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Chapter 4 – Generating and Sustaining Attention

Forethought

Is curiosity a good thing?

Figure 4.1. Attitudes Toward Curiosity.

What do you think about this? Do you have an opinion one way or the other?

Introduction

A few years ago I would announce in my motivation classes that the study of curiosity had been neglected in the educational and psychological literature. But, that seems to have changed! Maybe it's because of the re-emergence of interest in multimedia, increased concerns about decreases in invention and patent applications in our society, or just because researchers have regained interest in this topic. Whatever the reason, this chapter tries to capture essential information about the concept of curiosity and the related concepts of boredom and sensation seeking. Following this review, the latter part of the chapter contains guidance for applying this knowledge. It describes three major subcategories of curiosity, or the broader concept of attention, and lists a selection of principles and strategies for generating and sustaining learners' attention and curiosity.

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Psychological Basis for Attention

Learner attention is necessary for both motivation and learning. In motivation the issue is with how to **stimulate** and **sustain** the learner's attention. In learning, the concern is with how to **direct** the learner's attention to the concepts, rules, skills, or facts to be learned. In that regard, consideration is given to providing cues and prompts that will signal the key elements of instruction to the learners. In the context of motivation, and in particular within the ARCS model, the term *attention* represents a synthesis of several related concepts including arousal theory, curiosity, boredom, and sensation seeking. Most of the early research in these areas was done in the 1950s and 1960s (Berlyne, 1954b; Maw & Maw, 1966; Schachter, 1964; Zuckerman, 1971). For several decades there was little research on these topics, but there seems to be a resurgence of interest (Lowenstein, 1994; Renninger, Hidi, & Krapp, 1992). This is timely and relevant because of the contemporary interest in multimedia instruction, web-based instruction, and other forms of e-learning. In all of these delivery systems it is challenging to find and employ techniques for getting and keeping attention without distracting students from effective learning (Harp & Mayer, 1998).

Arousal Theory and Early Concepts

Arousal theory represents an effort to explain how behavior is activated and how it changes as one's arousal level changes. Much of the research and theory in this area is physiological. It attempts to understand how various bodily functions and systems function in relation to levels of arousal (Hebb, 1955) and stress (Selye, 1973). However, there are also formulations of arousal theory that involve both physiological arousal and cognitive attributions (Schachter, 1964). Arousal is assumed to be on a continuum ranging from very low levels, such as sleep, to extremely high levels of stress which can be expressed actively in emotional behavior such as rage or its opposite which would be paralyzing fear. However, the changes in behavior are not considered to be a linear, steadily progressing, increase in motivation and performance as arousal increases. The pattern is generally considered to be curvilinear in keeping with the Yerkes–Dodson Law, also known as the inverted-U curve (see Chapter 2). This pattern of low levels of arousal being associated with low levels of performance extending through a phase of optimal arousal and performance to a decline in performance resulting from excessive stress is an important component of the ARCS model. In particular, as was briefly illustrated in Chapter 3, Figures 3.3 and 3.4, this concept provides a basis for audience analysis and is also useful in helping to decide what types of motivational tactics to use. When analyzing learners and trying to identify specific problems, it is necessary to consider both the low motivation side of the curve and the high stress side. Both can result in less than optimal performance and disruptive behavior by students.

Curiosity

What is *curiosity*? On the one hand, everyone understands intuitively what it means to be curious, but on the other hand, we can find very different ideas about this concept. For example, consider the following perspectives:

- After the Olympian gods led by Zeus defeated the Titans, as told in the ancient Greek myth, *Pandora's Box*, Zeus created a man to live on the earth and have dominion over it and all its creatures. His name was Epimetheus and as time went by, his actions became totally predictable to the gods and to himself giving rise to high levels of boredom. So, in consultation with Poseidon, the god of the sea, Zeus decided to create a woman who would be like Epimetheus yet unlike him. He said, ''Poseidon, this creature must be different in every way from man. Where man is hard, she will be soft. Where man is strong she will be weak. Where man is foolish, she will be wise. Where man is brave she will be timid. Where man shall be scared she will be brave'' (Hoffman, 2007). After a time, boredom arose once again. This time, Zeus summoned Hades, the god of the underworld and asked him to gather the sprites, which are spirit-like creatures, of everything he could find in all the dark places (disease, hunger, hopelessness, cruelty, etc.). Zeus put these sprites into a beautifully decorated, sealed box which was carried to earth by an avatar in the form of a man. This man encountered Epimetheus and Pandora and asked them to watch over his heavy box because he had to hurry along on his journey. He cautioned them not to look inside the box or there would be terrible consequences. Eventually, Pandora's curiosity overwhelmed her and she opened it. Immediately almost all of the creatures swarmed out of the box, biting and nipping at her and then Epimetheus as they flew away. One of the sprites that had remained in the box came to Pandora, touched each hurt, and healed it. Then the sprite entered into Pandora's heart and gave her the gift of hope. This made Pandora realize that even though she could not undo the damage and pain she had caused, she could make it easier through the knowledge that one can have hope.
- Aristotle, as translated by Wheelwright (1951), begins *The Metaphysics* by saying, ''all men [sic] by nature have a desire for knowledge.'' He goes on to say that this is evidenced by the joy we derive from our perceptions and insights quite apart from any practical benefits they might have.
- William James (1890) talked about there being two kinds of curiosity. The first is physiologically based as an instinct that is aroused by partially perceived, unexpected, or startling stimuli in the environment. The second is more cognitively based, such as scientific curiosity or metaphysical wonder.
- Berlyne (1954b) says that curiosity is a drive that is aroused by a stimulus such as a question and is reduced when the question or other stimulus event is resolved (Berlyne, 1954b).

What can you infer from these various conceptions of curiosity? Is it an innate drive, like hunger, that is activated when the appropriate stimuli are present and disappears when the body or mind's needs are met? Is it a self-activated behavior that arises because it is a pleasurable activity that is not satiated by success; that is, successful excursions of curiosity lead to increased amounts of curiosity-focused behavior? And, is curiosity a trait that works to the benefit of mankind, or is it a dangerous trait that must be managed carefully? In other words, is curiosity voluntary, a self-initiated quest for knowledge or an innate instinct or drive born of a need to resolve conflicts? And, is it a pleasurable state which also has positive benefits for mankind, or is it an unpleasant state and perhaps fundamentally evil force? Now, it is easy to see why the young woman in Figure 4.1 became so confused after being so confident!

Conceptual Foundations of Curiosity

All of these perspectives are represented in the study of curiosity, just as they are represented in the history of myth and philosophy. With regard to the psychological study of curiosity, there are basically three theoretical perspectives. The first is drive theory which assumes that curiosity results in a state of arousal which is considered to be aversive, or unpleasant, and results in exploratory behavior aimed at resolving the situation that led to curiosity arousal. The second is incongruity theory which assumes that curiosity is stimulated by perceived incongruities in the environment which, in moderate amounts, can be pleasurable, but otherwise tends to be aversive. The third perspective is based on the concept of competence in that curiosity is presumed to be a human characteristic related to the desire to achieve mastery of one's environment.

The empirical study of curiosity is relatively recent. Berlyne, who is one of the best known psychologists in this area, said (Berlyne, 1950), ''Psychology has so far had surprisingly little to say about stimuli which influence behavior simply because they are new,'' p. 68. He introduced a preliminary theory of curiosity grounded in drive theory (Hull, 1943). Berlyne proposed that when an organism perceives a novel stimulus a drive-stimulus-producing response will occur. He also proposed that after a period of time curiosity will diminish. After habituating a group of rats to their environment, an experimental box, he removed them, placed three cubes in the box with one group of rats and three rings in the box with a second group. In both cases the rats approached the objects and investigated them for a while and then ignored them. In the next step, Berlyne replaced one of the cubes with a ring and one of the rings with a cube. Again in both cases the rats investigated the new object while ignoring the familiar objects. Thus, Berlyne concluded that novelty activates the curiosity drive resulting in exploratory behavior until the stimulus is no longer perceived to be novel.

In a subsequent study Berlyne (1954a) studied more complex forms of stimulus-generated exploratory behavior which he called *epistemic*

curiosity (Berlyne, 1954b). This type of drive is aroused, for example, when a question is raised and reduced by obtaining its answer. In this study, one group of students was given a set of ''fore'' questions followed by instruction and then an after-questionnaire, while the other group was given only the instruction and after-questionnaire. He found that the pre-questions generated a higher level of curiosity and recall on the post-questions. He also found that interest was higher for questions about more familiar animals and whose concepts seemed incompatible. In this study, the preference for more questions about more familiar animals may have been due to the complexity of the study which led to excessively high levels of stress with the more unfamiliar material. However, questions and answers that had unexpected, or surprising, elements were most interesting. Thus, Berlyne found support for this more complex curiosity setting that was consistent with the earlier study; that is, curiosity was aroused by novel, unexpected stimuli and reduced after the objects or topics became familiar to the subjects.

Inherent in this theory is the notion that curiosity is stimulated by environmental stimuli. However, people may engage in exploratory behavior in the absence of a specific stimulus. Berlyne explained this by distinguishing between *specific* and *diversive* exploration (Berlyne, 1965). Specific exploration is stimulated by a novel or unexpected stimulus that results in either a reflexive response, such as a puff of air across the side of one's eyes which leads to blinking and then turning to identify the cause, or a perceived incongruity such as the blocks and rings that were presented to the rats in Berlyne's study of novelty and curiosity (Berlyne, 1950). Specific exploration, also called *perceptual curiosity*, focuses on a specific object and is information seeking. It abates when there is sufficient information to reduce the uncertainty associated with the object. Specific exploration is stimulated by what Berlyne calls the *collative variables* which refers to stimulus attributes such as novelty, change, surprisingness, incongruity, complexity, ambiguity, and indistinctness (Berlyne, 1965).

In contrast, diversive exploration results in settings that are monotonous or boring and do not have a specific object. The organism searches for anything that is interesting or novel and is not distracted by specific information gathering. Thus, diversive exploration is related more to boredom relief than to curiosity. However, the phrases ''specific curiosity'' and ''diversive curiosity'' are used in the literature. Day described specific curiosity as ''an approach and exploratory response'' that is high in collative characteristics such as novelty and ambiguity (p. 491). He also characterized a divisively curious person, as quoted in Vidler (1977), as being ''restless, easily bored, continuously seeking change, but possibly fails to concentrate on these situations until full understanding is reached'' (p. 25).

These distinctions between perceptual and epistemic curiosity and between specific and diversive exploratory behavior are well established in the literature and also fit well with our everyday experiences of being

curious. We can easily distinguish between a momentary event that captures our attention briefly until we recognize and then dismiss the source of the intrusion and the experience of having a desire to investigate a topic of interest until we find the answers we seek. We can also distinguish between a focused type of curiosity that has a specific object and casual, somewhat random, visual explorations of our environment due to monotony or boredom. Even though these concepts grew out of a drive theory orientation to the study of curiosity, they are relevant to our general experience.

Another conception of curiosity is grounded in the concept of incongruity. According to Kagan (1972) the desire to remove uncertainty is a motive. It is similar to Berlyne's concept of epistemic curiosity, but it is not the result of a state of deprivation or any tension reduction process; hence, it is not considered to be a drive. As a motive it represents a human tendency to try to make sense of the world. This motive is supported by Festinger's (1957) work on cognitive dissonance as well as gestalt psychology. Cognitive dissonance occurs when two ideas or behaviors are perceived to be inconsistent or contradictory. This creates an aversive state and activates the motive to eliminate the incongruity by removing the cause of the discrepancy or modifying one's cognitive interpretations of the situation. For example, if a young boy believes that his father is strong and self-controlled, but observes his father losing his temper at his Little League ball game, yelling at the umpire, and being told to leave the ball field, the boy is in a state of cognitive dissonance. He can resolve the situation by modifying his concept of his father's character or by justifying his father's behavior as an expression of his father's principles regarding football games.

This assumption of a human motive to make sense of the world is also a cardinal principle of gestalt psychology which was founded in Germany in 1912 by Max Wertheimer (Koffka, 1935). With many experiments, they demonstrated that the whole can be more than the sum of its parts due to human tendencies to close gaps by organizing their perceptions into meaningful and familiar shapes and patterns. For example, they would present a line in the shape of a circle but with the two ends not touching each other. In recall tests, subjects tended to draw a complete circle. Even though this school of psychology is no longer active other than in the study of perception (Banks & Krajicek, 1991), its basic principles, like those of cognitive dissonance, are consistent with and support the incongruity theory of curiosity. Other researchers whose theory and experiments support this perspective, as described by Lowenstein (1994), include Hebb, Piaget, and Hunt.

A third theoretical perspective is also based on curiosity as a motive rather than a drive and focuses on human beings' desires to be competent and achieve mastery of their environment. It is reflected in the often cited description of curiosity provided by Maw and Maw (1964). Based on their review of existing literature on the topic and investigations with elementary school children, they concluded that curiosity is manifested when a person

1. reacts positively to new, strange, incongruous, or mysterious elements in his environment by moving toward them or manipulating them;
2. exhibits a need or a desire to know more about himself and/or his environment;
3. scans his surroundings to seek for new experiences;
4. persists in examining and exploring stimuli in order to know more about them (p. 31).

Their description of curiosity implies that it is a positive quest for knowledge and information that will answer questions, lead to deeper levels of understanding, and increase one's level of competence and mastery. This is different from both the drive theory explanations of curiosity which are grounded in the reduction of an aversive state of mind caused by uncertainty and the incongruity theory which is based upon the supposition of a motive-based behavior but still has the assumption that uncertainty is an aversive state of mind. From the perspective of motivational design, each of these theories will support certain types of analyses and strategies to be incorporated into a learning environment as will be explained later in this chapter.

Research on Curiosity

Research on curiosity includes studies designed to establish its validity as a psychological construct. These include studies to determine whether it has predictive validity; that is, do people who are higher in curiosity behave in the ways they are expected to behave relative to people low in curiosity. This research also includes studies of its concurrent and discriminate validity which determine whether curiosity is correlated with other constructs which would be expected to be correlated and not correlated with constructs that are expected to be independent from curiosity. One of the issues in establishing the validity and theoretical foundation of a construct is to answer underlying questions about what it should or should not be related to. For example, is curiosity correlated with intelligence or not? Should it be expected to be correlated? These issues are not always clear from the theoretical basis for the concept and must be determined by empirical studies. The following sections summarize some of the research findings regarding curiosity in relation to intelligence, learning, parental attitudes, schooling, self-concept, creativity, tolerance for ambiguity and perceptual rigidity, achievement, motivation, and anxiety.

Curiosity and Intelligence

One would expect curiosity to be positively related to intelligence, because we think of people with high levels of curiosity as being more inquisitive and having a higher desire to learn new things. However, the research has not demonstrated that there is a particularly strong

relationship between curiosity and intelligence. Maw & Maw (1964) found significant but moderate correlations, ranging from 0.43 to 0.67, between IQ as measured by the Lorge–Thorndike Intelligence test and teacher judgments of curiosity for 148 5th graders in five different classes. The correlations of IQ with peer judgments of curiosity among the same 5th graders were also significant, ranging from 0.32 to 0.65, but less so. This led the researchers to control for IQ in the development of their curiosity assessment development and construct validation studies.

In contrast, at about the same time, Penny and McCann (1964) found almost no relationship between curiosity and intelligence. They were developing and validating a measure of reactive curiosity which they defined as "(1) a tendency to approach and explore relatively new stimulus situations, (2) a tendency to approach and explore incongruous, complex stimuli, (3) a tendency to vary stimulation in the presence of frequently experienced stimulation" (p. 323). They wanted to distinguish between the state of being curious and actually acting on one's curiosity. In a study with 120 boys and 154 girls in the 4th, 5th, and 6th grades, they found positive but insignificant correlations ranging from 0.06 to 0.14 for the boys. The correlations for 4th and 5th grade girls were 0.03 and 0.07, respectively. The correlation for 6th grade girls was much higher (0.24) but still not significant.

Day (1968b) administered an instrument consisting of 28 visually complex patterns originally developed by Berlyne (1963) to measure specific curiosity with a large group of 7th, 8th, and 9th grade students. He found no relationship between specific curiosity and IQ ($r = -0.01$, $n = 395$). However, he (1968a) reported finding positive correlations in a number of different studies with a self-report measure of curiosity that he created and the verbal portion and total IQ scores of the WISC. In a study of curiosity and intelligence in relation to creativity, he (Day & Langevin, 1969) found no correlation between curiosity and intelligence as measured by the overall score on the Hartford–Shiply IQ test, but there was a small but significant correlation at the 0.05 level with the verbal subtest ($r = 0.26$, $n = 75$). In a study of the relationships among curiosity, test anxiety, convergent thinking, divergent thinking, and intelligence Vidler (1974) found only a small positive relationship between curiosity and intelligence that just reached significance at the 0.05 level.

In summary, the literature shows that there might be no relationship or only a moderately positive relationship between curiosity and intelligence. However, it is difficult to draw a firm conclusion because this research has used many different methods for measuring curiosity. Until there is a more consistent, widely accepted definition of curiosity, there will still be uncertainty as to how strong this relationship actually is. For the time being, it is probably best to follow the example of Maw and Maw and to control for IQ in research and development studies involving curiosity.

Curiosity and Learning

As with the relationship between curiosity and intelligence, it is logical to assume that there would be an overall positive relationship between curiosity and learning and this assumption is supported by the research. There appears to be a moderate to strong correlation of curiosity with learning and the relationship might be even stronger than with intelligence, but the research is not altogether clear on this. Maw and Maw (1961) found that delayed retention of two large samples of 5th grade students was higher for high curiosity than low curiosity children independently of IQ. Many of the high curious children with higher retention scores were below average in IQ. Caron (1963) also found a positive relationship between curiosity and learning, both rote learning and comprehension, but especially on comprehension. His measurement of curiosity was a composite score consisting of subjective expectancy for acquiring the given knowledge and degree of involvement in the learning task. He found significantly positive results with a group of 1000 college sophomores, but he also found that past academic performance was correlated with the outcome. Thus, it was clear that curiosity did make a contribution to learning in this setting.

Another relevant concern pertains to the distinction between intentional and incidental learning. Research has shown rather consistency that anxiety and other elevated drive states can result in aversive levels of anxiety which is related to reductions in the range of cue utilization in learning. This research has shown that task related learning, or intentional learning, can improve under these conditions but incidental learning decreases. Incidental learning would be facilitated by attending to cues in the learning environment that are tangential to the specific task-related demands of the learning environment. The question is, how does this relate to curiosity? The drive reduction theories consider it to be, like other drives, an aversive state. But, other theories regard it as being a motive that is characterized by positive affect and approach behaviors. Paradowski (1967) investigated this question by testing the effects of novel versus familiar stimuli on intentional and incidental learning with undergraduates who were given pictures and text of common animals and unfamiliar animals in a counterbalanced design. The unfamiliar animals were designed to arouse curiosity and he found that the high curious group scored higher on both intentional learning as tested by details about the animals and incidental learning which was tested by asking questions about the background designs and colors. These results were unexpected given the traditional drive theory explanations of curiosity which postulate that curiosity arousal creates anxiety and reduces the processing of extraneous cues and confirmed the more positive conceptions of curiosity as a motive. However, these results to not rule out that there can be both drive-induced and motive-induced aspects of curiosity.

Developmental Influences: Parental Attitudes and Schooling

As with other personality characteristics, one can question whether there are developmental influences on children's curiosity. A fairly commonly held opinion is that children are naturally curious but it becomes diminished after they are in the school system for a while. Yet, many people persist through the school system and into adulthood with high levels of curiosity. Maw and Maw (1966) asked whether there are parental attitudes that are correlated with children's levels of curiosity. Using a combination of teacher and peer judgments, they identified high and low curiosity 5th grade boys and girls in a middle-class suburban area. Parents of these children completed the Parental Attitudes Research Instrument (PARI) (Schaefer & Bell, 1958). The researchers found several relationships between parental attitudes and curiosity for boys but not for girls. The fathers of high curiosity boys scored significantly lower than fathers of low curiosity boys on fostering dependency, harsh punishment, ascendancy of husband, and suppression of sexuality. Fathers of high curiosity boys scored significantly higher than fathers of low curiosity boys on the equalitarianism subscale. Mothers of high curiosity boys scored significantly lower than mothers of low curiosity boys on three subscales: fostering dependency, excluding outside influences, and intrusiveness. No differences were found with respect to girls. However, the number of pairs of girls and parents, 30, was much smaller than with the number of boys and their parents, 57. Thus, the parents of high curiosity boys tended to support higher levels of independence, more egalitarianism among the two parents and the child, and less suppression of their gender-based behavior.

Saxe and Stollak (1971) studied the behavior of 40 1st grade boys consisting of four groups. Each group represented a specific personality characteristic (high curious and prosocial, low curious, high aggressive, and high neurotic). Each child and his mother entered a play room outfitted with a variety of familiar and novel objects and toys. Mothers were told they would be observed for the purpose of seeing how her child interacted with the toys and she could play with him or not as she chose. They found that mothers of curious high prosocial boys displayed more positive feelings, fewer restrictions, and less inattention than mothers of aggressive boys. Mothers of curious high prosocial boys also displayed more positive feelings than mothers of low curious boys and mothers' positive feelings were correlated with their boys' attentiveness, manipulation, and offering of information. A child's curiosity toward novel stimuli was most highly correlated with mother's novel curiosity. Also, there was a moderate but significant correlation between education level and quantity of question–answer interactions.

All in all, both of these studies demonstrated a clear relationship between parental attitudes and behaviors and curiosity as well as other personality characteristics. Socioeconomic factors can have an influence

but in these studies those factors did not appear to be nearly as influential as the personalities and parenting style of the mothers and fathers.

Independently of parental behaviors, questions have been raised about the influence of schools on curiosity. Curiosity tends to decline with age (Vidler, 1977) but it isn't clear whether this is due to maturation or environmental influences such as the schools. There is broad agreement that curiosity is one of the personality characteristics that should be fostered in school (Maw & Maw, 1977; Messick, 1979; Piaget, 1952; Wohlwill, 1987), yet there is evidence that teachers do not always encourage curiosity even though they say they value it. Torrance (1963) found that among teachers who say they value curiosity the students they identified as being best were not the most curious. And, Arnstine (1966) found that most classrooms do not include elements of the collative variables (novelty, paradox, surprise) that stimulate curiosity. Also, with regard to environmental influences, it might be that classrooms become less conducive to curiosity development as children progress through the grades. Several researchers have found that there is a substantial decline in the percentage of teachers in the intermediate grades who encourage expressions of curiosity compared to the primary grades (Englehard, 1985; Goodlad, 1984; Torrance, 1965). In a quasi-longitudinal study, Engelhard and Monsaas (1988) measured school-related curiosity of elementary students in grades 3, 5, and 7 in two public and one Catholic schools. There was a decrease in school-related curiosity across grade levels, but there was no influence due to type of school.

Based on the available evidence it is easy to want to blame the schools for the decreases in curiosity. As children progress through the grade levels there tends to be a stronger emphasis on getting right answers to specific questions and to acquiring established paradigms of thought. However, it isn't clear that this is a necessary condition as opposed to simply being the status quo. It would be interesting to examine classrooms that incorporate innovative educational approaches such as constructivist learning models and problem-based learning to see if there are measurable differences in levels of curiosity compared to more traditional instructivist approaches.

Curiosity and Creativity

It has been argued based on theory and conceptual definitions that there should be a relationship between curiosity and creativity (Day, 1968a) and there is some evidence to support this contention. Torrance (1969) asked a group of 75 highly gifted 6th graders to generate unusual questions about ice. One half of them had been identified by their teachers as being their most curious pupils and the other half the least curious based on a set of criteria that followed Maw and Maw's characteristics of the curious child. He asked the students to produce questions that would lead people to think about ice in new ways. One half of the children were given five minutes to

produce as many questions as they could and the other half were given small notebooks called ''Idea Traps'' to take home and bring back the next day. He found that there was no difference between groups on the number of questions produced during the timed conditions but that the low curious children actually produced slightly more divergent questions than the high curious children even though the difference was not significant. However, under the untimed, take home, conditions the high curious children produced significantly more divergent questions. This confirmed the researcher's expectation that high curious children require more time for pursuing a problem and processing it in order to produce creative results.

Several other studies tend to support the relationship between curiosity and creativity. Based on a factorial discriminant analysis conducted on a battery of tests administered to 416 5th grade boys and girls who had been rated by their teachers and peers as high or low in curiosity, Maw and Magoon (1971) found that highly curious children were also higher in creativity. The association between curiosity and creativity was also found by Vidler (1974) who obtained positive relationship between curiosity and divergent thinking which is associated with creativity. His study included 212 undergraduate students in introductory education classes. Day and Langevin (1969) found positive correlations between curiosity and two measures of creativity with 75 female undergraduate nursing students. And, in a factor analytic study of 224 5th grade boys who were classified by their teachers and peers as to curiosity level, Maw and Maw found a positive correlation between creativity and a general curiosity factor.

One of the challenges in assessing these relationships is that neither curiosity nor creativity has clear, unambiguous definitions Maw and Maw (1970a). Using discriminant function analysis, the researchers found that higher levels of curiosity were associated with effectiveness, loyalty, reliability, accountability, intelligence, creativity, social attitudes, tolerance for ambiguity, a sense of personal worth, and responsibility. These results were based on 26 different measures of cognitive abilities, personality characteristics, and social action indices.

Curiosity, Tolerance for Ambiguity, and Perceptual Rigidity

It seems that to possess high levels of curiosity one must be open to new ideas and experience and not be too upset by experiencing a fair amount of uncertainty doing so. It is difficult to avoid ambiguities and other sources of uncertainty while exercising ones curiosity. The only way to avoid this would be to already have the answers before you start and that, of course, would be contradictory to the concept of curiosity.

In some ways the relationship between curiosity and ambiguity seems to be reciprocal. Smock and Holt (1962) studied children and found differences in the type of conceptual conflict introduced by different types of stimuli with some eliciting more curiosity than others. They also found a

negative relationship between perceptual rigidity and curiosity motivation. Children with more rigid schemata tended not to perceive as much incongruity, perhaps because they were not open as much to new or discrepant information. In other words, children who were perceptually rigid avoided the unpleasantness of ambiguity by not perceiving incongruities in the same stimuli in which curious children did perceive them.

When students are comfortable with their surroundings and the nature of the learning task, they seem to be more open to expressing curiosity, probably because they have less anxiety than when the setting and task are unfamiliar or uncomfortable to them. Lenehan et al. (Lenehan, Dunn, Ingham, Signer, & Murray, 1994) found that students who were provided homework prescriptions based on their identified learning style preferences compared to a comparison group that received conventional study skill guidelines achieved higher grades, demonstrated more curiosity about science scores, and had lower anxiety and anger scores.

Curiosity, Self-Concept, and Anxiety

One can investigate the relationship between curiosity and many other personality characteristics. For example, Maw and Magoon (1971) found that higher levels of curiosity were associated with effectiveness, loyalty, reliability, accountability, intelligence, creativity, social attitudes, tolerance for ambiguity, a sense of personal worth, and responsibility. These results were based on a discriminant function analysis of 26 different measures of cognitive abilities, personality characteristics, and social action indices. However, the focus in the present setting is on relationships that are particularly useful in the context of designing and creating motivating learning environments. In addition to the relationships that have already been described, it is useful to consider curiosity in relation to self-concept, achievement motivation, and anxiety.

Self-Concept: A positive relationship between curiosity and self-concept appears to be a relatively stable finding. Maw & Maw (1970b) identified 15 high curiosity boys and 14 low curiosity boys from 19 different 5th grade classrooms. They measured a variety of factors, such as self-reliance, sense of personal worth, sense of personal freedom, feeling of belonging, and lack of withdrawing tendencies to estimate self-concept, and all of these factors were positively correlated with curiosity. Maw and Magoon (1971) found that several factors indicating positive self-concept loaded on the curiosity factor in their discriminant function analysis with a group of 5th grade boys and girls.

Anxiety: With respect to anxiety, its relationship to curiosity is usually inverse; that is, low levels of anxiety are associated with higher levels of curiosity. As Day (1968b) points out, high anxiety, especially as measured by Manifest Anxiety Scale, is associated with tendencies to withdraw from a situation and with feelings of helplessness which means that

exploratory behavior will have ceased. If the state of anxiety is strong enough, it will depress curiosity in both high curious and low curious people. Peters (1978) found that high curious college students asked questions more than three times as much as low curious students when the instructor was perceived to be nonthreatening. But in the condition where instructors were perceived to be threatening, there were no differences between the two groups.

Vidler (1974) studied the correlations among curiosity, test anxiety, convergent thinking, divergent thinking, and intelligence. He found that both convergent and divergent thinking are negatively related to test anxiety and positively related to curiosity. He also found that convergent thinking is closely connected with traditional measures of intelligence and divergent thinking with creativity. He found a negative relationship between test anxiety and intelligence. He found a small, positive relationship between creativity and intelligence. He found a moderately positive relationship between curiosity and creativity.

In summary, there are many dimensions to the concept of curiosity and this is, without a doubt, a human characteristic that is of great interest to people. Furthermore, it is clear that people are not united in a desire to promote curiosity. One of the challenges to educators and counselors is to understand the conditions that promote curiosity development in order to know how to assist clients, students, teachers, and parents in developing this important survival skill.

Boredom

Eric Fromm (1955) said, "... one of the worst forms of mental suffering is *boredom*, not knowing what to do with one's self and one's life" (p. 253) (quoted in Healy, 1979, p. 38). This thought has been expressed throughout the ages in many ways. Carl Jung, the famous psychoanalyst who was a contemporary of Freud, expressed it from a different point of view (Figure 4.2).

The human characteristic of boredom has been studied independently from the study of curiosity for the most part. But, like curiosity, the concept of boredom has been a topic of philosophical, sociological, and psychological thought for a long time! For example, boredom, or ennui, combined with anomie, which refers to feelings of normlessness or a loss of values, was a central theme in Federico Fellini's famous film "La Dolce Vita." Released in 1960 and set in the era of the 1950s closely following two world wars and when there was a constant awareness of the possibility of a nuclear holocaust, it portrays a bored group of well-to-do "drifters" who have lost faith and allegiance to the Church and other traditional values and are always searching for thrills to escape momentarily from an overriding sense of purposelessness and boredom. This group is set in contrast to an intellectual who fills his apartment with philosophers, poets, and artists,

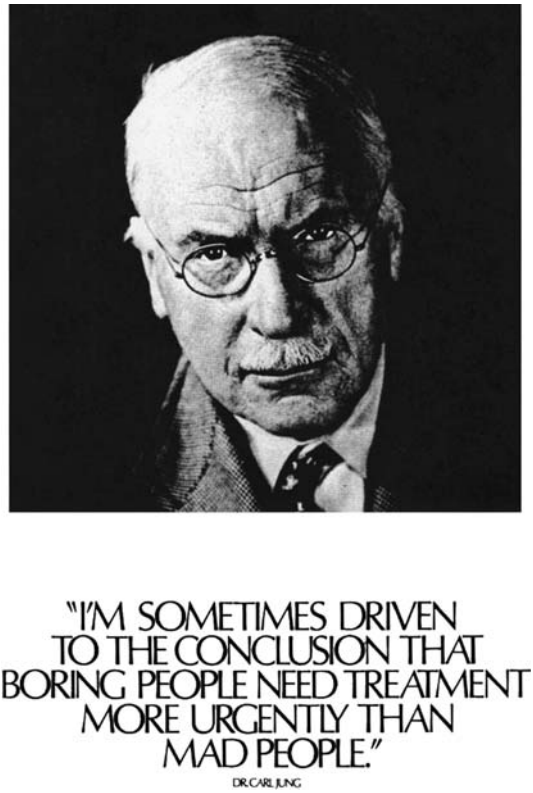

Figure 4.2. Carl Jung on Boredom (Source: Personal Collection).

but their musings are ultimately pretentious and empty resulting in a tragic action by the host. This film is considered to be brilliant and even profound as a work of cinematic art but also because of the powerful way in which it captured key sociological characteristics of this era.

This sociological perspective on concerns about disassociation and boredom is also captured in a treatise by Sean Healy called *The Roots of Boredom* (Healy, 1979). His central thesis is that although boredom has always been a topic of consideration in human affairs "its incidence and character has radically changed in the course of the last three centuries, and that what was a rarity has become a pervasive aspect of Western culture ..." (p. 1). One can wonder if Healy would draw the same conclusions today because, thanks to the many distractions offered by technology and social networking opportunities and the number of two-parent families in which both are working, people seem to be anything but bored. However, many of these alternatives to boredom might be escapist in nature rather than meaningful engagements with life and intellectual development.

These considerations, while not grounded in empirical research, are valuable in that they illustrate cultural orientations and values that influence peoples' motivation and behavior. With regard to psychological research, Geiwitz reviewed the available literature on boredom (Geiwitz, 1966) and found four constructs that tend to be mentioned in conjunction with it. The first was *arousal* which was generally considered to have an inverse correlation with boredom. In other words, low levels of arousal are associated with high levels of boredom. The second was monotony which was considered by many to be positively correlated if not actually

synonymous with boredom. However, some of the previous research found that reported levels of boredom could vary independently of the level of reported monotony but that boredom was associated with *repetitiveness* which was an element of monotony. A third construct, *constraint*, was presumed by some to be related to boredom but had not been empirically demonstrated. And, the fourth construct was *unpleasantness* or negative affect.

How is this related to schooling? Imagine sitting in a class in which you are finding it almost impossible to stay awake. Assume that it is a class that you do not want to take (unpleasantness), you can't leave until the bell rings (constraint), the teacher speaks in a monotone voice (low arousal), and is very redundant (repetitive). It is the perfect scenario to induce boredom! And sleepiness. Is this scenario realistic or an exaggeration of reality? I will let you answer that question.

As a result of his experimental study, Geiwitz (1966) found that there are differences among the four constructs with respect to their effects on boredom. After performing several episodes of a highly repetitive task (making check marks on sheets of paper) the subjects reported high levels of arousal, repetitiveness, constraint, and unpleasantness and all were significantly correlated with boredom. However, when holding three of these variables constant and studying each one independently in relation to boredom, he found that low arousal and high constraint were independently related to boredom. Unpleasantness was somewhat related to boredom when there was repetitiveness. Thus, the three conditions of low arousal, high constraint, and high unpleasantness were most closely associated with boredom.

Independently of Geiwitz's (1966) work, Mehrabian and O'Reilly (1980) proposed a similar three-dimensional model consisting of three pairs of characteristics that could be used to characterize various dimensions of temperament. They are pleasure–displeasure, arousal–nonarousal, and dominance–submissiveness, which are similar to constraint in Geiwitz's model. Examples of emotional states and their characterizations by the three sets of constructs are exuberance (pleasant, arousable, dominant); anxiousness ((unpleasant, arousable, submissive); relaxed (pleasant, unarousable, dominant); and disdainful (unpleasant, unarousable, dominant). Boredom, as characterized by Kopp (1982) is low on arousal, pleasantness, and dominance, which he called self-determination.

These studies attempted to define boredom in terms of its associated characteristics which are helpful to understanding the critical attributes of the concept. But a limitation of these definitional efforts is that they are indirect based on inferences drawn from correlations. Another direction in the study of boredom is represented by efforts to develop self-report measures that provide direct, albeit subjective, estimates of it. Vodanovich (2003) reviewed 25 years of research on the measurement of

boredom and describes several instruments that are relevant to learning and work settings.

A conclusion to be drawn from these various studies is that boredom can be conceived as being below one's optimal level of stimulation. This reductionistic representation of the concept is helpful, but it is even more helpful to have knowledge about the attributes of boredom and ways of assessing it in different settings, especially when one tries to diagnose the causes of boredom in a learning environment and design strategies to alleviate it.

Sensation Seeking

In contrast to boredom is the concept of sensation seeking (Zuckerman, 1971, 1978, 1979) which refers to the extent to which people seek unusual or novel experiences. Would you, for example, prefer to ride in a hot air balloon or watch a travelogue on your television set? High sensation seeking needs are associated with a variety of risky behaviors such as fast driving, gambling, excessive use of alcohol, promiscuousness, and even using controlled substances. But, this represents the risky extreme forms of behavior and these risky behaviors are not the goal of high sensation seekers but rather the consequences of pursuing behaviors that satisfy their desires for novelty, change, and excitement. Other forms of behavior that satisfy needs for sensation seeking include physically challenging activities such as mountain climbing or hang gliding, emotionally engaging entertainments such as horror movies or other kinds of suspense movies, high levels of social activity, and even adventure such as travel to foreign places (Zuckerman, 1979).

Traditionally, the primary method for measuring sensation seeking tendencies was with Zuckerman's "Sensation Seeking Scale" (SSS) which originally had 34 items but was later expanded to 72 items (Zuckerman, 1971). This instrument has pairs of forced-choice items which ask you to choose between such things as

a. I enter cold water gradually, giving myself time to get used to it.
b. I like to dive or jump right into the ocean or a cold pool.

Sensation seeking is not a unidimensional construct. The measurement scale provides a general SSS score as well as scores on four factors: thrill and adventure seeking, experience seeking, disinhibition, and boredom susceptibility. The propensity toward high levels of risk taking would characterize only some people and be reflected in a high score on the thrill and adventure seeking subscale. One of the subscales, boredom susceptibility, suggest that some people are motivated more by a desire to avoid boredom that to seek high levels of risk, which illustrates why there can be such a wide range of behavior among people scoring high on the SSS.

Research on both sensation seeking needs and boredom illustrate that people vary in the amount of stimulation that is optimal and that there

are both trait and state differences in these characteristics. An instructional pace that will be considered relaxing by a person low in arousal needs might be insufferably boring to a person high in sensation needs. This is another reason why audience analysis combined with variation in approach is useful in motivational design. You need to know how much variation there is in your audience, and what level of stimulation will be appropriate.

Strategies for Attention and Curiosity

By now, you know how important the category of attention is. Before any learning can take place, the learner's attention must be engaged. The best-designed instruction will be completely wasted if the learner's mind is elsewhere. Even if students want to learn, they will find it difficult if their minds are dulled by an environment that is too bland or repetitive or they are distracted by the features of an environment that is too noisy. The challenge with attention is to find the right balance of consistency, novelty, and variation for your learners, because people differ in their tolerance of stimulation. Some people get bored very quickly while others prefer a relatively more stable environment. By understanding how people differ, what tactics to use, and how to adjust the tactics for your audience, you will be able to keep them focused and interested. There are several different sub-components of attention (Table 4.1), each of which has a central question and supporting tactic that helps define it. Also, each of these is based on one of the major supporting concepts of attention. The first, perceptual arousal, is based on Berlyne's concept of the same name and incorporates other basic elements of arousal theory. The second, inquiry arousal, is directly related to Berlyne's concept of epistemic curiosity, and the third, variability, incorporates the issues surrounding boredom and sensation seeking.

Table 4.1. Subcategories, Process Questions, and Main Supporting Strategies for Attention.

Concepts & Process Questions	Main Supporting Tactics
A1. Perceptual arousal What can I do to capture their interest?	Create curiosity and wonderment by using novel approaches, injecting personal and/or emotional material.
A2. Inquiry arousal How can I stimulate an attitude of inquiry?	Increase curiosity by asking questions, creating paradoxes, generating inquiry, and nurturing thinking challenges.
A3. Variability How can I maintain their attention?	Sustain interest by variations in presentation style, concrete analogies, human interest examples, and unexpected events.

A.1. Capture Interest

> Jim began the workshop, ''Safe Operation of the Forklift Truck,'' with a true story of Fred who decided driving the forklift had to be a snap and tried it out after watching a friend drive it. Luckily Fred survived, but both the forklift and three aisles of stored merchandise were lost. Jim told the story with dramatic gestures and facial expressions, using good story-telling techniques. If available, he could have shown a video dramatization as an alternative.

An unexpected noise or movement will automatically attract a person's attention. This phenomenon can be and is used by teachers when they pause dramatically, yell ''pay attention,'' slap a book on the desk, or use any number of other tactics to regain their students' focus. However, these tactics are effective only if used sparingly and even then their effects are usually momentary. There has to be something to excite a deeper level of curiosity or the moment is lost.

Another and more powerful element of perceptual arousal is concreteness. Generally speaking, people are more interested in specific people and events than in abstractions. For example, compare the following statement

> Just before the beginning of the Revolutionary War, a famous American patriot said that people should be willing to die if necessary to obtain liberty for the citizens of this county.

to this one:

> On the eve of the Revolutionary War, the famous American patriot Patrick Henry exclaimed, ''I know not what course others may take; but as for me, give me liberty or give me death!''

Which one, in your opinion, is the more attention getting sentence? I hardly need to point out that research shows that it is the second one. It has a much higher level of interest because it mentions a specific person and contains a quotation of an emotionally charged statement of his.

All of the tactics in the following list are examples of ways to get or regain the attention of learners as a result of exciting their senses or their expectation that something interesting is going to be presented. These tactics can apply to the way you prepare printed or multimedia materials, and to your own presentation style.

1. Include references to specific people rather than ''mankind,'' ''people,'' or other such abstractions.
2. Illustrate general principles, ideas, or other abstractions with concrete examples or visualizations.

3. Make complex concepts or relationships among concepts more concrete by use of metaphors or analogies.
4. Present items in a series of list format rather than paragraph format.
5. Make step-by-step procedures or relationships among concepts more concrete by use of flow charts, storyboards, diagrams, cartoons, or other visual aids.
6. Ensure that the instructor establishes eye contact and exhibits enthusiasm.

A.2. Stimulate Inquiry

> Susan asked her students in widget production what they would do if they received a request to produce 300 widgets in two days and the electricity went off during the first afternoon.

It is critical to get students' attention, but the bigger challenge is to keep it. The learners will have a greater desire to pay attention if you can awaken a deeper level of curiosity than simply exciting their senses. The other components of motivation also contribute to maintaining learner motivation, but within the frame of reference of this category, the concept of curiosity arousal is a key element. This level of curiosity, which is called epistemic curiosity (Berlyne, 1965), occurs when you have awakened the learners' desires to know the answer to a problem, to learn something new.

There are, as with all of the categories of motivation, many ways to accomplish this goal. A good question to ask yourself is, "Can I violate the learners expectations?" Many topics can be introduced problematically; that is, in a way that arouses epistemic curiosity if you give it some thought. For example, you might say something startling such as, "Junk food is important to your diet." Then, ask the students if they know why this could be true. Afterward, explain how certain ingredients of junk food are nutritionally beneficial even though other ingredients are not, and if a person is not getting the beneficial ingredients in other parts of his or her diet, then the junk food can be beneficial. In a more advanced science class, you could present conflicting principles or facts. For example, begin a lesson on properties of light with a description of light first as a wave then as particles.

After introducing a topic in a manner that arouses epistemic curiosity, it is effective to have an assignment that allows the student to investigate the problem and produce an answer or opinion. In this way, they are learning numerous research and communication skills in addition to the content of the lesson. It would take far too much time to teach every topic in this manner, but by using this technique from time to time, you will get a higher level of inquiry-focused curiosity in the learners. The following four suggestions can help you think of ways to approach this goal:

1. Introduce or develop topics problematically (that is, stimulate a sense of inquiry by presenting a problem which the new knowledge or skill will help solve).
2. Provoke curiosity by stimulating mental conflict (for example, present facts that contradict past experience; paradoxical examples; conflicting principles or facts; or unexpected opinions).
3. Evoke a sense of mystery describing unresolved problems that may or may not have a solution.
4. Use visuals to stimulate curiosity or create mystery.

A.3. Maintain Attention

> Elaine introduced the relationship between marketing personnel and outside computer retail operators by doing the following: First she showed a video introducing retail concepts with brief examples of actual operations; second, she gave a lecturette on details of the concepts and procedures associated with them; and third, she asked the class to read and discuss a brief scenario of a problem between a marketing person and a retail operator.

What do people do when they want to go to sleep? They try to avoid any unexpected or unusual stimuli. They try to manage their environment so that it is quiet or that all the sounds are familiar. When they are young, they like for someone to read to them. The steady, quiet voice of another person lulls them to sleep.

Unfortunately, these sleep-inducing conditions are often produced in a classroom. The immobility of the students who are sitting at their desks, the absence of windows or rules prohibiting the students from noticeably looking out of them, and the regular cadences of a teacher's voice can be very effective in creating boredom and sleepiness.

This subcategory of attention refers to factors in the environment that can be used to overcome boredom and meet people's sensation seeking needs by providing changes of pace, changes in approach, and using media that provides visual or auditory appeal.

Variation in Format

1. Use white space on paper or screen space in multimedia to separate blocks of information (text and/or illustrations).
2. Use a variety of typefaces to highlight titles, quotes, rules, key words, etc., but maintain a consistent style.
3. Use variations in layout; that is, variation in spatial location of blocks of information.
4. Include variations in types of material (for example, alternations between blocks of text, figures, tables, pictures).

Variation in Style and Sequence

1. Have variation in writing function (for example, exposition, description, narration, and persuasion).
2. Include variation in tone (for example, serious, humorous, exhortation).
3. Include variation in the sequence of the elements of the instruction (for example, vary a sequence such as ''introduction,'' ''presentation,'' ''example,'' and ''exercise'' varied by changing the order, adding an extra exercise).
4. Include variation between content presentations and active response events (e.g., questions, problems, exercises, and puzzles).

Summary

The attention dimension is critical because, to state it in the extreme, students have to be awake to be motivated to learn. At the same time, they cannot be appropriately stimulated to learn if they are hyperactive. If there are too many distracting stimuli in the environment, then they need to be simplified. Once this basic level of attention is achieved, then the use of inquiry arousing activities will provide a deeper level of motivation and will lead to the next requirement, which is relevance.