DOCUMENT RESUME

ED 337 401 SO 021 509

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TITLE Visitor Learning in Museums. Curiosity and Human Development Theories: Implications for Museum Programs and Exhibit Design. Museum Studies Program. Reviews of Current Research Volume 1.
INSTITUTION Florida Univ., Gainesville. Coll. of Education.
PUB DATE 91
NOTE 45p.
PUB TYPE Information Analyses (070)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Adult Education; Child Development; *Curiosity; Developmental Psychology; Educational Facilities; *Educational Research; Elementary Secondary Education; Exhibits; *Individual Development; *Museums
IDENTIFIERS *Developmental Theory; *Museum Studies

ABSTRACT

This paper reviews human development theories that could be utilized in the study of museums as well as theories or approaches to curiosity that appear to be of significant interest for museum exhibit designers and educators. An overview of each theory is followed by a general evaluation of the theory and research that appears relevant. The implications for practice as well as potential future directions for research in informal settings also are discussed. (55 references) (DB)

VISITOR LEARNING IN MUSEUMS

Curiosity and Human Development Theories: Implications for Museum Programs and Exhibit Design

MUSEUM STUDIES PROGRAM

UNIVERSITY OF FLORIDA

REVIEWS OF CURRENT RESEARCH

VOLUME 1

SPRING, 1991

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Abstract

Museums can generally be assumed to be a place where "learning" and "instruction, education or enrichment" are expected outcomes (Booth, et al., 1982; Falk, Koran & Dierking, 1986; Grinder & McCoy, 1985; Koran & Koran, 1986; Screven, 1974). It is obvious, however, that to achieve these outcomes, programs and exhibits must "take into account the needs, interests, and abilities of the intended audience" (Miles, Alt, Gosling, Lewis, & Tout, 1988, p.#20). Understanding the learners'/visitors' needs is perhaps best underscored in the comment that "certainly visitors don't complain if they can't understand what they see" (Shettel, 1988, p.#16). For these reasons it is appropriate to examine the developmental theories that may be applicable to museum programs and exhibit design.

This paper reviews human development theories that could be utilized in the museum field as well as theories or approaches to curiosity that appear to be of significant interest for museum exhibit designers and educators. An overview of each theory will be followed by a general evaluation of the theory and research that appears relevant. The implications for practice as well as potential future directions for research in informal settings will also discussed.

Visitor Learning in Museums - Curiosity and Human Development Theories: Implications for Museum Programs and Exhibit Design

Museums and their role in the American educational and social process are best described in a general sense by Soltis (1984) who states that

> education is a social process larger than pedagogy. It is carried out by all our socially constructed means for developing social beings, from schools and churches to museums and television, to boy scouts and sports. Whatever their primary functions all such institutions educate. (p.#9)

Garfield (1989) quotes Cartwright (1939) as pointing out that the "museum fulfills its social responsibility" by "inciting" the visitor through exhibits to return for further contact with the museum (p.#100). Booth, Krockover, and Woods (1982) expand on this by stating that a major purpose of museums is "awakening visitor interest and curiosity and helping him to develop some ideas on the subject" (p.#7). UNESCO (1986) also suggests that the major responsibility of museums is "to broaden the rational basis of their (visitor's) knowledge" (p.#86). Museums therefore can generally be assumed to be a place where "learning" and "instruction, education or enrichment" are expected outcomes (Booth, et al., 1982; Falk, Koran & Dierking, 1986; Grinder & McCoy, 1985; Koran & Koran, 1986; Screven, 1974). It is obvious, however, that to achieve these outcomes, programs and exhibits must "take into account the needs, interests, and abilities of

the intended audience" (Miles, Alt, Gosling, Lewis, & Tout, 1988, p.#20).

Schouten (1987) suggests that the museum educator needs to know more about

> human development, communication theory, information processing, the nature of nonverbal learning, group dynamics, cross-cultural learning and human responses to built environments -- and he or she needs not only a general knowledge of these fields but one oriented as far as possible to the museum environment. (p.#241)

Traditional program and exhibit development, however, frequently do not take these variables into account. Curators often initiate exhibit ideas, and designers, whether in-house or out, convert the ideas of the curator into their finished product (Shettel, 1988). The need for understanding the learners'/visitors' needs is perhaps best underscored in Shettel's comment, "certainly visitors don't complain if they can't understand what they see" (p.#16). For these reasons it is appropriate to examine the developmental theories that may be applicable to museum studies.

This paper will review human development theories that could be utilized in the museum field as well as theories or approaches to curiosity that appear to be of significant interest for museum exhibit designers and educators. An overview of each theory will be followed by a a general evaluation of the theory and research that appears relevant. As a conclusion to this paper the

implications for practice as well as potential future directions for research will be discussed.

For the purposes of clarity the following definitions have been found in references used in this article:

Curiosity:

1. is the arousal state that leads to exploration, play and creativity (Cecil, Gray, Thornburg, & Ispa, 1985, p.#202). They suggest that curiosity is a prerequisite for the three other elements.
2. is not a homogeneous phenomenon but rather it implies a need for novelty, an avoidance of apparent and superficial explanations, and a tolerance of the unknown (Necka, 1989, p.#25).
3. is a broadly conceived exploratory behavior (Engelhard & Monsaas, 1988, p.#22).
4. is information gathering responses including looking, smelling, tasting, listening and touching that are coordinated with movement of the body or parts of the body. Sensory motor curiosity involves sensory motor responses directed toward objects in a designated environment (Peterson, 1979, p.#188).
5. is the desire to learn or to know about anything, inquisitiveness (Camp, 1986, p.#375).

Specific curiosity occurs when

> an individual reacts positively towards a novel and complex situation and approaches the it with the

primary intention of exploration, stimulation, reduction of uncertainty and acquisition of information. (Camp, Rodrigue, & Olson, 1984, p.#390)

Diversive curiosity is

characteristic of individuals aroused primarily by boredom and monotony. (Camp et al., 1984, p.#390)

Exploration:

1. is behavior that is the active observable investigation of objects and events (Cecil et al., 1985, p.#203).

Play:

1. is a spontaneous and positive behavior that is self-initiated and personal behavior that has a sensory motor component (Cecil et al., 1985, p.#203).

Creativity:

1. is behavior that presents an uncommon, novel approach to materials or problem solving (Cecil et al., 1985, p.#204).

Developmental Theories in general.

A review of the museum literature reveals scant information on theories of human development used in the design of museum programs and exhibits. A majority of the studies are efforts at discerning the effectiveness of museum exhibits or learning outcomes (Bitgood, 1988; Grinder & McCoy, 1985; Korn, 1988; Loomis, 1973, 1987; Shettel, 1988; Wolf, Andis, Tisdall, & Tymitz, 1979). Shettel (1988) summarized the fundamental

criteria used in the development of exhibits and which covers most programs including educaticnal programs.

1. "Accuracy and completeness of the subject matter" of the program or exhibit.
2. "Quality of the subjects on display" - usually objects.
3. "The fit and finish of the exhibit."
4. "The use of "high-tech" devices"."
5. "Visitor acceptance" - based on attendance usually.
6. "Peer acceptance" (Shettel suggests this "counts more than visitor acceptance)." (p.#26)

Historically museum evaluation appears to be associated with an effort to define the visitor or user of museums and their exhibits. There also appears to be a common thread in most case studies to determine the educational value of the museum (Loomis, 1987).

Are there developmental theories then, that have applicability to the museum field? Miles (1988) in his book entitled The Design of Educational Exhibits offers no clues as to theories of development that might be of value to the museum educator/designer. Perrot (1980) suggests a theoretical directio when he recommends that museums should be "accessible so that, at the earliest stages of development, the tangible truths within them can serve to enhance the child's exploration, discovery and learning" (p.#19). He further goes on to imply some form of developmental consideration in suggesting that the process "starts with the beginning of consciousness and mobility" and which "should extend through the rest of one's life"

(p.#19). A UNESCO (1973) publication on a conference on museums and education raises the issue of age-related differences with the recommendation that intensive educational programs should not be done for children under the age of 15 because "their background and powers of absorption are too limited" (p.#137). Cohen (1987) infers a link to Piagetian theories when he discusses the emerging concepts of "participatory experiences" (p.#16). In particular he is referring to the relationship of the physical environment to child development. Waterfall and Grusin (1989) raise the developmental question in their discussion of when it is appropriate to begin taking children to the museum. They acknowledge that the "developmental stage" has an impact on the experience.

> Four year olds - physical understanding of the world
>
> Five and six year olds - interested in mystery and intrigue
>
> Seven and eight year olds - sense of historical time
>
> (p.#12)

Although appearing to be based on some theoretical foundation, they do not refer to any developmental or psychological theory.

Piagetian Theory. Ackermann (1987) discussed the value of Piaget to museum professionals only with respect to the value of the clinical method in helping the child to "construct tools for acquiring knowledge" (p.#8). Duckworth (1990) suggests that Piaget's "emphasis on centrality of actions to ways of knowing" and his tracing of the origin of human knowledge to the activities of infants are the most important aspects of Piagetian theory of interest to museum educators (p.#4). In keeping with

the same theme, Booth et al. (1992) in discussing museum educational techniques introduce the value of Piagetian developmental theories by highlighting that "Piaget's fundamental thesis about knowledge is: To know an object is to act on it" (p.#80). This object oriented concept appears to be one of the major reasons that the Piagetian theories have an appeal (though frequently not articulated) to the museum professional. They further emphasize the following aspects of the Piagetian theory:

1. maturational processes
2. social interaction
3. experience - interaction with objects,
   physical experience and logico-mathematical experience

Furthermore they emphasize the need to consider Piaget's major stages in the development of thought:

1. Sensorimotor - birth to 2.5 years of age
   characteristics: motor skills unevenly developed, language develops rapidly, great curiosity
2. Pre-operational - 2.5 to 7 years of age
   characteristics: high activity level, increased attention span, uses language well
3. Concrete operational - 7 to 12 years of age
   characteristics: crafts-shop oriented, attention span longer, individual differences apparent
4. Formal operations - 11/12 years of age on
   characteristics: ability to perform controlled experiments, widest range of individual differences

Piaget's theory appears as well as a significant aspect of Grinder and McCoy's (1985) discussion of how people learn. They suggest that museum education is primarily concerned with "cognitive" processes that deal with thinking, reasoning, and knowledge acquisition. Piaget's stages of human development are presented by Grinder and McCoy with insights into cognitive processes as opposed to the activity or behavior orientation of Booth, et al. (1982). For instance, sensorimotor (focus on object permanence, movement and actions),; symbolic (language emerging, world is one of pictures and images); operational (reasoning dominated by direct personal experience, categorizing and grouping of mental images); and mature thought (capacity to analyze connections between premises and conclusions) (p.#29-30). Booth, et al. (1982) as well as Grinder and McCoy (1985) acknowledge Piaget's position that his theory is hierarchical and that all children must pass through each stage. They, however, indicate that the stages are not fixed at particular ages and that children of any given age will not be alike in their cognitive development.

Selman's Theory of Role-taking. With respect to museums, Grinder and McCoy (1985) highlight the only other developmental theory that appears in museum publications. This theory parallels that of Piaget, but as they point out, focuses on the social aspects of cognition. In particular, they report on Muuss's (1982 discussion of Robert Selman's Stage Theory of Role Taking (1980). This theory focuses on the "child's ability to draw interpersonal

inferences about somebody else's perceptual or conceptual social awareness" and is influenced in part by Piaget's theory of cognitive development (Muuss, 1982, p.#235). Grinder and McCoy's interest in reporting on this developmental theory is from the perspective of how interpersonal interactions influence cognition. Selman's theory is categorized as follows:

1. Egocentric, undifferentiated stage (3-6 years of age)
   characteristics: own ideas and perspective
2. Differentiated and subjective perspective-taking stage (5-9 years of age)
   characteristics: judgment based on physical observation, recognizes perspectives of others
3. Self-reflective thinking or reciprocal perspective taking stage (7-12 years of age)
   characteristics: can make inferences about other peoples' perspectives
4. Third person or mutual perspective taking stage (10-15 years of age)
   characteristics: can move to neutral third person perspective, concepts of larger social system
5. In-depth and societal perspective taking (16 to adulthood)
   characteristics: societal perspective taking, understanding of individuals unique perspectives

This theory is suggested as being important because it provides added understanding of the relationship between intellectual development and social development for program and exhibit

development. The aforementioned theories are the only ones that have been clearly applied or related to the museum field in published form.

Developmental theories - curiosity

A review of the literature on theories of curiosity and museums reveals that developmental theories of curiosity are non-existent. Their importance, however, is perhaps best hinted at by Bettelheim (1980) who states that

> the museum's greatest value to the child...(is) to stimulate his imagination, to arouse his curiosity so that he wishes to penetrate ever more deeply the meaning of what he is exposed to in the museum. (p.#23)

Other authors such as Cecil et al. (1985) use developmental generalities to describe children's curiosity by stating that "healthy secure children are naturally curious" (p.#212). Ball (1982) suggests age-related changes: "curiosity and exploratory behavior are strongly manifested in early childhood and again, although more narrowly, during adolescence" (p.#1260). Necka (1989) implies some form of developmental process in suggesting that those concerned with the stimulation of curiosity should be concerned with "education throughout the periods of childhood and adolescence" (p.#27).

Voss and Keller (1986) originally concerned with the motivational basis of behavior report that there has been only "marginal reference to curiosity" in psychology publications (p.#327). Harty and Beall (1984, 1985) summarize other problems

associated with the study of curiosity and the establishment of a clear developmental theory. In particular there is

1. "a lack of valid instruments necessary to measure curiosity,"
2. "an inability to differentiate between curiosity and interest" and
3. "an inability of researchers and theorists to arrive at a common definition of the construct."

(Harty & Beall, 1985, p.#214; Ball, 1982; Engelhard & Monsaas, 1988).

Harty and Beall also point out a few of the areas that a curiosity theory will have to take into consideration: ethnic origin, intelligence, achievement, sex differences, and prior structured learning experience. Necka (1989) described this difficulty in characterizing curiosity in the following: "Curiosity takes place between the intellectual and the motivational spheres of human mind, perhaps even with the slight lean towards the latter" (p.#25).

Age-related changes although not well described are reported by other authors in general terms. Engelhard and Monsaas (1988, p.#23) summarize developmental aspects in the following way:

1. Curiosity decreases with age. (Vidler, 1977)
2. Boys tend to be more curious than girls. (Maw & Maw, 1968; Voss & Keller, 1983)

A very broad developmental approach to curiosity is described by Beiser (1984). This approach is more of a description of how curiosity is expressed at various

developmental points in life. Beiser does not believe that for curiosity there is a clear separation of stages, but that there is blurring of boundaries as can be seen below.

1. infant - quiet awake state, use of vision and hearing to explore the environment
2. first year - refinement of use of hands, vision and hearing to express curiosity
3. ambulatory period - range of exploration increases
4. language period - asking questions and direct exploration; with an increase in language and cognitive skills, the "primitive" modes of exploration recede
5. reading acquisition period - increases field for curiosity
6. school years - attempt is to relate preschool child curiosity to subject matter taught in school - reward and inhibition of natural curiosity comes into play based on mastery of content
7. prepuberty - children who master school based content and regulation begin testing out their knowledge and range of conditions for playing games
8. puberty - curiosity based on physical as well as well as intellectual skills grows
9. mid adolescence - interest in own thoughts, feelings, and introspection

10. adulthood - widest range for the expression of curiosity

    mid adult - curiosity expressed in one's work and leisure interests

    later adulthood - curiosity about mental and physical aging process

    (abstracted from Beiser, 1984, pp.#518-519)

The author suggests that for the adult periods curiosity can also be expressed in antisocial and/or pathological ways.

A "theory" of curiosity is described by Voss and Keller (1986) in which they equate exploration and curiosity. Their view is one of "motor cognitive development" or "exploratory activities as activities serving cognitive strategies for mastering the environment" (p.#328). Voss and Keller suggest that the development of exploratory behavior follows that of general cognitive skills. They further develop this idea by stating that "exploration can be thought of as the organism's effort to maintain an individual rate of cognitive structuring that corresponds to the amount of change, elaboration and consolidation of cognitive structures per time unit" (p.#335). They also suggest that one might conclude that there is a "developmental process by which parts of a behavioral sequence that are performed independently from each other by a younger child may later become integrated into a larger behavioral unit" (p.#331). They go on to propose a theoretical model to account for the complexity of exploration in children as abbreviated below:

first level - exploration with breaks between exploration events

second level - orientation followed by manipulation, play and further exploration

third level - hidden cognitive/emotional processes that involve attention and activation of curiosity

Children would go through the levels of this model with termination of the exploratory activity at any level. They support this model with evidence from their work on parent-child interactions and eye contact data during the first months of development (discussed in the following section).

Camp (1986), based on earlier research, offers developmental evidence for an understanding of curiosity as it relates to information acquisition at different ages:

1. "Older adults may be as interested as the young in acquiring new information, but have less access to novel information, less willingness to expend energy to get to it".
2. "The need to acquire information in younger and older adults may be determined by secondary factors such as environmental constraints and perceived novelty of the input".
3. "The greatest influence of curiosity on learning may be in making decisions about initiating behaviors that facilitate learning". (Camp, 1986, p.#382)

With respect to the information processing relationship to curiosity, Camp (1986) cites Rossing and Long (1981) as speculating that older adults have more "structured and less flexible" information systems thus making them less interested in information acquisition especially if it does not fit with previously acquired information. Camp also suggests that younger adults may be more interested in "transitory" change with older adults exercising greater "controls and restriction over innovation and new habits" (p.#375). This latter perspective appears to be presented in an adaptive or evolutionary sense of development. Camp (1986) suggests that the older adults, through "control and restriction" of innovative or new habits, be acting as a "filtering system", allowing only adaptive behaviors to be selected and retained (pp.#375-376).

In closing this section it appears appropriate to discuss several linkages that appear in the literature and that may provide some insights as to a rationale for the apparent preference for the use of Piagetian stages in the museum field. A most obvious characteristic is that the stages offer some form of conceptual structure that at least on the surface feels good to those concerned with cognitive outcomes as is the case with many museums. Hunt (1963) concludes that Piaget's observations of infants in the sensorimotor stage suggest that the relationships between the infant and the environment contain the "basis for motivation," which is linked to the curiosity construct. Hunt also offers an interpretation of Piaget's

sensorimotor stage approach in his motivation hypothesis that includes:

1. first sensorimotor stage - begins at birth - infant is responsive
2. second sensorimotor stage - appearance of intentional activities
3. third sensorimotor stage - interest in novel and complex
4. fourth sensorimotor stage - language appears and verbal as well as perceptual interactions begin

Piaget is also interpreted to have suggested that the interest which a child has in the environment is a function of the variety of objects and patterns that have been encountered during earlier periods. Hunt (1963) uses these and other observations of Piaget to support his premise that motivation is a function of familiarity and pleasure and that after a pattern has become familiar, it is the "variation in that pattern that brings pleasure" as well as "the effort to retain or re-elicit the pattern" (p.#273). Duckworth (1980) further clarifies this interpretation by suggesting that for young children the focus on actions is primarily an emphasis on success and goals rather than on understanding and relationships.

Learning or cognitive development also appears to be a concern infused in many of the approaches or "theories" described by the authors cited above. Camp (1986) cites Piaget as believing that curiosity is a "prerequisite for growth of knowledge"(p.#375). Hawkins (1982) suggests that at Piaget's

concrete operations stage, curiosity is a "component in learning through manipulative tasks" and that advancement is based on a child's level of curiosity (p.#100). Hawkins further speculates that curiosity may play a significant role in the transition phase between concrete and formal operations stages; however, he gives no real insight into the process.

In summary there appear to be developmental theories that have relevant information for the museum practitioner. In common across most of the theories is their apparent connection to the Piagetian developmental theories. Object oriented development, cognitive process formation, social aspects of cognition and the development of motivational aspects such as curiosity would all appear to be very closely interwoven and dependent on each other. Similarly across all of the theories is the concern for cognitive growth of the individual and more specifically the relationship between the individual and the sources of knowledge (i.e. objects, experiences, etc.). Differences occur in the ability of the theories to describe as well as support their basic hypotheses. Only Piaget and Selman have described the developmental process in a hierarchical or formal stage theory. Each of their levels have been described using distinct or observable characteristics; whereas others have been more vague and less hierarchical in their approach. Duckworth (1990) suggests that the Piagetian approach in particular offers two points of value to the museum educator. One being that "objects are known to people only as taken in by them through the frameworks that they have developed and bring with them" (p.#5).

The second being that the "focus on the centrality of actions in children's understanding is that they play an important part in our adult understanding" p.#6). In the end the theories that have appeared in the museum related publications have a "feel good" or intuitive component that appeals to the practitioner and at least on the surface appears to describe observed behaviors and museum visitor characteristics to some degree. With the considerable growth in museum education and the inclusion of trained educators on museum staff, one would expect a greater reference to as well as inclusion of developmental theories in museum related research and literature. It would be appropriate then to take a look at the developmental research as it relates to museums with an emphasis on curiosity studies.

Museum Related Curiosity Research

Within the museum, research in developmental aspects of children and visitors is non-existent. Piaget's as well as Selman's theories of development have not been replicated or studied in the museum field. Crain (1985) and Siegler (1986) as well as numerous other authors have reviewed research that both supports as well as questions these theories.

Curiosity has not been well described by a developmental theory or studied in general and even less in museums (Engelhard & Monsaas, 1988; Wohlwill, 1987). However, research that has been done on the concept of curiosity and its development provides some evidence of developmental processes. Mukherjee and Jain (1987) in studying 4-, 5- and 6-year-old children found that

curiosity about names increased with age. They report, however, that curiosity about "why" questions is not affected by age. They relate this to the link that has been made of curiosity with novelty. They suggest that older children are more knowledgeable and thus less curious or stimulated to ask "why" questions.

Voss and Keller (1986) report that during the first month to 14-18 weeks the visual system processes "information consisting of differentiated looking patterns" that increases until 14-18 weeks of age (p.#329). Maturational considerations complicated their study and did not allow them to evaluate looking patterns past this time period. They hypothesize, however, from their results that novelty preference for faces and complexity increases with age. From birth to 2 years of age exploration in the different channels does not change dramatically. At 2 years of age manipulatory ("producing effects") activities dominate all other behaviors followed by tactile ("touching") and the visual and verbal behaviors according to their study (p.#330). Exploratory behaviors are reported to change qualitatively as they are increasingly integrated into other systems (single behaviors such as looking are now incorporated into approaching and/or manipulating objects and communicating about them). The use of objects increases with age (from 2-6 years of age); however, the correlation between the range of objects explored and age decreases as age increases (2-6). They report that the predictive value of certain exploratory behaviors changes depending on age which may be related to the task themselves. Sex differences are reported between boys and girls: at age 3

girls' interests in visual behavior is strong, whereas boys' interests in "manipulatory details" is strong.

Voss and Keller (1986) report a positive relationship between manipulatory exploratory behavior and eye contact with mothers for 1- and 4-year-olds, a decreasing relationship for 2- and 6-year-olds and negative relationships between eye contact with mothers and manipulation in 5-year-olds. Based on correlational studies of eye contact interactions with mothers and exploratory measures they suggest that the mother-infant relationship is a significant part of exploration at least in the early period.

Henderson and Moore (1980) investigated variations in curiosity related to individual differences, noveltv of situation, and adult interactions in 3.5 - 5 year olds. Assignment to a particular level of curiosity was based on four tasks that they used to assess predisposition to explore that included a preference for complexity task, a preference for the unknown task, a curiosity box task and a puzzle box task. They found the following:

1. High-curiosity children explore novel toys more than low-curiosity children regardless of adult interaction.
2. Level of curiosity is not a useful predictor of exploratory behavior in situations in which the objects are redundant and less novel.

3. Novel perceptual toys are explored more than either novel-problem solving toys or conventional toys.
4. High-curiosity children explore at high levels regardless of the adult interaction style.
5. Low-curiosity children had low-curiosity scores relative to high-curiosity children regardless of whether adults explored, reinforced or were present.
6. Children who are very high or very low in curiosity are unlikely to be influenced by short term interventions.

(Henderson & Moore, 1980, pp.#464-465)

Koran, Koran, Foster & Fire (1989) in a study of the relationship between curiosity, verbal ability and learning in seventh and eighth graders found that psychomotor curiosity and written curiosity are positively correlated. They postulated that the "complexity of the task may play a role in determining the degree to which curiosity is involved" in problem solving processes (p.#408). Furthermore, they found that "students with high verbal ability perform well in science no matter what the method of instruction" (p.#409). They concluded that well developed verbal skills may facilitate curiosity behavior by contributing to the processing abilities of students (words stand for objects and symbols).

Engelhard and Monsaas (1988) studied the effects of school (public vs. Catholic) on curiosity by looking at changes in

curiosity as a function of grade level. Their results, which are limited due to research design problems, indicate that curiosity "decreases as a function of grade level," and the effects are greater in Catholic as opposed to public schools (p.#25). The study is worth mentioning because other authors have also suggested that the effect of schools on curiosity is a negative one.

Peterson (1979) offered contradictory or perhaps more appropriately clarifying information to the discussion of the decline of curiosity in school. Using a museum setting and objects in a longitudinal study of the same group of subjects from age 6 to 18, Peterson found:

1. The form of curiosity from childhood to adolescence changes qualitatively--younger children explore objects, whereas older children spend more time exploring books and magazines.
2. Sensorimotor curiosity does not decrease from childhood to adolescence and remains relatively high.
3. Five- to 18-year-old students explore with great interest when given the opportunity.
4. Individual styles or modes of expressing curiosity (sensorimotor versus verbal) may be relatively permanent by elementary school age. (pp.#190-191)

Camp, Rodrigue, and Olson (1984) reported on adult curiosity as a function of age. In a review of the literature they

concluded that the perceived value of the information may play a critical role in influencing adult curiosity:

1. Curiosity in younger adults (25-35 yrs old) is more often the result of boredom and monotony (diversive curiosity) which the authors interpreted as a search for stimulation.
2. For young (25-35 yrs old) and middle (45-55 yrs old) aged adults there is a positive relationship between perceived value and desire for additional knowledge. The strength of the relationship decreases with older (65-75 yrs old) age.
3. No age effects are found on measures of specific curiosity. Age is not related to search of information.
4. Age differences can be found in willingness to expend energy and perceived meaningfulness of tasks. (Camp et al., 1984, pp.#397-398)

They concluded that "learning is meaningful to the degree that the new learning task can be related to the existing cognitive structure" of the individual (Camp et al., 1984, p.#398). This research lends support to the cognitive process connections made previously by other authors.

Research in this area, although scant, offers support for the notion that curiosity appears early in the development of humans. Novelty of objects, situations and information all play a significant, although not completely understood, role in the development of curiosity and related exploratory behaviors.

There also appears to be an interest in research into the relationship between curiosity and cognitive development as well as more specifically problem solving skills. Setting effects appear to have a particularly strong enhancing as well as deleterious effect on curiosity behaviors and their development. Formal or traditional settings appear to have a negative impact, whereas the scant information on informal or museum settings indicates a more positive effect. There is a hint that the development of curiosity may have an early critical period in which it is stimulated or restricted based on the mother infant relationship, although more studies are needed to clarify this position. The general thinking that curiosity decreases with age is not well supported. Age related changes in curiosity do appear to be qualitative in nature and based on interaction with environmental contexts as well as the acquisition of knowledge and related cognitive processes. In general, difficulties with methodologies and definition of the construct as well as related constructs do not allow for conclusions beyond the generalities discussed above.

Evaluation of the Theory and Research

As stated above both the Piaget and Selman theories have a "feel good" or self-satisfying aspect to them. Booth, et al. (1982) suggest that the Piagetian theory provides a basis for evaluating "the performance of children and adults" (p.#82). Neither of the major theories discussed appropriately predict adult development to any great extent. The theories focus

primarily on the individual and the early years of development. Booth et al. are somewhat ambitious in their extending the Piagetian theories to the evaluation of the performance of adults. Selman's theory does take into account more of the contextual or social variables that affect the developmental processes of children whereas Piaget sees the process as more internal and individual driven. These theories on a whole do provide museum professionals with a beginning point from which to develop as well as evaluate their programs and exhibits.

Curiosity research, however, lacks a clear definition of the construct as well as a clear understanding of the relationships between curiosity and other related constructs such as exploratory behavior. Methodological problems further weaken the confusing results. This is perhaps best stated by Voss and Keller (1986) who suggested that one of the greatest difficulties facing curiosity research is that of the impossibility of assessing the "complex multidimensional exploratory construct by a-priori defined behavioral categories observed in situ" (p.#328). Furthermore, they add that curiosity cannot be studied without some inclusion of the "natural environment of the individual" (p.#328). This concept of environmental inclusion in studies is supported by Henderson and Moore (1980) who in their study of individual differences in curiosity suggest that what is needed is an understanding of the "interpersonal and situational factors about which little" was known in 1980 and appears to still be the case.

Peterson's (1979) study, although valuable in that it is longitudinal, is weakened by the small sample numbers and the fact that the children were taken out of the school setting. The results are generalized to school settings that are considerably different in perceptions as well as structure. Prior museum experience is not discussed and validity threats due to dropouts from the study were prominent problems the author acknowledged.

The effect of prior knowledge is also a point brought out in the work of Koran et al. (1989) when they raise the issue of aptitude interactions with curiosity. There is also an implication throughout the research that information processing abilities may be both an outcome of curiosity as well as a major "player" in the development of curiosity itself.

In general, what research is being done appears to be an effort to reflect the real world and predict as well as describe curiosity from infancy through adulthood. The research and theories do offer potential directions for new research as well as raise fundamental questions about existing assumptions.

Implications for Museum Practice

A number of the studies reviewed make recommendations for practice based on their outcomes. A review of each recommendation begins to provide the museum professional with some alternatives and directions for practice. These recommendations will be summarized as they apply to the specific theories and research discussed, with recommendations for the museum professional.

Grinder and McCoy (1985) suggested that Piaget's theory of development "shows how instruction and teaching must fit into ways children think and reason" (p.#31). This theory provides the museum educator with "broad guidelines" and "an understanding of the cognitive capabilities of young people and adults" that they can use in the preparation of programs and exhibits (Grinder & McCoy, 1985, p.#31). Selman's developmental theory adds the understanding of the interpersonal relationships and perspectives that children are capable of at different ages.

Booth, et al. (1982) suggested that docents must provide children and visitors with opportunities for "cognitive growth in three realms of experience" (p.#83). In particular they referred to social, physical and logico-mathematical experience. They do however, caution that museum educators should not focus on the stages "for categorizing children" but that the focus should be on the ways of learning in each stage which "make necessary contributions to capabilities at later ages" (p.#83). These ways of learning should also influence exhibit design or "ways of teaching".

Booth, et al. (1982, pp.#84-86) made recommendations of museum educational methods that might be appropriate at the various Piagetian stages:

Sensorimotor: Provide time, patience, interest and guidance from adults; provide simple, clear, routine and limited choices.

Pre-operational: Focus attention and provide opportunities for active participation.

Concrete operational: Focus on conceptual knowledge, written objectives and ways to elicit explanations.

Formal operational: Provide freedom to search, scan, focus and function autonomously.

Other practices supported by Perrot (1980), Waterfall and Grusin (1989), Grinder and McCoy (1985) and Booth, et al. (1982) included learning by discovery. They recommended this practice as being non-threatening, relatively free of the anxiety of making mistakes or getting wrong answers, as having greater individual/visitor participation, and stimulating greater attention. Effectiveness, however, is dependent on the individuals interests, abilities, and cognitive levels of thinking as well as on the interaction with the environment. Discovery learning has led to the formation of discovery rooms or object galleries in many museums especially those that include in their name the idea of "children's museum."

Discovery areas have been thought of as places that stimulate curiosity which Koran and Longino (1982) and Hardy and Beall (1984, 1985) suggested as having a strong influence on learning. Vidler and Levine (1980) suggested that teaching through contradiction may stimulate conceptual development by stimulating curiosity. Conflict resolution requires the seeking out of new information and leads to equilibration. They suggest that with a reduction in conflict "curiosity is diminished" (p.#38).

Cecil et al. (1985) took into consideration individual differences in recommending that low-curious children need

teacher/docent help to impart a greater sense of involvement. Earlier research of Henderson and Moore (1980), however, provide the caveat that we need to be much more cautious about our assumptions about adult as well as environmental influences on the arousal of children's curiosity or exploratory behaviors. The implications are that short term activities/support may not have a significant effect at least on the extreme groups. This then raises the question about what are the effects on the mid-range group that one could argue is what programs and exhibits may be focusing on.

Cecil et al. (1985) also discussed the implications for the use of objects in practice by suggesting that novelty has a curvilinear relationship to exploration. Too much novelty may be avoided, whereas too much familiarity may lead to avoidance as well. The teacher /docent is critical in adding the right "prop," providing the choices or providing the appropriate "variation in the play process" (Cecil et al., 1985, p.#213).

Necka (1989) offered five principles for stimulating curiosity that can guide the educator in any setting:

1. Do not avoid questions.
2. Allow open questions.
3. Let important questions remain unanswered.
4. Show incompleteness in existing knowledge.
5. Show developmental trends in human knowledge.

He further suggested that the most important aspect for curiosity stimulation is that of "careful and thoughtful education throughout the periods of childhood and adolescence" (p.#27).

Engelhard and Monsaas's (1988) research on the implications of schools on curiosity implies that museums and related institutions should carefully consider the methods that they use in their programs and exhibits. There is always a tendency to mimic that which is used in schools to provide students with some stability; however, the indications are that museum staff should look for novel ways of teaching and supporting education using methods that counteract the negative effects encountered in other settings and that can be uniquely provided by museums.

Peterson's (1979) research implies that all educational settings must be concerned with providing students with "environments sufficiently stimulating to arouse curiosity" and that the lack of curiosity may be a reflection of deficiencies in the environment. This research further supports the concepts of discovery areas and opportunities to explore that museums provide today. Sensitivity to individual differences in styles of expressing curiosity is also an area where museum educators and designers should be concerned especially considering the probability that styles may be set by elementary school age (Peterson, 1979). All of these recommendations appear to suggest that adults need to be "attentive listeners and observers of the child's reactions and interests and of his interactions with the museum" (Waterfall and Grusin, 1989, p.#32). The difficulty in implementing these recommendations as well as those of other authors is compounded with the fact that teachers and even moreso museum professionals may have a "difficult time in identifying curious students" (Koran and Longino, 1983, p.#21). Koran and

Longino (1983) in a review of the literature found that teachers' ratings of curiosity in students often correlate with intelligence, degree of activity, concentration, and adjustment. They also reported that these factors do not correlate with measures of curiosity. The literature then provides a wide range of implications and recommendations as well as conflicting results with respect to curiosity.

What does it take then to prepare a good museum program or exhibit? The following are suggestions for designing good programs and exhibits in a museum setting:

1. Be aware of the developmental aspects of the audiences being addressed. Museum curators and designers must be well informed about their proposed audiences taking into consideration developmental considerations on all levels. The most basic is related to an individual's biological level of maturation (age, vision, etc.). Cognitive developmental characteristics should also be clearly addressed; young children may attend differently to information than adults with greater base of experiences as well as knowledge. Efforts to address many levels of maturity may often fail; however efforts to encourage the interaction of those at developmentally different levels may yield greater success.

2. Define curiosity. There needs to be an understanding of the research and general literature on curiosity. This assumes that the developer will then have a better understanding of the audience. Clearly if the designer at the outset defines

the meaning of curiosity in terms of the exhibit or program being developed there is a greater likelihood of achieving the desired effect.

3. Identify the areas that create curiosity related responses in the particular audience or group. Museums need to know who their audience is in order to identify what they find stimulating. Individual differences such as age, sex, level of education, and prior experiences to name just a few play a major role in the expression of curiosity behavior. The development of exhibits solely on the basis of curatorial curiosity is alright if the exhibit is for the professional or curatorial staff; however, it may not have the intended effect on the visitor.

4. Change the stimuli over time. Familiarity generally decreases the curiosity response. A problem arises in that individual differences also play a major role in the degree to which change over time will have an influence. Exhibits or programs need not be totally changed; however, the inclusion of flexibility in the design process might provide an avenue for continued stimulation of curiosity. Changing panels, adding questions, and introducing new objects that alter the way one looks at the whole exhibit could maintain audience curiosity.

5. Provide wider range of curiosity stimulating experiences. This might be achieved through variations in structure as well as contexts. High ability individuals may need less direction than low ability. However, low ability

individuals might do well with a more limited structure than that needed in formal settings. Programs that include a mixture of hands-on as well as group activities with more formal activities can stimulate curiosity. Exhibits that provide attention directing devices, push buttons, flip panels, and various information organizing techniques can provide for the variety of audiences that might be exposed to them. If learning is to be the objective, one must be very cautious about the interactive approaches taken as simply pushing a button may not indicate learning.

6. Establish discovery areas or "curiosity corners" (Koran and Longino, 1983, p.#23). These areas allow the audience or individual to express their curiosity behaviors in concert with the exhibit or program. Discovery areas that are isolated to one gallery may not be as beneficial as exhibits hat include a discovery area as part of the exhibit. The interaction of the formal exhibit with the discovery area might produce a reinforcement effect of the behaviors as they are expressed rather than waiting until both time and distance must be overcome.

7. Provide age appropriate models of curiosity behavior. Teachers, parents and peers provide differing levels of support for curiosity. Koran and Longino (1983) recommend a further refinement of modeling that includes the differentiation between "reinforcement" and "sanctioning conditions"(pp.#23-24). Reinforcing situations are those where the individual's curiosity behavior receives immediate

support for the activity; whereas under sanctioning conditions, a supportive environment may be present but the individual is neither inhibited nor rewarded for curiosity behaviors. A discovery area or curiosity corner might be very ineffective if the objects or drawers were simply available with a sign saying "feel free to play". Adult monitors for these areas may in fact unwittingly suppress curiosity behaviors. Children actively engaged in activities that are supported by peers and mediated by adults would generate curiosity in others.

8. Recognize and reward all forms of curiosity: sensorimotor, verbal, specific, diversive, etc. Exhibits and programs that rely on formal written text or verbal information may satisfy only the curiosity of those that are highly verbal. The research would suggest a balance of a variety of forms of presentation as well as levels of presentation.

9. Encourage problem-solving processes. Activities that challenge c[illegible]'s knowledge and ways of knowing would provide a form of disequilibration or conflict requiring resolution. The exhibit, however, must also provide for directions on possible ways to solve problems. Those activities that can be resolved easily by one approach often become boring and unappealing. An exhibit that has no single solution or that allows the audience to decide on the meaning of the information may stimulate curiosity over repeated visits.

10. "Timeliness". Exhibits and programs that deal with current realities and events often evoke more curiosity than those dealing with the distant past.

11. Evaluate all exhibits and programs from the outset. The use of front end evaluation, formative evaluation and remedial evaluation (Screven, 1990) in conjunction with an awareness of the abovementioned research can provide a valuable understanding of the visitor's experience as well as prior experiences and allow for further enrichment. Focus groups as well as any number of other evaluation models such as Stufflebeam's decision making CIPP (Context, Input, Process, Product) model can also enhance this process (Madaus, 1983; Stufflebeam, 1983; J. Paul Getty Trust, 1991).

A final recommendation for practice is to include one through eleven and more. Although presented individually it should be obvious that curiosity as well as human development is an interactive process between the individual, group, and context. One simple solution does not necessarily yield the desired response and the response elicited becomes a part of a domino effect over time. From a developmental view, the most critical aspect of developing curiosity may be out of the museum's hands in one sense (the home environment) and in another, it may in effect be part of the development of the home environment. Parents who were raised understanding that museums are places where curiosity is stimulated may in effect be encouraging their own children by providing them with the rich and rewarding experiences they received. Museum professionals

then should not only be attentive listeners and observers of their audiences' reactions and interests and of their interactions with the museum, but also should incorporate this knowledge in their work whether it be in the classroom or in exhibit development.

Recommendations for Future Research

Curiosity research in museum settings is needed across the span of the research discussed above. Replication of studies done in other settings or "school" related studies in general need better clarification especially with reference to informal settings such as museums. A critical point in any research will be the need for a greater understanding of the museum audience in any given setting. Student related studies have some relevance to class visits or the use of the more formal museum classroom. One age group in particular is not part of the museum field trip as well as a visitor in general. Booth, et al. (1982) reported that "adolescents are infrequent museum visitors" (p.#116). This suggests that studies of 13- to 19- year olds and of programs that interest this age group are needed.

Voss and Keller (1986) highlighted in their research the impact of the mother-child relationship in the early years that appears to stimulate curiosity or exploratory behavior. They concluded that research is needed on the impact of the father-infant relationship on curiosity. They also questioned whether exploratory behavior is a separate behavior from that of play, problem solving, and other experiential behaviors and whether

there is some factor that explains the large interindividual differences, and the relationship between cognitive development and exploratory behavior. Major questions as to family activities that encourage children's curiosity in a museum setting are generally unanswered.

Waterfall and Grusin (1989) suggest three areas of influence on experience that would be of interest for further developmental research: "learning by doing-approach, the opportunity to choose, and the control of the visit" (p.#113). Koran and Longino (1983) suggest that based on all of the curiosity studies, research into the relationship of curiosity to learning is badly needed. They further suggest that curiosity may play a significant role in cognitive process development and that more research is needed here as well.

In summary, many questions remain to be answered including basic ones related to the appropriate measurement of curiosity, to greater clarification of the interaction between contextual settings and curiosity responses, to individual difference and the various levels and types of curiosity as well as to questions that continue to focus our understanding and description of curiosity, its meaning, and relevance to learning. In the museum setting major questions include: What are the age appropriate stimuli needed to both nurture as well as foster curiosity in a museum? What stimulates curiosity in exhibits? How can curiosity be maintained? What type or kind of continuity is needed across exhibits and halls to maintain curiosity? What is

the long-term effect of the museum visit on an individual's lifelong curiosity?

Conclusion

Developmental psychology theory can provide the museum professional with a valuable source of information and understanding of the relationship between human development and the environment. Museum literature demonstrating an awareness as well as inclusion of this area is weak at best. A review of the research into curiosity research demonstrates the valuable nature of cross-disciplinary awareness and of potentially new approaches to museum programs and exhibit design based on both developmental and curiosity research and the interaction of the two.

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The authors would like to thank Dr. Patricia Ashton, Professor, Foundations of Education, College of Education, University of Florida, for her editorial comments and review of this paper.

04/26/91