered as one personality construct that could affect the relative weighting of goal relevance in interest's appraisal structure. Additional measures of motivation could further illuminate goal relevance's function in interest, such as the Study of Values described in Chapter Two.

A proposed extension to interest's appraisal process is that goal relevance's weight in predicting interest would increase in proportion to the duration of and required investment in the task of engagement with an object of study. If accurate, momentary stimuli such as a brief glimpse at a photograph on a turning page of a book would not call up a significant role for goal relevance, whereas the act of pouring over a tricky essay on a complex subject would give a wider berth to the influence of goal relevance. Additional adjustments to interest's appraisal process specifically target text-based interest, in which certain key text features are most conducive to two appraisals. It is suggested that vividness, and possibly surprisingness, are text features most likely to call up novelty-complexity appraisals, while coherence and concreteness contribute most to coping potential appraisals. Significant research supports the role of these three text features in leading to high ratings for these appraisals.

In essence, this extended model contributes two important features to our understanding of interest. First, it offers additional insight into the causes of text-based interest, including three key text features and a new appraisal. Second, it suggests that in addition to a functionalist

approach to interest, which accounts for novelty-complexity and coping potential appraisals, there appears to be a role for *functional autonomy* (Allport, 1961) in the generation and function of interest as well. According to this theory, a descendent of Dewey's theory of interest (Silvia, 2006), a motive force splits off from an extrinsically driven source (e.g., basic human or survival needs) and "becomes self-sustaining" (Silvia, 2006, p. 123). These motives, which include "interests, values, and sentiments" are said to have the power to "influence the selection of information, situations, and actions, and they organize and integrate the person's style of life" (p. 123). Goal relevance fits well within the theoretical framework of functional autonomy, and would account for a diverse element of interest that enriches what the literature has already acknowledged about its universal element. This individual difference aspect relates not only to differences in people's personal goals, but may relate to variance in their reactions to the duration of task engagement, and judgments of the resources this engagement requires. The fact that it may be present to some degree across populations seems a universal feature, but differences in judgments about task duration would lead to higher or lower weight for goal relevance.

More attention in research should be devoted to exploring and validating these extensions of Silvia's model, both in the direction of interest's appraisal structure and its appraisal process. The researcher recommends manipulating the relevant text features of different texts, and collecting ratings of interest and its appraisals. Since the present research's choice in measuring learning appears to have been a reasonably useful measure of indirect learning, comprehension measures are a good choice for adding learning to such future research. Another strong choice for future research is to use multilevel mixture modeling to measure the relative weights of the three appraisals across a variety of classes of objects, to determine precisely how goal relevance

fits into the appraisal structure more broadly, and to make further progress on how important goal relevance is to understanding interest in academic material. Finally, research should also investigate the effects of task duration on interest's appraisals – it may be that the proposed continuum of time works for goal relevance appraisals, which has implications for appraisal research above and beyond the emotion of interest.

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Appendix A: Definitions of Terms

Before delving into the related literature, key constructs need to be defined, in keeping with the researcher's goal of synthesizing the disparate branches of the interest literature and helping to resolve – rather than create – confusion over theoretical formulations. The following are the terms to be briefly addressed here: appraisal, the three classes of appraisal antecedents relevant to the present study (biological, psychological, and social), emotion, interest, and motivation.

Appraisal and appraisal antecedents

Roseman and Smith (2001) have offered a very simple definition of *appraisal* that still speaks to the breadth and depth of the construct: appraisals are evaluations of events and situations that elicit emotional states. *Appraisal antecedents* are classes of environmental or representational stimuli including events such as mental images and memories (Roseman, 2001) that contribute to the formation of appraisals (Lazarus, 1991). Among these classes, three have been identified in the literature relevant to the present study although they haven't before been explicitly defined as unique terms.

Biological antecedents are ideas, events, or objects contributing to the formation of appraisals whose perceived meanings are attributed to universally inherited phylogenetic mechanisms, while *psychological* antecedents are ontogenetic in nature and attributable to individual differences in personality factors such as beliefs and values, and *social* antecedents derive from exposure to a set of social structures and shared cultural meanings (Lazarus, 1991, 1999; Lazarus, Averill, & Opton, 1970).

Emotion

Definitions of psychological terms are almost always troublesome, particularly when one is tackling overarching constructs such as emotion. Lazarus warned of such trouble regarding attempts to define emotion, but made the attempt anyway. Conceptions of emotion must give weight to behavioral impulses, patterns of bodily change, and experiential components which include subjective judgments. Additionally, these three aspects of emotional experience occur simultaneously in four contexts: individual, observational, societal, and biological/adaptational (1991). Nevertheless, Lazarus' approach is cogent and useful: "Emotions are organized psychophysiological reactions to news about ongoing relationships with the environment", in which the "quality and intensity of the emotional reaction depends on subjective evaluations – I call these cognitive appraisals" (p. 38).

Interest

This definition relates well to the conception of interest as an emotion, which is a crucial element of the present study. As such, interest must share the same qualities as other emotions and serve similar functional purposes. Significant research suggests that interest does qualify as an emotion (see Silvia, 2005c, 2006 for reviews). Borrowing from Silvia's work on interest, the following working definition of *interest* is offered: interest is an emotional state produced by appraisals of novelty-complexity and coping potential that promotes engagement with the environment to serve the functional, adaptational ends of exploration, information seeking, and learning (Silvia, 2005c, 2006).

Motivation

Finally, because interest is theoretically related to many views of motivation (Silvia, 2006) and some motivation literature is reviewed in Chapter Two, a concise definition of

motivation is offered: “Motivation is the process whereby goal-directed activity is instigated and sustained” (Pintrich & Schunk, 1996, p. 5). One advantage of adopting Silvia’s (2006) approach to interest is that it can benefit from insightful distinctions made in the literature between emotion and motivation, and move scholarship past the unfortunate blurrings among terms such as interest, motivation, and intrinsic motivation that all too often plague the literature. For example, the emotion process can be thought of as having the capacity for rapid preemptive responses in order to handle crises and opportunities, while the motivation process guides behavior through the development of goals and is characterized by more deliberate cognitive activity (Roseman, 2001). One can be motivated by interest to select and pursue a goal, and one can be motivated to keep returning to a selected source of interest, but interest itself – based on a review of the research and related studies – appears to be “hotter”, more responsive, and more transitory than expressions of motivation.

Appendix B: Example of Effects of B-P-S Appraisal Antecedents

Imagine you're driving down the interstate in your car... Suddenly, you hit the brakes as your heart starts pounding and the blood flowing into your vital organs creates a burning sensation throughout your entire body. Why? You just flew past a marked police car that had been sitting, waiting, without warning, on the green grass at a break in the concrete divider.

Biological antecedents: Taking stock of yourself rather than just allowing the emotional responses to wash over you, you realize you are fearful. Fearful of being caught speeding. *Fearful of being trapped.* Having quickly and almost unconsciously evaluated some possible near-term consequences, you find you are afraid of being trapped by those as well (e.g., the “economic” trap of a \$90 ticket, the threat imposed by more points on your driver’s license). You also sense within you an initial flare up of hot anger followed by sadness. The anger results from a sense of your potential loss of control over your near future, while the sadness stems from a sense that you may be incapable of doing anything to prevent it.

Psychological antecedents: But you are also the type of person who is both *extraverted and very open to new experiences*. Moreover, a friend just described to you the other day a “failsafe” way of talking your way out of any traffic ticket, and your fear, anger, and sadness begin to make way for a flicker of hope. You find that you're looking forward to trying this out – after all, you've got your natural persuasive abilities plus a new secret weapon.

Social antecedents: Yet, in your immediate social environment there are mixed perceptions about the police, and as a result you're confronted with several social cues that are, without your direct awareness, affecting your emotional state. On the one hand, you've been

enculturated from your youth to *respect the police*, based on cues derived from school authorities, TV, books, and your family. So in addition to your burgeoning hope, these cues from your cultural environment generate some guilt, an emotional response heightened just by seeing the uniform as the officer climbs out of the squad car. You've crossed a line, broken the law, violated a moral imperative (Lazarus, 1991). On the other hand, you belong to a subculture of peers whose perception is that *the police target and discriminate against people in your group*. Over time, you've incorporated this perception into your outlook. As a result, the presence of uniformed police also generates hot anger – “you and yours” have been demeaned (Lazarus, 1991).

Reappraisal with biological and social antecedents: Nor do the cues you're picking out of your environment merely affect you independently. These cues combine with your ongoing scan of the situation and produce new results – reappraisals and the possibility of changed or new emotional states amidst your current set of emotional responses. One such interaction of cues, for example, is supported by research showing that shorter police officers are assaulted on the job more frequently than taller officers (Gregor, 1972, cited in Barkow, Tooby, & Cosmides, 1992). So even while you are experiencing the emotional responses of fear, anger, sadness, hope, and guilt, *you have noticed now that the approaching officer is unusually short*, maybe six inches shorter than you are.

A new response is generated, momentarily dulling some of the influence of the other emotions. You sense a new aggressive response within you, cued by *an evaluation that you may have more control over the situation* than you first thought. Consequently, you experience a brief resurgence of anger and all the physiological responses that come with it – your body seems to be preparing you for action should your next move be to steamroll over the officer, verbally or

physically. However, this sequence of events is muted by yet another set of competing influences. Your upbringing includes memories of *important lessons about avoiding physical attacks on smaller, potentially weaker beings*. So what's your next move going to be? Your competing emotional states are preparing you for a variety of follow-on "action tendencies" (Roseman, 2001, p.75) of varying degrees of appropriateness. Thankfully, in the end you opt for a conciliatory opening maneuver. "What's wrong, officer?"

Appendix C: Instrument 1 (Time 1)

Please read carefully the following description of the topic of a short article.

Topic introduction: The following short article describes a debate on the topic of free will. Some scientists argue free will is an illusion, while others insist it exists. Both groups say they have evidence to support their position.

Please answer these questions based on your expectations of a short article on the above topic. Along each range, choose the number most closely matching your reaction.

1. This text will be interesting.
1 (Strongly disagree) 2 3 4 5 6 7 (Strongly agree)
2. I am curious about this topic.
1 (Strongly disagree) 2 3 4 5 6 7 (Strongly agree)
3. The ideas presented in this text will be:
1 (SIMPLE) 2 3 4 5 6 7 (COMPLEX)
4. 1 (FAMILIAR) 2 3 4 5 6 7 (UNFAMILIAR)
5. I feel I will be able to understand this text.
1 (Strongly disagree) 2 3 4 5 6 7 (Strongly agree)
6. I have a sense of what will be written about in the text.
1 (Strongly disagree) 2 3 4 5 6 7 (Strongly agree)
7. The topic of this text touches upon my personal concerns.
1 (Not at all) 2 3 4 5 6 7 (Extremely)
8. The topic of this text includes important things to think about.
1 (Not at all) 2 3 4 5 6 7 (Extremely)

Appendix D: Instrument 1 (Time 2)

You've finished part of the article. Please answer these questions based on your reading of the article so far:

1. This text is interesting.
1 (Strongly disagree) 2 3 4 5 6 7 (Strongly agree)
2. I am curious about this topic.
1 (Strongly disagree) 2 3 4 5 6 7 (Strongly agree)
3. The ideas presented in this text are:
1 (SIMPLE) 2 3 4 5 6 7 (COMPLEX)
4. 1 (FAMILIAR) 2 3 4 5 6 7 (UNFAMILIAR)
5. I feel I am able to understand this text.
1 (Strongly disagree) 2 3 4 5 6 7 (Strongly agree)
6. I have a sense of what is written about in the text.
1 (Strongly disagree) 2 3 4 5 6 7 (Strongly agree)
7. The topic of this text touches upon my personal concerns.
1 (Not at all) 2 3 4 5 6 7 (Extremely)
8. The topic of this text includes important things to think about.
1 (Not at all) 2 3 4 5 6 7 (Extremely)

Measure of Comprehension

Circle the letter with the best answer for all items. You can refer back to article as needed.

1. Laplace's claim in 1815 that all future events could be predicted is based on:
 - a) the philosophical contributions of the Greeks
 - b) conclusions drawn from physics and chemistry
 - c) the views of St. Augustine on God's omniscience
 - d) findings in biology and early neuroscientific studies

2. The newer findings of quantum physics most directly question the:
 - a) the idea that all events have pre-determined causes
 - b) beliefs of ancient thinkers in the existence of human free will
 - c) notion that neurotransmitters could fire unpredictably
 - d) findings of all recent genetic and neuroscientific studies

3. According to the article, the newer findings of quantum physics _____ the Greek belief in fate.
 - a) complement
 - b) question
 - c) underlie
 - d) are unrelated to

4. The phrase "user illusion" from the text refers to the idea that people:
 - a) are unaware of their ability to use free will
 - b) believe in a falsely created soul or "self"
 - c) pretend that events have pre-determined causes
 - d) have a "self" that is incapable of free will

5. The main point of the article is that:
 - a) science and religion will never agree with each other
 - b) ancient and modern ideas can be misleading unless we compare them
 - c) free will helps us fight the forces trying to control our choices
 - d) there is still room for free will in the modern world of ideas

6. Kant's argument that we are free to follow our moral duty to act right:
 - a) questions the beliefs of the ancient Greeks
 - b) supports the idea that people have "user illusions"
 - c) has been rejected by quantum physics
 - d) requires that pre-existing conditions dictate our choices

7. The author implies that because neurotransmitters behave unpredictably:
 - a) we can never be certain of what we think or know
 - b) the existence of free will can never be proven
 - c) free will is possible from a scientific perspective
 - d) pre-existing conditions have more control over our choices

8. In the article, an exclusive reliance on biological causes of behavior most closely fits the views of:
 - a) Enlightenment thought
 - b) quantum physics
 - c) determinism
 - d) Kantian philosophy

9. The author of the article implies that the move to eliminate the "self" and free will is:
 - a) long overdue
 - b) totally unwarranted
 - c) scientifically sound
 - d) religiously motivated

10. The author of the article implies the debate over free will's existence is:
- a) only a recent phenomenon
 - b) over due to the latest scientific advances
 - c) unlikely to ever be completely resolved
 - d) irrelevant since there is no "self"
11. By using the phrase "everything for a reason", the ancient Greek Leucippus displayed his belief in:
- a) free will
 - b) the "self" or soul
 - c) determinism
 - d) the Law of Necessity
12. According to the article, it is most accurate to say the ancient Greeks believed that choices were:
- a) possible only for the gods
 - b) restricted by one's station in life
 - c) a function of one's moral duty
 - d) foretold and never free
13. Greek thought, as represented by the story of Oedipus, has the most in common with the:
- a) conclusions of Schwartz
 - b) views of St. Augustine
 - c) claims of Laplace
 - d) philosophy of Kant
14. According to the article, the idea that conditions, not choices, produced all events led to:
- a) significant advances in neuroscientific theory
 - b) ideas that people are free to follow their moral duty
 - c) widespread disbelief in free will and the "self"
 - d) widespread belief in God's omniscience

15. The author of this article is most likely to support the idea that there is a real “you”, but that the “you” is:
- a) hidden in an organ of the brain
 - b) not a biological organ
 - c) best thought of as a “user illusion”
 - d) not capable of free choices
16. The author indicated surprise at Laplace’s claim that all future world events could be predicted. The author’s surprise was most likely due to:
- a) Laplace’s background in philosophy
 - b) the complexity of the world by 1815
 - c) the inabilities of the French in science
 - d) Laplace’s belief in free moral choices
17. Scholars like Jeffrey Schwartz still support free will, and oppose determinism. According to them, modern arguments for determinism are primarily based on:
- a) religious beliefs
 - b) unscientific bias
 - c) Greek philosophy
 - d) quantum physics
18. The most significant conclusion readers can draw from quantum physics is that:
- a) the brain is a totally predictable organ
 - b) decisions aren’t pre-determined
 - c) neurotransmitters can be isolated
 - d) decisions are made by neurons

END OF TEST. GO ON TO THE NEXT PAGE.

Appendix F: Measures of Control Variables (Instrument 3)

Measure of Trait Curiosity

Rate the statements below for how accurately they reflect the way you generally feel and behave. Do not rate what you think you should do, or wish you do, or things you no longer do. Please be as honest as possible. Place your rating in the blank space at the end of each statement.

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

1. I actively seek as much information as I can in new situations. ____
2. I am the type of person who really enjoys the uncertainty of everyday life. ____
3. I am at my best when doing something that is complex or challenging. ____
4. Everywhere I go, I am out looking for new things or experiences. ____
5. I view challenging situations as an opportunity to grow and learn. ____
6. I like to do things that are a little frightening. ____
7. I am always looking for experiences that challenge how I think about myself and the world. ____
8. I prefer jobs that are excitingly unpredictable. ____
9. I frequently seek out opportunities to challenge myself and grow as a person. ____
10. I am the kind of person who embraces unfamiliar people, events, and places. ____

BARSCH LEARNING STYLE INVENTORY

Please circle the appropriate frequency after each statement.

- | | | | |
|--|-------|-----------|--------|
| 1. Follow written directions better than oral directions. | Often | Sometimes | Seldom |
| 2. Like to write things down or take notes for a visual review. | Often | Sometimes | Seldom |
| 3. Are skillful with and enjoy developing and making graphs and charts. | Often | Sometimes | Seldom |
| 4. Can understand and follow directions on maps. | Often | Sometimes | Seldom |
| 5. Can better understand a news article by reading about it in the paper than by listening to radio. | Often | Sometimes | Seldom |
| 6. Feel the best way to remember is to picture it in your head. | Often | Sometimes | Seldom |
| 7. Grip objects in hands during learning period. | Often | Sometimes | Seldom |
| 8. Obtain information on an interesting subject by reading relevant materials. | Often | Sometimes | Seldom |

Science in Doubt Over Free Will

“Willpower as a cause of behavior is a myth”, according to professor of clinical psychology Michael Lowe. People naturally like to think they make decisions in life – that they have free will to make at least some choices. But some experts such as Lowe are convinced the human body behaves on its own according to its design on the basis of genetic coding quite nicely without interference from a controlling entity.

The scientific advances of the last twenty years have led many scientists to make declarations similar to Lowe’s. In their view, natural processes are the only factors with identifiable causal roles in human activity. They argue the more experts learn about chemical and biological processes, the more it’s shown that everything will be able to be explained by certain logical causes. Human beings are subject to forces beyond their individual control that determine their behavior.

Neuroscientist Robert Doty agrees. He explains all human behavior to be the consequences of prior brain activity. In an overall sense, these scientists argue that genes and environment are responsible for everything people do. In other words, the environment places certain conditions or controls on the human body, and the genetic coding of the human body determines the optimal reactions to these conditions or controls. Some of these scientists have summarily dismissed the idea of a “self”. They say there’s no individual entity anymore that is distinct from a complex arrangement of biological organs.

The challenge for determining whether or not people have a self is that no one has established ideal criteria for proving or disproving the existence of a self in or out of the body. If it’s accurate that humans are merely and only physical and the whole human “isn’t greater than its parts”, when people think they have decided on and done something, it really wasn’t them after all. As scholar Daniel Dennett points out, genetic coding dictated our responses, or “our genes made us do it”.

Instead, evolutionary development has created for people an illusion that they exist in any distinct sense from physical organs. And if there’s no “person” defining each human being beyond biological parts, there can’t be willpower or free will. It is the body that is in control. According to this view, the message that people have an identity independent of the body comes

from a mechanism that evolved within the human body. The mechanism convinces us there is a disembodied identity that exists and actually dictates the body's behavior.

Other scholars disagree. They argue free will is still compatible with the latest scientific findings. Disagreeing with the concept that the universe is a "closed" system, in which logically connected processes of cause-effect determine all outcomes, the objectors think new discoveries suggest the likelihood of indeterminism – effects are subject to multiple potential causes.

Are human beings just highly complex physical arrangements of biological organs with no ability to alter the course of future events? Are they mere responders to environmental challenges, programmed to behave in predetermined ways according to the inter-related activity of genetic codes? Or are they something more – beings with the capability to choose from among numerous possibilities? Are they selves with an independently functioning, undetermined will?

BREAK

In our past there may not have been as much debate over whether there was such a thing as the "self". But uncertainty over free will's existence has been around for a long time. Like today, the ancient and Enlightenment worlds could not agree on this issue.

Some say the idea of an unavoidable, unforgiving "Fate" originated with the Greeks. The Greek philosopher Leucippus said "Nothing happens at random, but everything for a reason and by necessity". This is supposed to be the first statement of the doctrine of *universal determinism*, the view that every event has a pre-determined natural, material cause that has nothing to do with choices or freedom.

Since such events are the only possible outcome from pre-existing conditions, these events are "determined" – no alternative outcomes, or choices, are possible. So much for free will. But that was precisely the message of the Greeks – whatever you do, you can't escape your fate.

As primitive an idea as this seems, hundreds of years and many scientific advances later many scholars were still saying the exact same thing. According to French Enlightenment thinker Simon Laplace, if you could have knowledge of every event occurring on earth at one particular moment, you would be able to predict every future event in the entire history of the world.

That's some claim for the year 1815 – I'm sure the world already must have seemed exceedingly complex at that time. But discoveries in physics and chemistry suggested to many people that any event could be foretold by examining the conditions prior to the event. The next logical step, which many took at the time, was to assume that *conditions*, not choices among several possibilities, determined outcomes. It was the same for human beings as well as inorganic matter. Free will had to be an illusion.

But not everyone agreed with this, in the ancient world or during the Enlightenment. For instance, consider the philosopher Saint Augustine. He fought strongly for the idea that we are still free to make choices in our lives. Then there's Enlightenment philosopher Immanuel Kant.

Kant was well aware of the discoveries of the hard sciences since Augustine's time. Despite this knowledge of the physical laws of the universe, he argued free will still existed. According to him, people are responsible for behaving morally because we have a duty to act the way we want everyone else to act. If we are free to make this choice to do the right thing, we must have free will.

But arguments like Augustine's and Kant's have been pushed to the background of modern science, casualties of our current knowledge of the human brain. Most of the voices in neuroscience have publicly concluded that physical cooperation between genes and neurons causes one-hundred percent of our behavior – all of it. That's why Dennett calls our apparently mistaken view that we are a person with a conscious will a “user illusion”.

Surprisingly, a few scholars strongly object to this conclusion from neuroscientific findings, accusing proponents of basing their claims on unproven assumptions, not hard evidence. These objectors find room within science for the possibility that a self exists. UCLA psychiatry professor Jeffrey Schwartz says the move to eliminate self and free will is biased and unscientific. Lowe, Rosen, Dennett, and others may be relying on an outdated idea from classical physics – that all events have a pre-determined material cause. But nowadays actual physicists don't accept this idea anymore.

The new “quantum” physics of the last eighty years, according to Schwartz, shows there is too much uncertainty in physical events and within the human brain to ever say that all events have pre-determined causes. Schwartz says humans are free to choose what they pay attention to. He says the laws of the new physics confirm that these decisions, even though they end up as brain outputs, can be real choices – the outcome hasn't already been determined by brain functions or anything else.

Therefore, “something” other than brain processes appears to be doing the choosing that affects our behavior. Stripped down to its basics, behavior-causing neurotransmitters in our brains can either fire – or not fire. According to quantum physics, no study will ever be able to predict whether they will fire or not. Consequently, says Schwartz, it's entirely possible this “something” is the elusive self, which includes a mind that can affect the brain.

And he's not alone. Physicists like John Polkinghorne, geneticists like Michael Collins, former head of the Genome Project, and neuroscientists like Mario Beauregard all assert there is room in modern science for a mind, a self, and room for free will.

Science's Civil War Over Free Will

“Willpower as a cause of behavior is a myth,” states clinical psychology professor Michael Lowe. We human beings like to think we're in charge of our lives and choices – that we have a soul or mind of our own that has free will. But in that one sentence above, Lowe tells us we don't. And he isn't alone.

There's a growing clamor of experts suggesting he's right. In the words of psychology professor James Rosen, “there is no magical stuff called willpower that should somehow override nature”. Neuroscientist Robert Doty agrees. He explains all human behavior as the result of prior brain activity. In other words, what neurons do dictates the actions we take, and we have no control over our own neurons.

This disregard of the concept of free will is nothing new. There's the old Greek story of Oedipus – the sad, incestuous king who in a rage blinded himself with hairpins. In Sophocles' play, just after Oedipus' birth it is foretold he will kill his father and marry his mother, destroying the future of three lives. Fearing the prophecy, his parents abandon him to die in the wilderness, but he is rescued and matures, unaware of his identity. After he learns of the prophecy, he tries to avoid this tragic future at every turn.

But fate must claim its victim. As Oedipus is walking down the street, an arrogant king being carried on a litter demands Oedipus move out of the way. In the street brawl that follows, the outnumbered Oedipus defends himself by running the king (his father) through the heart with the king's own lance. When he visits the king's castle to claim the widowed queen for his bride, he unwittingly fulfills the second half of the prophecy – he marries his mother.

The Greek idea of a controlling Fate has now been replaced by the scientific idea of a controlling Nature. But the effects are the same – no free will allowed. If that's true, genes and environment cause everything we do. Some experts have even dismissed the idea of a “self”.

According to them, there is no “you” or “me” – only brain wiring. And if there's no “self” that defines each of us beyond our biological parts, there can't be willpower or free will. We're just living out a script. As scholar Daniel Dennett explains, “our genes made us do it”. On the other side of the argument, however, a handful of scholars disagree.

They argue free will is entirely possible. In their view, the efforts of Lowe, Doty, and others to label free will as a myth is a crusade based on personal prejudice – not evidence. In an act of open defiance against the scientific establishment, they are researching the possibility that free will can be scientifically demonstrated.

As to who will win this struggle, or if the truth will surface above the rubble on the battlefield – no one can say. Are we just a complex stack of biological parts with no ability to change the path

in front of us? Or is each of us a self with a will of our own? Until a decision is made, this civil war over free will continues to threaten prospects for the unity of scientific thought.

BREAK

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