University of Leicester

MUSEUM STUDIES

Researching Learning in Museums and Galleries 1990-1999: A Bibliographic Review

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RCMG
Research Centre for Museums and Galleries

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ISBN 1 898489 23 8

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1. INTRODUCTION

In January 1999, the Research Centre for Museums and Galleries (RCMG) was established in the Department of Museum Studies at the University of Leicester. An early focus for RCMG was the educational role, function and potential of museums and galleries. It was clear that while RCMG might wish to carry out research into learning in museums and galleries, there was no readily available overview of what had already been done in this area. At the start of a new research centre, it seemed appropriate to review what was already known about the field that was likely to become a major site for future work.

It was decided to review easily available books, articles and reports on learning in museums and galleries; to review only those written in English, and to limit the scope to those published between 1990 and 1999. We decided not to include student theses as these are not always readily available and there seemed little point in discussing work that could not be accessed by those using the review. We also decided not to include straightforward evaluations that judge the effectiveness of exhibitions or programmes but which did not include any significant material on learning processes or outcomes. While we have attempted to be as comprehensive as possible in locating our sources, the task has not been easy.

Our intentions in this research review were to discover what was already known about learning in museums and galleries; to assess the theoretical approaches taken to carrying out the research on learning; and to identify the locations and types of museums where most of the work has been carried out.

From the review we wanted to be in a position to identify the gaps in the research and to set an agenda for future research for RCMG. We also wanted to see how our developing ideas about appropriate research theories and methodologies for exploring and analysing museum-based learning related to what had already been achieved. And finally, in our research at RCMG we will be developing theories and perspectives on how we can understand and talk about learning in museums and galleries. We wanted to know whether the work that had been carried out offered useful material for our own learning.

This bibliographic review begins by placing learning in museums and galleries in the context of influential learning theories, it moves on to identify the location and range of research into museum-based learning and then discusses the work that has been done during the past decade. This work is divided up according to the type of museum in which it was carried out, as the location of the research has had a major effect both on the way in which learning has been conceived and the way in which research methodologies have been chosen. We describe research based in science museums and science centres, where the bulk of the work has been done; followed by research based in children's museums, art galleries, history and archaeology museums, and zoos, aquaria and botanical gardens. It is immediately apparent that the vast bulk of the work has been carried out in the United States. It is also clear that there are major philosophical differences between researchers as to what counts as learning and what counts as research. We do not address these complex philosophical matters in detail here, although we do acknowledge them. For further analysis, readers are referred to Hein (1998). Hooper-Greenhill (2000) also addresses these issues. Major issues of the transferability of the research arise for those researching museum learning in Britain. The final section of the review sets out a basic research agenda for the understanding of museum learning in Britain.

The research has been funded from initial grants from the (former) Museums and Galleries Commission and the University of Leicester Senate Development Fund which provided an initial platform for RCMG. The research was begun in 1998, and it has taken much longer than initially planned. During this time there have been major shifts in the political context within which museums and galleries in the UK are placed. As we complete the work in July 2001, learning in museums and galleries has moved into a much higher priority than when we began. Following the closing of the Museums and Galleries Commission and the establishment of Resource: the Council for Museums, Archives and Libraries, a new learning standard for museums and galleries is being developed. With shifts in governmental responsibilities for the cultural sector, museums now find themselves officially partnered with libraries and archives. This partnership will extend to accountability in relation to learning and its outcomes, which, together with high-level political agendas on social inclusion and neighbourhood renewal, set new challenges for museums.

While we are all too conscious of the shortcomings of this piece of work, one of its merits is that it is timely[1]. We hope it will prove useful.

2. THE USE OF LEARNING THEORIES IN MUSEUMS AND GALLERIES

2.1 Introduction

> 'Learning involves a great many processes. The most basic are perception and memory. Perception is strongly influenced by prior experience - we see what we know, what we recognize. Learning is influenced by motivation and attitudes, by prior experience, by culture and background, and - especially in museums - by design and presentation and the physical setting. When we talk about learning, and particularly learning in museums, we are not talking about learning facts only. Learning includes facts, but also experiences and the emotions. It requires individual effort, but is also a social experience. In museums, it is the social experience that frequently is best remembered.' (Hooper-Greenhill 1999a: 21)

> 'Learning is an active process in which the learner uses sensory input and constructs meaning out of it. ...People learn to learn as they learn: learning consists both of constructing meaning and constructing systems of meaning. ...The crucial action of constructing meaning is mental: it happens in the mind. Physical actions, hands-on experience may be necessary for learning, especially for children, but it is not sufficient; we need to provide activities which engage the mind as well as the hands. ...Learning involves language: the language we use influences learning. ...Learning is a social activity: our learning is intimately associated with our connection with other human beings, our teachers, our peers, our family as well as casual acquaintances, including the people before us or next to us at the exhibit. ...Learning is contextual: we do not learn isolated facts and theories in some abstract ethereal land of the mind separate from the rest of our lives; we learn in relation to what else we know, what we believe, our prejudices and our fears. ...One needs knowledge to learn: it is not possible to assimilate new knowledge without having some structure developed from previous knowledge to build on. ...It takes time to learn: learning is not instantaneous. ...Motivation is a key component in learning.' (Hein 1991: 90-91)

> 'Learning is an active process of collecting information, a process of utilizing this information to build complex, internal knowledge structures called *schemata*. Every individual's schemata are unique and appear to have a physical reality represented by many branching connections of neurons within the brain. Schemata are accessed both as places in which to store new information and as places from which to retrieve old information. By virtue of differences in both genes and experience, every individual uniquely acquires, processes, and stores information. ...The process of learning can be conceptualised as involving seven major factors. These are the influences of: prior knowledge and experience; subsequent, reinforcing experiences; motivation and attitudes; culture and background; social mediation; design and presentation; [and] the physical setting. To fully understand the nature of the museum learning process requires an understanding of the role, independently and collectively, of these seven influences.' (Falk and Dierking 1995a: 11)

Education is now seen as a core function of museums and galleries. The educational role of the museum is acknowledged both by museum professionals and by the public. Focusing on the educational role of the museum, much of the discussion has evolved around the question of whether, and how, visitors learn in museums and what the nature of the learning is. Despite their efforts to assess learning, researchers still find it difficult to agree on a common definition of museum learning. One of the reasons is that, until recently, much research into learning was conducted in formal, school-based, educational settings where learning was narrowly defined and these research findings are not easily transferable to museums and galleries.

Learning in museums and galleries and other non-school-based environments is often referred to as informal learning or free-choice learning. Free-choice learning has been proposed as an appropriate term that describes the type of learning that takes place in informal educational environments (Falk and Dierking 1998, On-line). It is a term that takes into account both the physical setting and the motivation of the visitor. 'Free-choice learning is a term that recognizes the unique characteristics of such learning: free-choice, non-sequential, self-paced and voluntary. It also recognizes the socially-constructed nature of learning, the dialogue that goes on between the individual and his or her socio-cultural and physical environment.' (p2). Learning in museums and galleries is generally

based on the collections and/or the exhibitions within the museum; it thus operates in rich and complex sites, and, in focusing on concrete material matters (objects and exhibits) is qualitatively different from learning abstract ideas from books.

We have now started to understand the complexity of museum learning. New research carried out in museums takes into account both the nature of the learning environment and the different learning experiences visitors have. Visitors are viewed as actively constructing meaning from their experiences. This emphasis on the role of the individual to create meaning from a museum experience has influenced museum learning research. This new approach to understanding and assessing visitor experiences has been informed by theories of learning. Learning theories have also been used to develop exhibitions and programmes (as well as evaluate them) in an effort to be more responsive to visitors' needs.

There are different ways in which researchers understand and study development and learning. Each approach is based on different assumptions, uses different concepts and asks different questions. They all, however, try to illuminate different aspects of human development and learning processes. Hence, different methodological and theoretical perspectives provide us with ways of understanding, describing and studying learning. The approaches used to describe and understand learning have not only theoretical but also practical implications. Hein (1991, 1997 and 1998) suggests that different frameworks can be applied both to learning theory (how people learn) and to epistemology (the nature of knowledge). He points out that our educational theory determines our pedagogic views. Hence, the approach used and the way terms are defined have methodological and interpretive consequences.

Knowledge has been approached in two fundamentally different ways by the main frameworks that are used to study human development. A positivistic or realistic view of learning has favoured the idea of knowledge as being 'out there', independent of the learner. On the other hand, the constructivist approach to learning sees the learner as actively constructing knowledge through interaction with the social environment. Hence, people are seen as constructing knowledge or meaning both individually and socially (Hein 1991; Hooper-Greenhill 1997, 1999a and 1999b; Silverman 1995). This refers to the idea of how people construct their social reality and how this process relates to descriptive practices available to society. The constructivist approach has increasingly been utilised in the conceptualisation and development of museum exhibitions and programmes. However, most of the exhibitions and programmes developed until recently, as well as approaches to evaluation, were influenced by the positivist approach to understanding and assessing learning. Both approaches have their supporters whose views are often presented in professional meetings and publications[2]. In practice, however, museum professionals use a combination of different positions in developing and interpreting exhibitions, programmes and educational material.

This section introduces some of the educational theories used as a theoretical framework by the research studies discussed in the main body of the paper. It begins with theories that have concentrated on children's development and socialisation. Although most of the research in human development has focused on the period that ends with adolescence, this work also provides useful insights into complex adult processes. The main frameworks that have tried to explain children's developmental process are: behaviourism, cognitive-developmental theories, and socio-cultural theories. Ideas about the significance of play and artistic activity are introduced, as are studies from other disciplines that will be referred to where applicable. We will then move on to discuss work that focuses specifically on adults' developmental needs, lifelong learning, and prior knowledge. Reference will be also made to the application of these frameworks in exhibition and programme development and evaluation.

2.2 Learning theorists and their influence on theories of learning in museums

Attempts to understand and interpret children's development go back to ancient Greece and Rome. The origins of modern theoretical frameworks can be traced back to the ideas of the early theorists of the 18th and 19th centuries such as John Lock[3] and Rousseau[4]. Other influential thinkers and practitioners who stressed the importance of first-hand experience were Pestalozzi[5], Froebel[6], Dewey[7] and Montessori[8].

Lock's view of human development was used as the basis for the behaviourist approach. With Watson and Skinner as the most influential figures, behavioural psychologists began with the assumption that much of children's typical behaviour is acquired through conditioning and learning principles. Learnt behaviour is defined as 'a relatively permanent change in behaviour that results from practice or experience' (Vasta et al 1992: 35). This distinguishes learnt behaviours from those that are temporary, unobservable or the result of biological processes. Bandura's ideas enriched this model by taking into consideration the social learning that results from imitating a model. Most of the criticism of behaviourism has been based on its deterministic nature. It sees human behaviour as a mere result of a response to a stimulus or, in the case of Bandura, as the interaction of the individual's characteristics and behaviour, and the environment. This model has been widely applied in museum exhibitions and exhibition design by using the exhibit as a stimulus. This led museum professionals to study exhibit effectiveness in terms of its 'power' to attract and hold visitors' attention (Dierking 1992).

Based on Rousseau's writings, modern cognitive-developmental researchers placed a great emphasis on environmental influences, reflecting the interactionist perspective that is central to all contemporary frameworks. Piaget is one of the most influential figures in psychology. He believed that the child understands the world only by acting upon it. He named the action patterns through which the child understands the world schemas (cognitive structures). To Piaget, children are actively involved in creating knowledge rather than passively receiving it from the environment. Adaptation and construction of new knowledge in children begins at birth and extends throughout life (Dierking 1992; Sund 1976; Vasta et al 1992).

Piaget's ideas have influenced the exhibit development process. Major elements of his theory have been applied in the museum space. His idea of learning as an active exchange between the learner and the environment has been applied in participatory exhibits. Science learning environments use his theory of developmental stages when they involve 'various senses and motor skills, present real objects and apparatus and provide opportunities for hands-on exploration of concrete and abstract concepts' (Black 1990: 23). Even his concept of developmental sequence is still accepted when trying to explain, for example, why many adults are engaged with exhibits originally designed for children (Black 1990). Birla Children's Gallery in Calcutta, India was developed based on principles from Piaget's theory (Bagchi et al 1992).

Bruner's ideas refer not only to cognitive development but also to knowledge in general. In particular he looked at how cognition affects perception, and at language acquisition. He proposed three modes in which children represent the world: the enactive (where representation occurs through actions); the iconic (where representation involves building up a mental image of things [picturing] one has experienced); and the symbolic (where representation takes place through symbols) (Gross 1987; Vasta et al 1992). Bruner's work on discovery learning has been very influential and widely used by museums, especially science museums which try to create open-ended experiences that encourage discovery learning (Hein 1998). Black (1990) has argued that a new concept - learning to discover - has gradually replaced that of discovery learning. This shift in terminology distinguishes between 'experienced and inexperienced learners' and the level of support they need to be provided with by the museum.

Gardner (1983, 1988, 1991 and 1993) formulated the theory of Multiple Intelligences (MI) which has been recently widely applied in museums in the United States. This cognitive study suggests that all human beings can approach the world and formulate their understanding of it via the eight human intelligences. These are linguistic, logical-mathematical, spatial, musical, bodily-kinaesthetic, interpersonal, intrapersonal and naturalist intelligences. Although the development of each of these intelligences differs, every individual should develop each of them to some extent provided that they have the opportunity to do so. The intelligences interact with and build on each other from the moment of birth. Having also the potential to be involved in symbolic systems invented by cultural environments, these intelligences function together in order to implement complex human activities (Gardner 1983, 1993). Gardner's ideas have been very influential on both formal and informal education settings. Recently, a number of applied programmes throughout the USA have been based on his work. These involve all levels of education[9] from preschool to college admission (Gardner 1988, 1993). The Hands-On History Room at the Smithsonian National Museum of American History, Washington, was developed based on MI theory. MI theory has also been employed in studying learning in museums[10].

Other researchers have tried to study how social experience[11] affects cognitive development. The most influential theory of social cognition is that of Vygotsky. Vygotsky and other Soviet psychologists believed in the cultural determination of individual development. The surrounding culture teaches children both what and how to think. Children learn through shared problem-solving experiences with someone else, usually an adult. This is referred to as 'social organisation of instruction' or 'socio-instructional process'. Through this process, a rich body of knowledge that exists in the culture is transferred to the child. Although this is initiated by the adults, gradually the child becomes responsible for the problem-solving activity and can perform it independently. This process is central to Vygotsky's construction of the 'zone of proximal development'[12]. Vygotsky developed this concept as an alternative to IQ tests that he criticised as being static. He suggested that research should not focus on the child in isolation. He developed two more concepts which refer to what children can do on their own (level of actual development) and what the child can do with help (level of potential development) (Black 1990; Moll 1995; Vasta et al 1992). Vygotsky perceived schools as a 'social setting specially designed to modify thinking' (Moll 1995: 1).

Vygotsky's work on the role of the child's language in the transition from external to self-control and adult-child interaction is of significance to the museum setting. Through social interactions children adopt the regulating speech of adults and internalise it as thought. This pattern is apparent in children between the ages of four and ten. Other studies[13] focus on parent-child interaction during problem-solving activities. It has been found that parents' behaviour changes according to each situation. Thus they tend to be more directive with younger children or those who are learning how to perform a new task. As far as children are concerned, there is evidence that they assume the regulating role in guiding their behaviour to solve the problems (Vasta et al 1992).

Constructivism is an approach to the theory of education that is based on modern theories of learning - in particular on the work of Dewey, Piaget and Vygotsky. It refers to the idea 'that learners construct knowledge for themselves - each learner individually (and socially) constructs meaning - as he or she learns' (Hein 1991: 89). For teachers, this means providing people with opportunities for direct interaction with their environment and for constructing their own world. The constructivist approach is applicable to both formal and informal education settings. For example, researchers have tried to apply it in mathematical learning in a classroom setting by using computers (Steffe and Wiegel 1994). The constructivist approach has also been widely used by George Hein (Hein 1991; Hein et al 1996) as a way of understanding, interpreting and assessing informal learning in museums. This approach has informed the basis of the development of the Art Learning Center, an interactive exhibition at the Speed Art Museum in Louisville, Kentucky. Further, a constructivist approach to learning, teaching, teacher training and programme development is utilised by staff at the Naturalist Center at the Smithsonian Institution's National Museum of Natural History, Virginia.

2.3 Play and artistic activity as a means of meaning-making

Play[14] has been identified by many researchers as an activity through which children construct much of their reality (Gardner 1973; Piaget 1951; Steffe and Wiegel 1994). According to Gardner (1973: 164), 'the purpose of play is contained in its unfolding: The child is guided less by a desired end result than by the proclivity to explore exhaustively the implications of his schemes or actions'. This description is supported by Piaget's (1951) view of play as an assimilatory activity during which the children adjust the world to their actions. In Vygotsky (Gardner 1973) play has a key role in the mastery of rule-learning in the preschool years. Children can use rules observed in every day life and modify them to various play situations. During this process, the meaning of objects can be modified in order to serve the rules in the play[15]. Through play, children can define and solve problems, explore different aspects of the structure and functioning of objects and be involved in role-play. In that sense, play is synonymous with development (Dyson 1990; Gardner 1973; Vasta et al 1992). Dyson (1990) used the metaphor of a 'canvas' to represent the use of play by children. On this canvas children can symbolise ideas and feelings through gestures and speech.

Artistic activity is a type of making activity that is more focused than play. Artistic activity involves the interaction of various symbol systems such as language, drawing and music. It is an activity in which children symbolise their feelings, perceptions and actions by using different means of communication. The development of this ability in children supports the acquisition of basic symbolic tools of their culture (Dyson 1990; Gardner 1973). The significance of play and artistic activity in human development has been explored by museums, especially hands-on museums that have been designed as environments that promote playing with and exploring concepts and ideas. It has also been used as a research tool.

2.4 Adults as learners and lifelong learning

Children's development is characterised by rapid change. However, adults change too through the years. This change refers to their sense of time, their career pattern, their psychological condition and their interests and motivation (Mezirow 1980). A crucial dimension of adult development which is often neglected involves 'learning how we are caught in our history and are revealing it. We learn to become critically aware of the cultural and psychological assumptions that influence the way we see our relationships and ourselves and the way we pattern our lives' (p270). Adult lives are full of special dilemmas (life crisis) which cannot be solved by learning more about them or by learning how to cope with them more effectively. 'Resolving these anomalies through critical analysis of the assumptions behind the roles we play, can lead to successive levels of self-development' (p271).

Learning is a lifelong process. The rapid pace of technological and, therefore, socio-cultural change, the increasing percentage of older people and the availability of leisure time have made lifelong learning not just desirable but necessary (Hiemstra 1981; Knowles 1981). Arguably the most important aspect of lifelong learning is that it is the individual who directs it (self-directed learning). It therefore has many implications not only for adult education, but also for child education, since the acquisition of work habits and the awakening of motivation for self-learning must be shaped in childhood and adolescence (Faure 1972; Faure et al 1980). The significance of lifelong learning has been captured in Faure's (1972: 13) phrase that 'for the first time in history, education is now engaged in preparing men for a type of society that does not yet exist'.

Knowles (1981: 135-136) has proposed a model the basic concept of which is that 'every social system - individual, family, neighbourhood, organisation, community, state, nation, world - can be seen as a system of learning resource [...] for individuals to make use of, in a continuing program of self-directed learning projects'. He also sees all agencies in the community, including museums, in an 'integrated holistic relationship' with each other. He has identified several conditions for adult learning (Hiemstra 1981). These can be summarised as follows: the learning process is related to and makes use of the experiences of the learners; learners gain a sense of progress toward their goals; learners feel the need to learn; learners participate actively in the learning process; learners share the responsibility for implementing learning; the learning environment is characterised by physical comfort, mutual trust, and freedom of expression; and learners perceive the goals of a learning experience to be their goals.

This model of transforming museums into community resource centres has been challenged by Dufresne-Tasse (1995) who believes that learning cannot be the predominant function for all types of museums. According to that view, the proposed transformation 'would cause the museum to neglect activities for which it possesses important and even unique resources in western society and to venture into areas where other institutions have already demonstrated their pertinence and effectiveness, thus running the risk of not doing what it can do and of doing badly what it does' (p246). Referring particularly to adult visitors, Dufresne-Tasse (1995) focuses on the cognitive and affective functioning of a museum visit which, she argues, relates to 'a series of pleasures not afforded by learning'[16] (p251).

Many museums today, however adopt the broad approach to learning suggested by Knowles. Hands-on exhibitions and the increasing importance of visitor studies in the development of exhibitions are two signs. Furthermore, some museums in the UK have started involving visitors in exhibition development from early stages (Hooper-Greenhill 1995). These efforts provide the opportunity for museum professionals and audiences to learn from each other. They also give audiences a chance to represent themselves and their culture in their own ways[17] and open diverse modes of participation.

2.5 Prior knowledge[18]

As has been implied in the above discussion, a fundamental issue in understanding learning as a process is conceptual change. According to Roschell (1995), we can trace the origins of most of the theories of conceptual change in Kant's distinction of *a priori* and *a posteriori* knowledge. Although these theories use the framework of '*a priori* structures combining synthetically with new experience', yet they differ in their 'notion of schemata, experience, and the construction process in which schemata and experience come together', and in their emphasis (p44).

Being sensitive to prior knowledge has not only theoretical but also methodological implications. To study prior knowledge, researchers have used new and have refined existing methods of investigation. Piaget investigated children's understanding of a concept using clinical

interviews, a method used by museum researchers as well (Feher and Diamond 1990). Researchers conducting research within information-processing and situated learning frameworks have developed the think-aloud protocol and video-recording techniques respectively, in order to study prior knowledge (Roschell 1995).

Due to the close affinity between prior knowledge and a specific subject matter, our understanding of the former is fragmented and incomplete. To add to this problem, much of the research into prior knowledge sees it as conflicting with the learning process itself. Roschell (1995) argues that biases in theory and method have resulted in a view of prior knowledge as necessary (since it is impossible to learn without prior knowledge) and also problematic (as it often leads learners to inadequate understandings). This is known as the 'paradox of continuity'.

Most of what we know about prior knowledge comes from research in science learning and it is, therefore, associated with theories of knowledge. Particularly relevant are ideas about the relationship between everyday or common-sense knowledge and scientific knowledge. Implicit in such a distinction is the belief that scientific knowledge is superior to other ways of understanding the world. Following that, many contemporary theories of conceptual change refer to prior knowledge as 'misconceptions' or 'naïve knowledge' and the concepts that the learner constructs as 'alternative conceptions' or 'alternative frameworks' (Alsop and Watts 1997; Hein 1998). However, these conceptions or meaning-makings may make perfect sense within the social context and everyday experience of the learner. Using an anthropological perspective, Ross (1998, On-line) argues that the distinction between everyday (or folk) and scientific (or social-scientific) theories is not one of kind but one of degree:

> 'Where by definition folk theories utilize actors' own concepts and frames of reference, social-scientific theories are more likely to employ concepts which many actors do not recognize or use themselves. This is not surprising since social-scientists attempt to develop general theories which can be used across contexts and folk theories are contextually specific. However, what both folk and social-scientific theories have in common is that each are generalizations about the world and are efforts to make sense of it' (Ross 1998: 2, On-line).

Similarly, Roschell (1995: 39) observes that 'scientific knowledge is not a *type* of knowledge but rather a refined product for which prior knowledge supplied the raw materials and social interaction supplied the tools'. He also urges us to see prior knowledge 'as the raw material that conditions all learning' (p41). Further, instead of trying to challenge, alter or replace the learners' conceptual frameworks, learners should be allowed to refine their prior knowledge (Alsop and Watts 1997; Roschell 1995).

2.6 Conclusion

Learning is a complex, multi-faceted phenomenon and this fact makes it difficult for researchers to agree on a common definition of it. However, most would agree that learning involves some kind of change. As far as museum learning is concerned, it is also agreed that the physical and the social environment plays an important role. Research on museum learning tries to describe, assess or suggest the conditions for conceptual change using a variety of theoretical and methodological approaches. Furthermore, certain studies do not focus on learning as such but rather broaden its meaning by trying to explore the multiplicity of motivations, experiences and meanings visitors make of museum visits.

Social and demographic changes have resulted in an increasing need and demand for learning throughout one's life. This involves individuals assuming responsibility and controlling their own learning experiences. Museums and other cultural institutions can and should play a key role in helping people in pursuing learning.

The following section looks at the institutions that, through their research, help us better understand how people learn in museums and galleries.

3. INSTITUTIONS AND ORGANISATIONS CARRYING OUT MUSEUM LEARNING RESEARCH

3.1 Types of institutions and organisations

We now turn to the institutions and organisation that carry out learning research in museums. Each type of institution/organisation carries out a different type of research related to its mission and tradition. They all have contributed to our current understanding of museum learning in particular and also, more broadly, of the role museums can play in people's lives. There is a wide range of institutions and organisations in North America, the UK and Australia which conduct, commission, or co-ordinate research, much of which is disseminated through publications, conferences and seminars. The following list does not aim to be exhaustive. The aim is to show the range and variety of institutions and organisations involved in studying learning in informal education settings. We have identified five general categories:

- governmental organisations including those that are funded or commissioned by government (federal, state and local) to conduct research. This includes: (in North America) the National Endowment for the Arts; the National Science Foundation; the International Center for the Advancement of Scientific Literacy; the Institute for Museum and Library Services; the Museum Learning Collaborative, University of Pittsburgh; and (in the UK) the Department for Culture, Media and Sport; and the Economic and Social Research Council

- independent and semi-independent organisations including research institutes and private bodies. This includes: (in the UK) the National Foundation for Educational Research (NFER); Comedia; and (in North America): the Institute for Learning Innovation, Annapolis, Maryland; the Institutional Studies, Smithsonian Institution, Washington, DC; Hood Associates, Columbus, Ohio; Selinda Research Associates, Chicago, Illinois; Randi Korn and Associates, Alexandria, Virginia; People, Places & Design Research, Northampton, Massachusetts; and Serrell & Associates, Chicago, Illinois

- academic institutions. This includes: (in North America) Visual Understanding in Education, New York; the Program Evaluation and Research Group (PERG) at Lesley College; the Informal Learning Project, University of Chicago; the Center for Social Design, Jacksonville State University, Alabama; the Groupe de Recherche sur l'Education et les Musées (GREM) at the University of Quebec in Montreal, Canada; and (in the UK) the Work, Interaction & Technology Research Group, King's College, London; the European Studies Research Institute, University of Salford; Liverpool Evaluation and Assessment Unit, University of Liverpool; and the Research Centre for Museums and Galleries at the University of Leicester. Many more universities offer postgraduate research programmes[19]

- museums and galleries (an increasing number of museums conduct and/or commission applied research or evaluation) and professional organisations. The latter includes: (in North America) the American Association of Museums (AAM); the Committee on Audience Research and Evaluation (CARE); the Visitor Studies Association (VSA); the Association Science-Technology Centers (ASTC); the Association of Youth Museums (AYM); and (in the UK): the Museums Association (MA); the Visitor Studies Group; the Group for Education in Museums (GEM); the Museums and Galleries Commission (up until April 2000); and Resource: the Council for Museums, Archives and Libraries

- other. This includes collaboration between public agencies, professional organisations, universities and museums such as (in Australia) the Australian Key Centre for Cultural and Media Policy, Brisbane; and (in the UK) the Campaign for Learning Through Museums, London; the National Association for Adult Continuing Education (NIACE); and the Policy Studies Institute (PSI), London.

Findings from research studies carried out by most of the above organisations and institutions as well as individual researchers can be found in this paper.

3.2 Types of research conducted

We are aware of debates, generally to be found in science-related fields of study, regarding distinctions between basic and applied research or evaluation (Bitgood 1996; Hein 1998: 54-67; Koran and Ellis 1991; Miles 1993), and the value and politics of evaluation (Ames 1993; Friedman 1996; Hayward 1992; Kamien 1992; Lawrence 1991 and 1993; Shettel 1996; Spock 1996). In these debates, evaluation is often described as pragmatic, topical, related to real-world problems, often using less formal and qualitative methods, being carried out under tight time constrains and addressing a very specific audience, generally of museum professionals (Miles 1993; Shettel 1991). Research, on the other hand, is described as furthering our knowledge about visitors and exhibitions through the testing of hypothesis and building models; appropriate research methodologies are seen as usually quantitative and results are expected to be generalisable; research studies tend to focus on several exhibits, exhibitions or sites; and their audience is the 'community of scholars' (Miles 1993, Shettel 1991).

Alternative approaches to research and evaluation can be found in some of the more recent British research studies (Macdonald 1992, 1993). Qualitative research data and ethnographic research methods fit best with a constructivist approach to the understanding of learning, where learning is seen as context-specific and learners are conceived as active in the development of their own understanding[20].

There are still many researchers who would see research and evaluation in terms of opposed pairs. However, as many of the studies being reviewed in this paper suggest, the distinctions proposed are not clear-cut. Furthermore, studies carried out within the framework of action research directly challenge these divisions. Action research aims to integrate theory and practice. According to Darling (1998: 2, On-line),

> 'the term action research[21] describes a family of systematic research methods which include the following steps: data gathering, feedback, and a cycle of planning, action, observation and reflection, with the goal of producing knowledge and improving practice'.

Action research sees knowledge as contextual and generative, a synthesis of local theory and practice with external theory, while action evaluation is described as a form of action research with a strong emphasis on process control (Damme 1998, On-line). By the same token, evaluators in other areas of social sciences have supported the need for 'theory-based' evaluation. Weiss (1997), speaking at the American Evaluation Association 1997 conference, argued that all social programmes are based on either implicit or explicit theories of change that suggest what will work, what is worth doing and why. She sees evaluation as a way of making these assumptions explicit.

3.3 Types of research reviewed

Both research and some evaluation studies can offer material for the understanding of museum and gallery learning. The research reviewed in this review covers studies that:

- are part of a more general research plan or agenda; are usually conducted by institutions/organisations or individuals who work in or come from an academic research background or who have long experience in carrying out basic and/or applied research (such as the Program Evaluation and Research Group (PERG) at Lesley College; the Institute for Learning Innovation in Annapolis, Maryland; and the Groupe de Recherche sur l'Education et les Musées (GREM) at the University of Quebec in Montreal, Canada)

- are comparative either because the researchers who conduct them are in a position to use multiple sites or because a comparative element has been built into the design of the study intentionally (such as the Institutional Studies at the Smithsonian Institution in Washington, DC)

- are longitudinal (studying people over a long period of time) or have an longitudinal element (studying people at specific times eg before, during and at different times after the visit)

- although driven by the development of exhibitions, build on previous research studies (see, for example, the study carried out at The Children's Museum of Indianapolis reviewed in section 4.3.3 below).

There have been some efforts to develop a plan of action or a long-term research agenda for museums. They aim to systematically document and analyse the variety of visitors' experiences and the impact museums have on visitors' lives using new research paradigms. The Institute for Learning Innovation in Annapolis, Maryland, has organised two conferences[22] where long-term museum learning research was very high on the agenda. These meetings brought together researchers from different fields who carry out research in informal education settings. Another example is the Museum Learning Collaborative at the University of Pittsburgh, a nationwide project which has brought together researchers and museums that work towards developing a museum learning research agenda[23].

Research into museum learning has also been carried out by doctoral students at the Department of Museum Studies at the University of Leicester, England. The most recent work that has been completed focuses on the development of museum education in Canada (Carter 2000), multicultural museum education approaches (Golding 1997), family agendas (Moussouri 1997a, 1998), and the experience of non-Chinese visitors in a gallery of Chinese culture (Tseng-Chang 2000). The theoretical approaches taken by these studies are informed by philosophical hermeneutics, critical theory and cultural studies. Accounts of work in progress are available through Museological Review which is published annually by the research students of the department.

4. LEARNING RESEARCH IN MUSEUMS AND GALLERIES

4.1 Introduction

Museums and galleries are visited by very diverse audiences. Museum visiting patterns have been studied and explained by two main approaches: the psychological and the cultural approach[24]. The psychological approach has been the major research paradigm in the USA[25]; it explains the motivation for visiting museums as deriving from leisure needs as perceived by individual visitors. However, no explanation is provided as to why these needs occur in the first place and there is no attempt to place museum visiting in a socio-cultural context[26]. Commenting on the limitations of this approach, Merriman (1991: 77) argues that 'although it identified socio-cultural factors as being important, it is unable to move beyond this observation to an understanding of how it is that these factors actually operate to bring about the patterns in cultural consumption continually detected by surveys'.

The other approach is the cultural approach which views museum visiting as a cultural activity. Bourdieu (Bourdieu and Darbel 1991) has carried out many studies in French and other European museums using the cultural approach. However, most of the studies looking at museum visiting patterns fall somewhere along a psychological-cultural approach continuum. In the UK, Macdonald (1992, 1993 and 1995), Merriman (1991) and Moussouri (1997a and 1998) have used ideas from the cultural framework[27] to explain museum visiting and attitudes to participation in cultural activities. From this work, it becomes evident that there is a wide range of different reasons why people visit museums. Many of them may well be idiosyncratic but the fact that it is possible to find patterns in visitors' motivation illustrates that museum visiting is determined by wider socio-cultural patterns. This assumption is further supported by the fact that patterns can be distinguished among attitudes to participation in cultural activities in general (Department of National Heritage 1996).

Much of the information we have on learning in museums comes from general visitor studies, many of which are relevant. Indeed, it is sometimes difficult to draw a line between the general and the specific, especially when learning is defined very broadly to include informal engagement with displays as well as involvement in formal learning programmes. In addition, there are a great many more of the former than the latter. This research review includes both general and specific studies, and includes research findings from studies carried out with audiences in different types of museums. The review provides an overview and highlights some of the directions museum learning research has taken; concrete examples are provided. Findings are presented in what follows according to the type of museum.

4.2 Research undertaken in science and technology museums and science centres

4.2.1 Introduction

This section looks at museums and/or centres exhibiting a wide range of static and interactive exhibits including natural history and physical sciences, and technology. Museums with 'live' exhibits (such as zoos) are not included in this section[28]. But studies are included that have been carried out across several institutions when one of those institutions is a science museum.

This section contains the largest number of research studies. Indeed, most of what we know about visitors comes from research carried out in this type of museum. The majority of this research has been conducted in North America. The section begins with a review of studies that examine the motivations for visiting science museums and science centres. It then moves on to consider research which explores the prior knowledge of visitors; this is particularly relevant where the approach of the museum focuses on ideas rather than on collections, as is the case in many science museums, especially those of contemporary science. The section continues with an overview of studies of specific audience groups which include studies of families, teenagers and adults, and school field trips.

Studies of museum websites are also featured in this section. Very little research on museum learning has focused on learning through museum websites (Dierking and Falk 1998). In fact, museums have hardly explored issues such as who uses their websites and how, and what and how they learn. Researchers in this field face the extra problem of selection of representative samples and low response rates (Chadwick and Boverie 1999). Like other museum research, website research seems to look primarily at visitor behaviour. Not surprisingly, science museums and their websites are most frequently featured as case studies.

Finally, the main findings from these studies are summarised, highlighting the main issues as well as gaps in the literature.

4.2.2 Motivation for visiting

Much museum visiting is a free choice activity; thus intrinsic motivation is an important matter for consideration. A three-year study (Linton and Young 1992) involving the Ontario Science Center, the Toronto Metropolitan Zoo[29], the Art Gallery of Ontario and the Royal Ontario Museum collected information on a wide range of issues including visitor motivations for visiting. The study included visitors and non-visitors who took part in three kinds of surveys and interviews. Six factors were studied in relation to visitors' motivation: advance information, special events, the role of the children, location of museum, leisure values and positive/negative experiences from prior museum visits. The age of the children was an important motivational factor for a large number of visitors who viewed museum visiting as a family or group outing. Frequent visitors to the Ontario Science Center described it in terms of entertainment, a family event, hands-on, 'intellectually stimulating' and requiring more 'energy' than a visit to the Art Gallery of Ontario, to the Royal Ontario Museum or to the zoo. The Royal Ontario Museum visitors perceived it as a place for 'intellectual stimulation', 'reflection', 'personal growth' and 'recreation'. Visitors to the zoo often referred to the 'outdoor physical surroundings', 'hot weather', and 'social-family opportunities' (Linton and Young 1992).

Social relaxation was one of the reasons visitors[30] at the Science Museum in London gave for visiting (McManus 1992). Other reasons included a general interest in science (slightly over one third of the respondents), having an enjoyable family outing (one fifth) and entertainment (one fifth). When asked what they expected to gain from their visit, they specified that they hoped to gain information related to science (more than one quarter), to satisfy a general interest in the subjects covered by the exhibitions (one fifth) and to see specific exhibits or exhibitions (one fifth). This means that all of them had education-related expectations (McManus 1992). Learning and having fun seem to be the most common motivation for visiting a science museum or centre. As shown by many studies reviewed here[31], learning and having fun denote different aspects of the same experience. For example, many visitors in the Kidscience at the Ontario Science Center used the word fun to indicate a type of experience that involved learning and being challenged (Soren et al 1995).

Macdonald's study at the Food for Thought exhibition in the Science Museum, London was in many aspects a pioneering one for the visitor studies field (Macdonald 1992, 1993, 1995; Macdonald and Silverstone 1992). The study followed the development of the exhibition on a day-to-day basis (as an ethnographic study) and also involved an examination of visitors' responses to it. This was a principally qualitative study which entailed unobtrusively observing visitors' movements and conducting semi-structured family interviews where visitors were encouraged to talk about their experience. In total, 42 completed tracks and interviews were carried out. What is interesting here is that 'the methodology was devised around an intention of looking at the kinds of readings of the exhibition which visitors would make' (Macdonald 1992: 402).

The study highlighted the ways in which the museum visit was appropriated by its visitors and how they were actively engaged in mentally constructing and reconstructing the exhibition. Visitors' motivation for visiting indicated the existence of 'a more general set of cultural projects about museums - about museums' perceived place in social life according to their visitors' (Macdonald 1993: 12). This idea has been referred to as 'cultural itineraries' which, in the case of visitors to the Food for Thought exhibition, were: life-cycle[32], place[33], family event[34] and education[35]. The educational itinerary was less important among the visitors while family, life-cycle and place seemed to be more dominant. Macdonald (1993: 12) argues that 'for a museum to attract visitors, the more cultural itineraries on which it features - and the higher up on each it is - the better'. Hence, where the itineraries intersect, visitors' motivation for visiting is even stronger. Further, 'the governing itinerary is likely to shape the frequency of visiting' (Macdonald 1993: 54).

The idea of cultural itineraries was pursued in a study[36] carried out in three museums in the north of England: the Museum of Science and Industry in Manchester (MSIM); Eureka! the Museum for Children, Halifax; and the Archaeological Resource Centre (ARC), York (Moussouri 1997a and 1998). Evidence of all the museums being used as part of the four cultural itineraries identified by Macdonald was discovered, but in addition a fifth itinerary was also found - that of entertainment[37]. Structural factors related to museum visiting were also identified

such as weather, proximity to the museum, time availability, crowd conditions and entrance fee. Although the itineraries were the same for all families in the three museums they were prioritised differently. Contrary to Macdonald's (1993) findings, the education itinerary featured very highly among the family visitors in all three museums. However, the picture changed when the other itineraries were compared across museums. Entertainment was a strong motivation for visiting Eureka! and was something communicated by the institution to its audiences through printed material; life-cycle was mentioned more often by MSIM visitors as there was a strong sense of the museum's buildings being part of the history of Manchester and its people for a very long time; and the place itinerary was more prominent among ARC visitors, with York being a city well known for its archaeological sites.

4.2.3 Assessing and describing learning: prior knowledge

The role of cultural preconceptions in the construction and reconstruction of a museum exhibition was explored by Macdonald (1992, 1993 and 1995). Her study looked at the readings made of the exhibition by visitors themselves. This sensitivity to visitors' accounts involved 'finding out how visitors themselves frame the issues involved, and the kinds of language and concepts they use' (Macdonald 1993: 53). The ways of seeing or reading an exhibition that visitors brought with them very much determined the messages they took from it. In the case of Food for Thought, visitors seemed to read the exhibition through three frameworks: 'culturally dominant ways of categorising the subject matter', 'a typology of exhibition-types derived from previous experience' and 'readings of the exhibition derived from its media and form'. Although these readings were not totally disconnected with the content of the exhibition, they did not reflect the intended messages. Macdonald (1993: 55) concluded that 'explicit or intended messages may be ignored or not seen by visitors where they are at odds with visitors' cultural preconceptions; the exhibition leaves room for alternative readings'.

Preconceived ideas in the form of 'misconceptions' or 'naïve knowledge' - as the authors called them - was the focus of an applied research study with children and adults at the Franklin Institute Science Museum in Philadelphia, Pennsylvania (Borun 1990; Borun et al 1993). The study aimed to investigate visitors' misconceptions about gravity and also to assess whether hands-on exhibits could alter these misconceptions. Visitors' ideas related to gravity involved explanations related to air, rotation, orbit, magnetism and the sun. The above list of explanations is not mutually exclusive and, hence, visitors were found to provide more than one of them. It was argued (Borun et al 1993: 207) that 'the most prevalent misconceptions involve air and rotation and are each found in 51% of the interviews[38]. Misconceptions relating to planetary orbits and magnetism were also common, with 45% and 41%, respectively. Finally, the idea that all gravity comes from the sun was expressed by 10% of the sample'. Not surprisingly, it was found that there were variations among the respondents in terms of both the content and the structure of their misconceptions which were held by both children and adults. In an effort to address the most frequently held misconceptions (about air and rotation) exhibit prototypes were made aiming to show what gravity is not. After conducting a series of formative studies, the authors concluded that hands-on exhibits successfully altered these misconceptions. This study has been criticised by Feher (1993) for the manner in which the questions about gravity were asked; the possibility of having misled visitors; and the conclusions regarding the success of the approach in changing people's misconceptions.

Feher (1990) has also carried out research into the prior knowledge that children, aged eight to 14 years, bring to a science centre. She looked at children's preconceptions of light and vision using 'a field version of the Piagetian task-based clinical interview' (p37). By presenting two ways children used to predict how shadows are formed and how light propagates, Feher (1990) demonstrated not only that their ideas constitute models used for prediction across different situations and tasks but also that they are very revealing about how children think about light. She also suggested that, as seen in the above study (Borun et al 1993), visitors' interpretation could be fed into the design of exhibits to make them more effective.

4.2.4 Studies of specific groups: family visitors

Maybe the most significant finding which is common in most family research studies is the importance of the social interactions between family members in enhancing learning behaviours[39]. These studies have opened up the way for viewing museum learning as a social rather than as an individual experience. It became evident that family visitors spend a lot of their time interacting with each other or other visitors (Hilke and Balling 1985; Stevenson 1991) and sharing and reinforcing family history (Taylor in Kropf 1992); and that social interaction is important as a factor contributing to information exchange and retention (Blud 1990a and 1990b; Diamond 1986; McManus 1987, 1988 and 1992).

In an effort to identify and measure family learning, four science institutions worked on a collaborative Family Learning Project funded by the National Science Foundation (Borun et al 1996; Borum et al 1997; Borun and Dritsas 1997). The group[40] consisted of The Franklin

Institute Science Museum, the Academy of Natural Sciences, the New Jersey State Aquarium at Camden and the Philadelphia Zoo. The project built on previous studies which focused on physical and verbal family behaviours and consisted of three phases, with each phase building on findings from the previous one. The first phase, a basic research study, documented the relationship between 'learning levels' and observable behaviour[41]. A set of learning levels was developed based on a list of learning goals related to the exhibits. These included: identifying, describing, interpreting and applying. Transcripts of family conversations at the exhibits and during the interview were scored in terms of learning levels. The analysis of the data showed that most families in all four museums fell between the first two learning levels (identifying and describing). Further analysis of the observational data showed that 'the level of learning is related to specific observed behaviour' (Borun et al 1996: 135). The types of behaviours that seemed to be statistically related to learning levels were 'ask a question'; 'answer a question'; 'comment on, or explain the exhibit'; 'read the text silently'; and 'read the text aloud' (Borun et al 1997: 280).

Phase Two of the project involved developing and evaluating four 'family learning components' - that is, exhibit components which were thought to enhance family learning - one at each of the institutions involved (Borun and Dritsas 1997). During this phase, a list of seven family learning-related exhibit characteristics[42] was devised based on existing research and research carried out in the first phase of the project. Phase Three of the project set out to compare 'the frequency of learning behaviors for treatment families that have used the enhanced test exhibits to control-group families that have used only the test exhibits' (Borun et al 1997: 279). There was a substantial increase in learning behaviours of the families who used the exhibits designed to enhance family learning.

Family discussions seem to enhance learning. Discussion with other family members after the visit was found to be a primary factor in the retention and formation of museum visit memories (Stevenson 1991). Stevenson[43] found that the recall of the visit occurred spontaneously and involved not only information about the exhibits but also how visitors had felt and thought about them. Although the study was followed up several months after the actual visit, the memories were quite vivid. There was evidence that cognitive processing did take place during the visit. However, 'most of the thinking was concerned with "effects" rather than "explanations" or "understandings", although quite often visitors related their experiences to what they knew already or had seen on television' (Stevenson 1991: 530).

There is some evidence that the nature of the exhibit influences the amount of social interaction taking place in front of it. Blud (1990a, 1990b) - in her study of families in the Science Museum in London, found that interactive exhibits were more successful than static exhibits in stimulating a constructive exchange between parent and child. Different types of exhibits (fully interactive, push-button and static) created different social contexts. Further, children's understanding of concepts presented by the exhibit appeared to have been aided by the social interaction between parent and child. This happened regardless of the accompanying adult's ability. This finding parallels that of White (1990: 8) who claimed that 'although children frequently initiate exploration of an object, interaction with a family member produces a more sustained inspection'. The significance of interaction was previously described by Hilke (1988) who found that one of the most preferred strategies for information pick-up among families was hands-on manipulation.

In two family observational studies by Falk (1991) and others which took place at the Florida State Museum of Natural History and at the Smithsonian Institution's National Museum of Natural History, it was found that a typical visit to a natural history museum consists of four components:

- the orientation period (lasting 3-10 mins)
- the intensive looking period (lasting 15-40 mins)
- the exhibit cruising period (lasting 20-45 mins)
- the leave taking period (lasting 3-10 mins).

These four components were found to vary according to frequency of visiting. Hence, for first-time and occasional visitors the visit included all four components while in the case of the frequent visitor it included two components. Frequent visitors were involved in intensive looking and then they prepared to leave the museum. These studies also reveal the importance of exhibit location since exhibits viewed earlier in the visit evoke much more concentrated behaviours than those viewed later (Falk 1991).

In an effort to account for the family museum experience as a whole, Falk and Dierking (1992) have developed 'the interactive experience model'[44]. This model takes into account the personal and the social context that visitors bring with them to the museum and the physical context (or characteristics) of the museum environment. The visitor is seen as being actively engaged in the construction and reconstruction of these contexts. The visitor/museum experience is perceived as the interaction of the personal, the social and the physical context. This ongoing construction and interaction of the contexts is expressed by the phrase 'whatever the visitor does attend to is filtered through the personal context, mediated by the social context, and embedded within the physical context' (p4).

Moussouri (1997a and 1998), in her study of family agendas, approached the family museum visit from the point of view of family members. An agenda for learning was among the possible elements of the family agenda investigated, but it was not the only possibility explored[45]. The investigation showed differences between the agendas of family members according to their age and role in the group, adults' educational level, frequency of museum visiting and the type of museum visited. The visit plans employed by families seemed to be directly related to the frequency with which family members visited a particular museum - or museums in general - and the type of the museum. Visit plans were the product of constant negotiations among family members but were also influenced by what the museum could offer. Some families (first time visitors and occasional museum visitors) had a fairly open plan for their visit, one that was decided on entering and which included seeing the whole museum or as much as possible. Those who had visited before had more flexible plans which included seeing favourite or recommended exhibits while the rest of the visit was negotiated during the visit. These groups had visited the museum before or at least one member of the family had. Finally, there were families in the MSIM and the ARC with fairly fixed plans which had been drawn before entering the museum. They intended to see or do specific things - a type of 'visit routine' which had been negotiated and refined during many previous visits to each particular museum[46]. Families in Eureka! (a place perceived to be designed for children) had planned to spend the whole day there (a day dedicated entirely to the child family members) and follow the children around. Hence, plan-making was the children's task.

There were different agendas between children, parents, and grandparents and other relatives. Children - although mainly concerned with their own visit experience - did express their wish to share the visit with members of their family. They expected to see specific object/exhibits (exhibit-specific agenda) and focused on the 'doing' aspect of the exhibitions. Parents were concerned with their own experience. However, the visit was child-oriented, especially so at Eureka! Parents at Eureka! seemed to be less concerned with their own experience as the museum was seen as a place for children. They expected to see things related to a particular theme or subject (subject-specific agenda) and intended to influence their children's educational experience and enjoyment. Grandparents and other relatives, on the other hand, denied any personal expectation and stated that their visit was child-oriented by emphasising its social character[47].

The way the exhibitions were experienced and remembered or reconstructed after the visit related very much to the agendas for the visit and also to visitors' educational level. Children enjoyed doing things while parents enjoyed exhibits that involved mental activity, exchanging ideas and information with their children and teaching[48] or helping their children construct meaning out of the exhibits. The investigation also identified alternative readings and levels of abstraction used within those readings depending on the educational background and age of the visitors. In the MSIM, for example, adults from a lower educational background and the vast majority of the children provided a phenomenological description[49] based on a sequence of events as they observed them while interacting. On the other hand, adults from a higher educational background and, in a couple of cases, their children, were able to provide more analytical abstract descriptions[50] (Moussouri 1997a).

4.2.5 Studies of teenage and adult visitors

Using the findings of the study on visitor agendas discussed above and, in an effort to measure learning, Falk and Moussouri (Falk et al 1998) carried out a research study at the new Geology, Gems and Minerals exhibition[51] at the Smithsonian National Museum of Natural History. Data was collected using a methodology devised by Falk, called Personal Meaning Mapping[52] (PMM). This is a Relativist-Constructivist approach to measuring learning. The initial assumption is that 'each individual brings varied prior experiences and knowledge into a learning situation and that these shape how that individual perceives and processes what he or she experiences' (Falk et al 1998: 109). The study aimed to measure the learning effect that an educational intervention - such as a museum exhibition - has on people. Visitors were asked to complete a pre- and post-visit PMM. The majority of the visitors showed significant gains in their ability to describe gems and minerals, in their conceptual understanding of the subject, and in their mastery of gems and minerals as a topic. It was also found that visitors with a strong education and entertainment motivation for visiting showed significant learning gains. Visitors' plans for their visit (or visit strategies) also seemed to influence visitors' learning gains and behaviour. Hence, those people who visited the museum to see the Geology, Gems and Minerals exhibition in particular showed significantly greater learning gains and spent more time in the exhibition as compared to those visitors who did not come to see a specific exhibition and also to those who just wandered into the exhibition as part of their visit. As the authors (Falk et al 1998: 117) conclude, this research highlights 'the multi-dimensionality of the visitor agenda'.

The relationship of entertainment and learning was also explored by a study (Eratuuli and Sneider 1990) carried out at the Lawrence Hall of Science located on the campus of the University of California at Berkeley. Based on the analysis of observational data it was shown that the large majority of visitors in a science centre 'engage in the kinds of learning activities that lead to both enjoyment and understanding' (Eratuuli and Sneider 1990: 492). This study, and the one discussed above (Falk et al 1998), adopt a more holistic approach to the study of learning than that used by those who perceive education and entertainment to be the two ends of a continuum and, as such, to compete with each other. The latter are usually studies that focus on the observed behaviour of visitors which is used as an indicator of learning; and that describe museum experience in terms of a (usually limited) set of variables such as the attracting and holding power of exhibits, age, gender, prior visits. For example, Lozowski Boisvert and Jochums Slez (1994: 137) stated that 'as informal educational institutions, science museums must do more than entertain and amaze visitors'. Their study (Lozowski Boisvert and Jochums Slez 1994), carried out at the Human Body Discovery Space in Boston's Museum of Science, examined the relationship between visitor gender, age and social grouping, and attraction and holding power. A correlation was found between holding power and visitors' engagement level with an exhibit which was assumed to be associated with learning.

A study that tested specific display techniques was that of Falk (1997) who studied the relationship between conceptual understanding and exhibit clusters with or without explicit concept labelling at the Californian Museum of Science and Industry in Los Angeles. Based on the analysis of the pre- and post-test interviews, it was found that visitors who used the exhibit clusters with explicit concept labelling (defining both major and minor messages) were better at articulating the major intended messages of the exhibition and they spent more time in it. However, visitors' understanding of the concepts presented in the exhibitions increased regardless of whether the exhibit clusters visited provided explicit labelling or not.

A very interesting research study, which comes from the field of the public understanding of science, was carried out by Alsop and Watts (1997). Although it is not museum-based research it has many implications for carrying out science research in museum learning. The focus of the study was to offer a description of personalised learning among inhabitants of a rural village in Somerset, UK regarding their learning about living in an area of possible high background radiation. To do this, the researchers (Alsop and Watts 1997: 638) used a model of conceptual change which allowed them to 'explore how learners feel about the science involved, the extent to which they see the knowledge as useful and can act upon it, and how they see themselves in relation to learning science'. The methodology employed involved in-depth interviews and aimed to encourage respondents to think analytically about their learning - a meta-cognitive and meta-affective analysis. It was based on the belief that informal learning is continuous and, hence, deciding on times of pre- and post-intervention interviews is not only arbitrary but also goes against the very nature of informal learning. This view is supported by research in museum memories (Falk and Dierking 1997).

Another interesting methodological approach has been utilised by Stevens and Hall (1997). It involves using video both as a tool for doing research about learning (where visitors are invited to talk about their actions being represented in the video) and as a tool to facilitate learning. The latter idea entails using video as a representational resource 'to organize visitors' experiences in interactive science museums' (Stevens and Hall 1997: 745).

4.2.6 Studies of school visits

This section refers to programmes for organised school groups as opposed to research into the learning experiences of casual visitors. Other researchers[53] have also reviewed studies in which different aspects of field trips were examined including learning experiences (Bailey 1999, On-line; Bitgood 1989; Price and Hein 1991; Ramey-Gassert et al 1994).

The Program Evaluation and Research Group (PERG) at Lesley College has carried out a series of studies of museum-based science programmes. Reviewing this work (Price and Hein 1991) some data emerged as important. Programme components which affected the programme experience of the participants include having small groups of pupils so that more time is spent asking questions (this is directly affected by staff number available); spending enough time at the museum (usually around two hours); offering a variety of activities involving first-hand experiences, opportunities for observation and social interaction, and introduction of vocabulary and concepts; and making repeat visits to the same institution. Provision for teacher training sessions and involvement in the development of the programme increased teachers' commitment to the programme and the possibility of doing follow-up work at school. Teachers' interest and commitment was also found to be proportional to pupils' interest and curiosity.

Using elements from the Interactive Experience Model (Falk and Dierking 1992), Anderson (Anderson et al 1998: 1) looked at 'how 11- to 12-year-old students draw on aspects of their personal, physical and social contexts during the course of a school visit to an interactive science museum ... to construct knowledge about electricity and magnetism'. The case study used was the Sciencentre in Brisbane, Australia and links were made with classroom activities linked to specific exhibits. A cyclical approach to data collection was employed where each cycle informed the next. Pre- and post-visit concept maps and semi-structured interviews were conducted. All students attended a presentation prior to the visit (which included information and images of the Sciencentre layout, exhibits and suggested activities for the visit) and another one after the visit (where Sciencentre staff talked about the underlying phenomena presented in the exhibits). Students' constructions and reconstructions of science concepts and principles included both accepted scientific understanding and 'alternative' conceptions. All students experienced small transformations in knowledge which were closely related to their prior knowledge and experiences.

Rennie et al (1998) investigated factors that influence children's interaction with hands-on exhibits and their understanding of science and technology principles. The research focused on three- to seven-year-old children visiting the Scitech Discovery Centre in Perth, Western Australia. Children - in both school and family groups - were observed and videotaped interacting with exhibits and were also interviewed. Adults were asked questions related to children's interests and activity preferences. Having set out to test whether children understood the intended messages, the authors (Rennie et al 1998: 13) distinguished those children whose 'interaction with the exhibits was epistemic' from those who 'played with the exhibits in ways which were not intended by the designers'. They concluded that the level of understanding of the former was invariably high while the latter were less likely to understand the concepts presented by the exhibits. However, the authors did recognise that it is hard to determine children's understanding by interviewing them.

Gilbert and Priest (1997) found evidence of socially constructed knowledge among eight- and nine-year-old pupils at the Food for Thought exhibition at the Science Museum in London. This was the result of organising pupils' visit around small groups, each accompanied by a knowledgeable adult who provided help, encouraged question-asking and information-exchange behaviours, and read chunks of text aloud for pupils. Making links between the museum visit experience and the school curriculum helped pupils engage with museum objects and develop mental models of them. The significance of providing links between the museum visit and the school curriculum was noted by students (ten-16 years old) at the Australian Museum (a natural history museum) and the CSIRO Science Education Centre in Australia (Griffin and Symington 1997). Students also mentioned that they would have liked to have more choices and control over their visit and learning experiences during a museum visit.

Peer interaction was the focus of a study carried out with schoolchildren (Tuckey 1992) in Stratosphere in Scotland. Tuckey found that peer interaction - especially between stable pairs - enhances interactions between children and exhibits and reading behaviour. It is also worth noting another study which focused on children's participation in informal science-related activities in general for its methodological approach (Korpan et al 1997). The study aimed to better understand the nature and scope of such activities for classroom instruction purposes. Museum visiting was indeed among these activities. Two structured interview procedures were developed: for parents with pre-school children (CHARTS/PS) and for parents with school-age children (CHARTS/SA). Both CHARTS/PS and CHARTS/SA include the following sections: information about the child, watching television, adult-child reading activities, science activities at home, community outreach programmes, and children asking science- and technology-related questions of the parents.

Long-term museum learning was the focus of a study which looked at people's recollections of school field trips (Falk and Dierking 1997). One hundred and twenty-eight people were asked to recall a school field trip. The nature of the experiences recalled were vivid and very similar across all age groups and type of institution visited. The most frequently recalled school field trips were those made to some type of science museum/centre: natural sites or centres, farms, historical sites, zoos or aquaria, natural history museums, and science and technology centres. An important aspect of recollections was that they contained elements of the personal, physical and social context of the experience. According to Falk and Dierking (1997: 216), 'the vast majority of recollections were embedded within descriptions of the physical and social setting, often in relationship to some statement of feeling or attitude. Furthermore, three-quarters of all recollections were content-related and aspects of the field-trip experience were frequently recalled before the interview whenever the interviewees encountered a similar context. These patterns of recollections are very similar to findings described in a previous study on museum recollections conducted by the same researchers (Falk and Dierking 1991).

Falk and Dierking are among the first researchers who conducted recollection or memory studies[54] in the field of museum visitor studies. Such studies have stemmed from an effort to broaden the definition and enrich our understanding of museum learning. In reviewing their own studies as well as those carried out by other researchers, Falk and Dierking (1992) concluded that there are consistent patterns which

run through all of them and can be explained using the Interactive Experience Model. Hence, all recollections related to personalised information about the visit, information about the social and physical aspects of the visit, specific exhibits, the time and, finally, the respondent's mental state at the time of the visit. Although initially recollection studies were not always well received[55], they have increasingly been used as part of exhibit evaluation studies (McManus 1993) and studies on cultural visitation (Prentice 1999).

4.2.7 Studies of website users

A research study carried out at the New Mexico Museum of Natural History and Science website looked at how individuals and groups use websites. There was an indication that groups engage more in browsing behaviours than individual users (Chadwick and Boverie 1999). A survey study (Thomas and Paterson 1998, On-line) carried out by Solomon Business Research on behalf of the Education and Programmes Unit of the Science Museum, London also focused on 'typical behaviour' in viewing the museum's site. Some of the topics the survey looked at included visitation numbers, demographic characteristics of the respondents, percentages of museum visitors among the respondents and reasons for visiting the site. A significant number of visitors stated that they used it for specific learning purposes (doing homework or private study and preparing for lessons).

An interesting approach to evaluating exhibits with hypermedia and interactivity comes from the field of educational technology (Peterson 1991). Peterson proposes that the Responsive Environments Program - developed by Omar K Moore - can be applied in museums to assist the development and evaluation of interactive exhibits. According to this approach, there are four principles that guide instructional design: Perspectives (presenting a subject with a variety of operational and social contexts); Productivity (ability of the learner to apply knowledge in different situations); Personalisation (engaging the visitor); and Autotelicity (giving visitors freedom of choice). Small (Small and Arnone 1999) at the School of Information Studies at the University of Syracuse has developed WebMAC, a website motivational analysis checklist, as a tool for evaluating motivational aspects of websites.

4.2.8 Learning research in science museums and science centres: conclusion

Most of the research carried out in science museums and centres has been conducted in the USA, followed (in numerical terms) by the UK and then Australia. The vast majority of the studies focused around exhibitions, mainly because the objects are less intrinsically significant in some science museums, where concepts rather than collections drive the subject matter of the exhibits. It appears that only a few studies concentrate on learning through participation in programmes or workshops, or through the use of educational material. And there is a corresponding lack of focus on learning from objects. Most of the studies reviewed have taken a positivistic approach to learning with the emphasis being on testing hypotheses. More studies are needed that would employ a constructivist approach to learning or would attempt an open-ended exploration rather than confirming what we expect to find. There is also a need for longitudinal research studies that will focus on the long-term effect of museums on the life of their visitors.

Studies into learning in museums and galleries are increasingly concerned not only with what happens during the visit but also with what happens before and after the visit. Hence, they have explored the role museums play in the social life of their visitors and how the motivation for visiting relates to culture. They have also discussed how prior knowledge influences museum learning. On the other hand, fewer studies have asked what is the long-term impact of museum and gallery visits. Even fewer studies have viewed learning as a continuous process and thus, tried to explore visitor learning before, during and after the visit as different stages of a single learning experience.

Overall, the vast majority of science museum learning research has focused on specific groups of visitors during a single visit to a particular gallery or exhibit and most of them have ignored the role of other aspects of the physical environment. There is a need for studies that look at visitors' experience as a whole taking into account as many factors affecting learning as possible. Most of the research was carried out with traditional science museum visitors that is, school and family groups. There are only a few studies of teenage or adult visitors while there are no studies of other visitor groups, including virtual visitors. Since different visitors use museums for different reasons and have different needs, it is hard to deduce evidence about visitors in general using findings from studies of children and adults in specific social groups. This fact also implies the need to develop new methodologies suitable for use with visitor groups not considered in research yet, for example very young children. Finally, research will need to explore all the possible functions that science museums and centres can play in visitors' lives apart from education.

4.3 Children's museums

4.3.1 Introduction

Although research and evaluation studies have been carried out in children's museums, particularly in the USA, they are rarely published. We only managed to find a few studies of family groups in children's museums. They are all basic research studies that have used a qualitative methodology and a constructivist approach to learning.

The first part of this section looks at studies that have tried to describe and assess the learning behaviour of child-adult groups in children's museums. There is also a study that has looked at the impact of children's museums on their community. The second and last part of this section presents examples of research studies that have been built into the exhibit development process. The conclusion brings together the main points of this section and highlights where the gaps in research are.

4.3.2 Assessing and describing learning

Perhaps the most comprehensive efforts to understand the 'what' and 'how' of learning in children's museums are three recent collaborative research studies. The first is Project Explore (1998), a collaboration between the Please Touch Museum in Philadelphia and Project Zero at the Graduate School of Education, Harvard University (Project Explore 1998). The second project was carried out in collaboration with the Children's Discovery Museum of San Jose in California and the Psychology Department at the University of California, Santa Cruz. Finally, Children's Museums: Bridges to the Future is an independent research project, which is the result of the collaborative effort of educators, researchers and museum practitioners. These studies are pioneering in many respects (with each study having most or, to some degree, all of the following characteristics): they are theoretically-based; they use a combination of qualitative and quantitative methods for data collection; data was collected in different sites, and focused on different audiences (including young children, who are usually ignored by visitor research studies); and they place learning in children's museums in the wider socio-cultural context in which they have developed.

Project Explore (1998; Haas 1996) is a two-year research study which aimed to answer the following questions: 'do young children learn in children's museums?'; 'what and how do young children learn in children's museums?'; and 'what conditions enhance children's learning in museums?' It consisted of two studies. The Learning Study set out to investigate the learning that takes place in children's museums and the conditions surrounding this learning. The Entry Point Study focused on children's engagement with exhibits and how it may lead to learning. The Learning Study was mainly carried out at the Please Touch Museum[56] using a multi-method approach to data collection which includes observations of children, focus groups, and interviews and questionnaires administered to various actors involved in the museum. Furthermore, the data was tested for its ability to be generalised by comparing it with other observational data collected at the Indianapolis Children's Museum, the Children's Museum of Boston and the Chicago Children's Museum. The Learning Study consisted of three phases, with the first one being more open-ended and less focused and providing a framework while highlighting specific areas for further research pursued in the next two phases.

Phase One of the study showed that the children observed were more likely to learn when the adults were involved in the interaction than not. 'Learning[57] varied in terms of levels of cognitive complexity and degree of generalisability outside of the museum context' (Project Explore 1998: 21). So, for example, simple cause and effect learning (defined as 'learning of a physical relationship between two things', p14) was usually quite specific to the museum context and, thus, not generalisable. Moreover, 'examples of learning of relatively higher levels of cognitive complexity and higher degrees of generalisability were observed more rarely than examples of learning at relatively lower complexity and less generalisability' (p21). Phases Two and Three revealed that four- and five-year-olds were more likely to demonstrate conceptual learning of a relatively high degree of complexity. Also when adults provided indirect instruction (defined as interacting 'with a child in a manner that guides the child to her own solution rather than providing the solutions for the child', p21) this resulted in the child gaining transferable problem-solving skills. This relationship between indirect instruction and learning - originally observed at Phase Two - was further tested using an experimental format at Phase Three and was found to be a strong one, at least in the short term. Despite the limited sample sizes and variations in the types of learning observed at the other children's museums, many of the types of learning observed at the Please Touch Museum were also observed at the other museums.

The second study used the Entry Point Approach[58] in order to 'address the potential range and multiplicity of children's learning and adult scaffolding behaviours at museum exhibits' (Project Explore 1998: 34). This study also consisted of three phases: the creation of a coding framework for the observational study, a primary research phase, and the identification of museum staff expectations and aims for learning processes. Data was collected at the Children's Museum in Boston and the Children's Discovery Museum in Acton, MA. This study showed that, although all entry points were used by children at the children's museums used as case studies, some entry points were utilised less often than others were. The entry points less utilised were Foundational and Aesthetic as compared to Experimental[59], Narrative and Logical/Quantitative ones. The importance of adult 'scaffolding' was also reconfirmed by the Entry Point Study. Adults utilised 'subcategories' of entry points in their effort to assist or scaffold children's learning activities during the visit. The strategies adults used to scaffold their children's learning activities were: 'modelling', 'posing a question', 'giving directions', 'giving an explanation', 'role playing', story telling', and 'providing physical support'. The study concluded that 'just as children are more likely to learn when adult scaffolding was present, in the Entry Point Study the rankings of most to least commonly observed entry points were identical for adults and children in the sample, suggesting a possible relationship between adult scaffolding for entry points and child engagement in that entry point' (p53).

Another study (Pilcher, Smith and Amsel 1999) showed that the questions adults posed to children seemed to be directly related to the context of the activity (fantasy play as opposed to problem-solving activities) which suggests that adults may be responding to the goals of different exhibits. This study looked at learning outcomes in relation to adults mediating children's experiences of exhibits and was carried out at the Treehouse Children's Museum in Ogden, UT.

The effect of the interaction of the adult on the children's museum experience was highlighted by another basic research study (Crowley and Callanan 1997) carried out at the San Jose Children's Discovery Museum. The study used a combination of socio-cultural and information processing theories on learning, and set out to explore shared scientific thinking among children and parents and how it influences children's ability to co-ordinate theory and evidence. Family interactions (verbal and non-verbal) at specific exhibits were video recorded. The study highlighted the parents' role as guide and interpreter of scientific phenomena. Parents provided three types of explanations around their child's activity: explanations relating to how the exhibit worked; explanations relating the exhibit with 'real world devices and phenomena'; and 'explanations linking the exhibit to formal scientific principles' (p15). Findings of this study helped the museum identify and redesign those exhibits that failed to encourage parents and children to adopt common learning goals.

The Bridges to the Future project has sought to study the role and impact of children's museums on the communities and organisations they work with. The Bridges project is as much about children's museums as it is about 'the processes of collaborative research and the current policy context' (Wyszomirski 1999: 132). According to Freedlander Gibans and Kres Beach (1999), 'the Bridges Project has sought to capture the "interactivity" that characterizes the relationship between children's museums and schools, neighborhood groups, individual children and their families, and professional colleagues working in museums of history, art, and sciences' (p3). It consists of four research studies: children's museums in relation to other museums; the effect of children's museums on families and individuals; the relationship between children's museums and schools, and between children's museums and the communities which they serve and exist in; and children's museums in a policy context.

4.3.3 The role of research in exhibit development

It is worth mentioning research studies carried out by children's museum professionals on a series of topics related to the development of new exhibitions. The kind of research aims at better understanding how children think and learn about science and tends to be theory-driven. The Children's Museum of Indianapolis - in collaboration with the Department of Educational Psychology at the University of Wisconsin, Madison - conducted a research study (Dierking and Pollock 1999, On-line; Schauble and Bartlett 1997) prior to the development of ScienceWorks, a science gallery for six- to ten-year-old children and their families. A theoretical framework was developed based on a series of studies with children of different ages. According to that, it seemed to be important that the gallery encouraged visitors to take part in science activities, to use scientific thinking skills and strategies, and to understand key science concepts. Learning options or entry-levels were developed for different types of visitors. During another research project (Perry 1993) carried out at the same museum, insights from research on intrinsic motivation were used to design exhibits that motivated visitors and, consequently, to develop a model for the design of such exhibits. The research identified six exhibit components that create an intrinsically motivating experience: curiosity, confidence, challenge, control, play and communication. The modified exhibit - where the new components were introduced - seemed to be more effective.

Eureka! the Museum for Children in Halifax, England took a similar approach in the development of its galleries. The programme of development of the exhibitions integrated existing basic research and applied research carried out by the museum staff who worked with 12 schools in the area. For example, one of the exhibitions which looked at how the body works and health and safety issues used findings from the Health for Life research carried out at Southampton University. Sections of the exhibition were developed in response to children's questions about their bodies (Thomas 1992). Researchers at Southampton University used a combination of write and draw, and questionnaire methods to collect data.

The development of NeoMuseum in Yoshimo (Ueda and Gross 1991), Japan, was based on other models of children's learning environments such as Sesame Street of the Children's Television Workshop, and the Logo and LEGO-Logo projects at the MIT Media Lab. The NeoMuseum is a product of collaborative research with universities and other research institutions and aims to create a multimedia learning environment for children. As seen in the case of the above museums, they used existing research but also carried out new research to guide the development of exhibitions.

4.3.4 Children's museums: conclusion

Research in children's museums focuses on a specific audience - mainly children in family groups - and is driven by attention to the needs of this audience. The aim of these research studies is to better understand children's learning. Most of the research reviewed is open-ended although some of the studies aim to inform exhibit development. This approach is unusual as most of the studies used to inform exhibit development are driven by the need to assess whether visitors understand the messages the exhibits aim to communicate. Furthermore, the studies reviewed are based on a sound theoretical framework.

Although the studies reviewed here are very good examples of the type of studies needed, we need a lot more research into learning in children's museums. We understand that children of school and preschool age form the largest audience of this type of museum. However, we have not found any studies of very young children (under-threes), of teenagers and of children in school groups or children visiting with grandparents and other relatives. There are also no studies looking at visitor motivation, prior experience or the long-term impact of children's museums on their visitors.

4.4 Art museums

4.4.1 Introduction

There have been very few studies carried out on learning in the art museum. This section is divided into two main parts; the first reviews visitor studies and what they say about motivation for learning, and the second examines studies that focus specifically on learning. What is it that motivates people to participate in different activities in their free time? What are the criteria according to which people make their leisure time choices? What factors influence visitors' aesthetic experience or learning in an art museum? These are some of the questions the following studies set out to answer.

4.4.2 Motivation for visiting

Studies on visitor motivation in art museums vary in their focus and approach. Some try to draw the profile of art museum audiences in order to answer policy questions (Davidson Schuster 1992). The studies reviewed in this section are those that use theoretical approaches to analyse the motivation for visiting (Csikszentmihalyi and Robinson 1990), and those that use an explicit or implicit psychological framework to study the phenomenon of visiting and non-visiting (Hood 1989; Koke 1996; Linton and Young 1992).

Csikszentmihalyi's (1988; Csikszentmihalyi and Robinson 1990; Csikszentmihalyi and Hermanson 1995,) work on creativity, the relationship of humans to objects, and motivation is of particular importance to museums. In one of his most recent studies he looked at art perception from the point of view of expert art perceivers (Csikszentmihalyi and Robinson 1990). Csikszentmihalyi has studied a wide range of activities, looking at what motivates people to pursue these activities even in the absence of any extrinsic rewards. He used the term 'flow' to describe 'a state of mind that is spontaneous, almost automatic, like the flow of a strong current' (Csikszentmihalyi and Hermanson 1995: 70). This state is characterised by the ability of the individual involved in the activity to 'fully express the self' (differentiation) and 'to feel connected with other entities' (integration). When an individual is in flow, they lose their sense of time and their sense of self. Csikszentmihalyi and Hermanson (1995: 71) claim that the 'dialectic between integration and differentiation is the process by which we learn'. Thus, the reward of flow activities is the growth of the self. They have distinguished three general characteristics of activities that produce flow. These are 'clear goals and appropriate rules', 'immediate and unambiguous feedback' and 'challenges and skills [that] are well matched' (Csikszentmihalyi 1988; Csikszentmihalyi and Hermanson 1995).

Hood is among those who have looked at people's motivation for visiting museums. She has developed psychographic survey tools in an effort to refine quantitative methods of evaluation (Bicknell and Farmelo 1993). Hood (1989) conducted a study at the Toledo Museum of Art using psychographic measures. Different groups of visitors valued different criteria in making leisure time choices. The criteria included having the opportunity to be with people, to do something worthwhile, to feel comfortable and at ease with one's surroundings, to have a challenge of new experiences, to learn, and to participate actively in leisure events (Hood 1989: 153). Family audiences put more emphasis on social interaction, active participation and entertainment than they put on opportunities to learn or do something worthwhile in their leisure time. In fact they were not at all in favour of the museum's emphasis on education opportunities. On the other hand, adults without children were most interested in learning (Hood 1989).

The way visitors use their leisure time in different types of museum varied considerably. In the study by Linton and Young (1992) reviewed in the section on science museums, it was found that visitors to the Art Gallery of Ontario viewed it as a place to visit specific exhibits and used it to 'calm down' and become introspective. In another study carried out at the Art Gallery of Toronto (Koke 1996), family visitors provided information about their leisure time criteria. The museum visits that had a positive and memorable effect on family members were those that allowed them to have shared participatory experiences and have fun together. They valued participating in activities that engaged all family members, that provided them with individual choices, that introduced them to new ideas or concepts and that had a clear task that they could achieve. Experiences with such qualities were remembered and taken back home with them. Not surprisingly, the characteristics of negative museum experiences included passive ones and those which are 'too structured, too pre-designed, and allowed little room for creativity or a personal stamp' (Koke 1996: 12).

4.4.3 Assessing and describing learning

The first study (Weltzel-Fairchild 1995) reviewed here looked at children's aesthetic responses to works of art. The theoretical framework for his study was the theories of Gardner and Horner on aesthetic response. A random sample of elementary school children (aged eight, ten and 12) was interviewed using different images of a realistic, an abstract and a semi-realistic work. The questions for the interview were based on Horner's ideas of aesthetic response. An important element of the methodology was that interviews were video recorded. Both verbal and non-verbal responses were transcribed and analysed. The study identified three factors that influence an aesthetic situation: the subject (the children interviewed), the picture (the images used for the interview) and the questions asked during the interview. Three styles of responses were identified as playing an important part in the aesthetic responses of the children: the concrete, the empathetic and the intellectual. Children with a concrete style found it hard to identify with the pictures. On the other hand, the empathetic children could easily identify with the pictures and made up stories relating the picture to their lives. Finally, the intellectual children were aware of the fact that works of art try to communicate a message.

This study also demonstrated that aesthetic responses depend on the art object as much as they depend on the viewer. Hence, the realistic picture was seen in terms of the story and the feelings it depicted. The abstract work elicited comments about the visual language used (shapes, space and colour) as well as 'imaginative' and 'poetic' responses. The semi-realistic work elicited comments about the subject matter. Children also made connection between the scene in the picture and their own lives. It was also found that the nature and sequence of the questions[60] children were asked about the pictures had an effect on their responses. Commenting on this, Weltzel-Fairchild (1995: 220) noted that 'the sequence moved from taking stock of personal feeling about the picture to evaluating it. The subject was vested in the situation on several levels: affective as well as cognitive'. This point is of special interest for museum educators who can use different questions to elicit different responses and to expand visitors' aesthetic experiences.

An evaluation study carried out at the Art Learning Center at the Speed Art Museum in Louisville, Kentucky tried to assess the degree to which the goals and objectives of the Center were met (Moreno and Adams 1998). The Art Learning Center development team used a constructivist learning model as a theoretical basis and aimed to assist visitors in developing their own meaning and personalising their learning. The objectives were loosely defined, allowing space for unexpected, personal learning: creating a 'safe, secure, and comfortable space for children and parents'; integrating original works of art and establishing connections to the museum's collections; and creating a space which would 'communicate an environment supportive of creativity and play and encouraging exploration in a social context'. Following that, a constructivist methodology[61] was employed which involved asking visitors to write down or make a drawing describing their expectations of visiting an interactive gallery. The same procedure was followed after the visit.

The study revealed that visitors made 'cognitive and affective shifts in their understanding and perception' after visiting the exhibition (Moreno and Adams 1998: 5). Visitors acknowledged the fact that the exhibition accommodated different learning styles, age groups and interest levels. They often reported having used the activities in imaginative new ways not expected by museum staff and having had experiences which are not available elsewhere. In terms of the social aspect of their experience, both children and adults found the visit rewarding and meaningful. The exhibition helped them make personal associations, and have fun and a relaxing time with other members of their families. Parents, in particular, seemed to associate spending quality time with their children at the exhibition with good parenting. The physical and social environment of the exhibition elicited positive comments: family members felt safe and at ease; they felt empowered to explore; and staff were perceived as friendly and helpful. Finally, visitors were enabled to make connections with the art content of the exhibition through the technology aspect of it (interactive computer exhibits) and vice versa; with other personal and professional experiences; and with the permanent collection of the museum.

Using Personal Meaning Mapping and other written and oral tools of data collections, staff of the Institute for Learning Innovation (Luke et al 1998, On-line) carried out a longitudinal programme study in order to evaluate the effectiveness of the Art Around the Corner programme developed by staff at the National Gallery of Art in Washington, DC. Using samples from both Art Around the Corner graduates and control students, the study showed that programme graduates used richer and more detailed vocabulary to describe a painting as compared to the control group. Programme graduates were also able to relate their interpretation of the painting to evidence drawn from it. The researchers concluded that the impact of Art Around the Corner was indeed significant and long lasting.

In a comparative study carried out by researchers of the Institutional Studies Office at the Smithsonian Institution (Doering, Pekarik and Kindlon 1997), the emphasis was on visitors' perspectives of their expectations and experiences, and how they constructed meaning out of these museum experiences. It was also examined 'whether or not "education" or "learning" are the best terms in which to describe those encounters' (p127). The case study used was a travelling art exhibition with historical components to do with art and censorship in Nazi Germany. The study was carried out in two sites were the exhibition travelled, the International Gallery of the S Dillon Ripley Center in Washington, DC and the Altes Museum am Lustgarten in Berlin. Commenting on the way the visitors in both countries responded to the exhibition, the authors argued that 'Washington visitors primarily saw the exhibition as having direct relevance to their lives today and strong emotional overtones, and their primary personal response was concern over sponsorship. Berlin visitors, on the other hand, tended to see the exhibition as an art exhibition within a historical context, and their primary personal response was an appreciation of the art' (p136). These responses seemed to match with their expectations and special interest in the topic and approach. Both Washington and Berlin visitors were highly selective and experienced types of visitors as they had a special interest in the subject, high level of education and were frequent museum visitors. All of the above factors contributed to helping those who visited to find personal meaning in the experience. It was also argued that if 'experienced visitors are especially likely to find what they expect to find, exhibitions may be more powerful as a way of validating an individual's view of the world than as a way of introducing new perspectives or effective transformation' (p137).

Evidence that visitors who choose to visit an exhibition tend to agree with the viewpoint of its makers was found in another study carried out by the same researchers at the Mechanical Bridges exhibition at the Cooper-Hewitt National Design Museum (Doering, Pekarik and Kindlon 1995). Researchers at the Institutional Studies use the 'entrance narrative' model to understand and describe this phenomenon (Doering and Pekarik 1997). This model consists of 'a basic framework' (the way visitors see the world), knowledge that visitors bring to the subject of any given exhibition and also their personal experiences. Apart from suggesting that visitors view exhibitions in ways that confirm their existing point of view, the model 'acknowledges that a visit to an exhibition or a museum is but one event in a larger flow of thoughts and experiences' (p47).

4.4.4 Art museums: conclusion

Although the studies discussed above are large scale and significant, this kind of museum is among the ones with the least studies carried out. This may well be that, contrary to science museums which often seem to feel that they wish to communicate specific ideas and to teach particular ways of thinking, art museums expect their visitors to respond in their own ways to the artworks. However, art museums are currently in the position of knowing very little about the actual experiences that their old and young visitors have in their galleries.

Bourdieu's early work in 1969 should be noted here. It has been very influential within sociology, but has not been much used within museum visitor[62] or learning studies. This is partly because it was not translated into English until 1991 (Bourdieu and Darbel 1991).

4.5 History and archaeology museums, and heritage sites

4.5.1 Introduction

There is far too little research on learning carried out in history and archaeology museums and heritage sites. Only four studies are discussed here: The first (Merriman 1991) concerns motivation for visiting. The following two (Allard, Boucher and Forest 1994, On-line; Allard and Larouche 1998) are programme evaluation studies which are part of a larger research agenda developed by the Groupe de Recherche sur l'Education et les Musées (GREM) at the University of Quebec in Montreal, Canada. The last one (Moussouri 1997a, 1998) concerns learning experiences in a hands-on archaeology museum.

4.5.2 Motivation for visiting

Merriman (1991) conducted a postal survey of 1,500 adults in order to collect information on public attitudes to, and attendance at museums and historic sites[63]. He found that people's reasons for visiting vary according to their frequency of visiting[64]. Hence, frequent visitors went to a museum due to a specific interest while regular and occasional visitors visited due to a general interest. The desire to take others to see a museum (12%) and sightseeing (12%) were mentioned as a motivation to visit by visitors of all types (frequent, regular, occasional and rare). Self-education was quite low as a motivation among all four types of visitors (1%). Merriman (1991: 56) concluded that what is significant `is that most people who visit museums do so for specific reasons of interest in the individual museums they go to'.

As we saw earlier[65], education was found to be the prime motivation for visiting the Archaeological Resource Centre (ARC) in York (Moussouri 1997a and 1998). The place itinerary was the second most important reason mentioned by family visitors for visiting the ARC. The sense of place was important to all visitors, whether they were on holiday or day trips, or with out-of-town visitors. This seems congruent with Merriman's study.

4.5.3 Describing and assessing learning

The first couple of studies report on research carried out by the Groupe de Recherche sur l'Education et les Musées (GREM) at the University of Quebec in Montreal, Canada. Both of them are programme evaluation studies and fall within the pedagogical models developed by GREM. The first study (Allard, Boucher and Forest 1994, On-line) was mainly carried out at the Musée David M. Stewart near Montreal. The main focus of the museum is the colonial history of Canada and Quebec. GREM has recently evaluated a number of programmes on the colonial history of the St Lawrence Valley in the 17th and 18th centuries. The study used as a theoretical bases Legendre's theory of educational interaction according to which four components (purpose, subject, method and milieu) influence a pedagogical situation. The study used a combination of qualitative and quantitative methods to record and assess the progress of the programme. Student involvement in specific activities both during and after the museum visit influenced their cognitive gains and also their attitudes towards the museum.

The other study conducted by GREM (Allard and Larouche 1998) is a programme evaluation study carried out at Cartier House in Old Montreal. The programme was attended by 'immigrant students' who learnt French. Ninety-two of them participated in this study. A combination of qualitative and quantitative methods were used to collect data at various points before, during and after the visit/programme. The analysis of the data showed a significant difference in the retention of specific knowledge about Cartier and his house, the territory, the technology of the time and the participants' country after the visit. However, there was some confusion among the participants as concerns the period of time when Cartier lived and his identity. It is suggested that this may be attributed to the fact that participants were more interested in the period rooms rather than the more didactic part of the exhibition.

Using research conducted at the ARC, Moussouri (1997a) points to the effect of gallery staff (in this case volunteers) on family visitors' ability to make sense out of their experience and to later reconstruct their visit. Volunteers in the ARC are the main mode of interpretation of the exhibits. First, they introduce visitors to the ways of working of an archaeologist. After the initial 'training', visitors participate in activities based on different skills of a professional archaeologist. Following this, the visit becomes increasingly less structured with volunteers available on request. Direct engagement of volunteers seems to be sensitive towards the family as a social group. This study points to the fact that the volunteer approach succeeds in making the exhibit-based information accessible to different types of learners by relating information to visitors' previous experiences and providing stimuli for following up later. Finally, it offers the opportunity for social interaction and the exchange of information between family members[66].

There were two main readings of the exhibition at the ARC: the 'history' and the 'object study' themes. The first referred to the past or a comparison of the past and the present. The second theme referred to the skills used to complete the activities. In the latter category, there were family visitors who viewed the activities as a vehicle to appreciate and relate to the artefacts and the role archaeologists play in our understanding of the material evidence[67]. Although a lot of family members were archaeology enthusiasts, they found the experience realistic which increased their appreciation and understanding of the subject matter. This was also related to the multi-sensory aspect of the experience. Family visitors at the ARC were able to relate the exhibits to their personal experiences and referred to the continuity of the past through the objects used then and now.

4.5.4 History and archaeology museums, and heritage sites: conclusions

Much research needs to be done in the area of history and archaeology museums, and heritage sites. Very little is known on either visitor motivation, prior knowledge and on adult or child learning for this type of museum.

4.6 Zoos, aquaria and botanical gardens

4.6.1 Introduction

It seems that only a limited number of studies have been published in zoos in the USA, the UK and Australia. Two of these studies were related to the development or evaluation of exhibitions. Anecdotal evidence implies that a lot of the research carried out in zoos, aquaria and botanical gardens is evaluation studies that are not published and thus are unavailable to the general public[68].

4.6.2 Motivation for visiting

A project funded by the National Science Foundation (NSF) in the context of informal science education was carried out by the Institutional Studies Office of the Smithsonian Institution. The institutions involved were the National Zoological Park[69] in Washington, DC, Zoo Atlanta and the Dallas Zoo. Staff at these institutions worked collaboratively in order to develop 'interpretive components' in exhibitions about reptiles. They aimed to 'transform the three reptile houses into science learning centers based around how people learn rather than traditional zoo design' (White quoted by Doering et al 1994: 1). More than 3,000 visitors were interviewed[70] and another 1,000 were observed in all three sites. Data was collected before and after the changes in the reptile exhibitions over a period of 42 days in total.

Visitors to the three zoos stated that their main motivation was either a special interest in the zoo or being on a social outing. The reasons for visiting the reptile exhibitions were much more specific. Most of the visitors mentioned either that they themselves or somebody else in the group had a special interest in reptiles, or in a specific part of the exhibition. The overall time spent in the reptile exhibitions and at individual exhibits increased after the interactive components were introduced. Visitors to the new interactive exhibitions were able to give much more accurate descriptions of reptiles as compared to those who had visited the old exhibitions.

Although visitors to both exhibitions seemed to be involved in learning-related[71] activities, visitors to the new exhibitions with the interactive elements were able to provide much more specific examples of such activities as compared to visitors to the old exhibitions. There is evidence that direct involvement occurred more often in the interactive exhibitions but it also varied with group composition. Hence, behaviours related to finding answers, discussing, and trying activities were more common with adults with children. Groups of adults or those visiting alone were more likely to be involved in reading, discovering and examining things. It was also reported that positive remarks about reptiles made by visitors to the new exhibitions were more than double. According to the researchers (Doering et al 1944), these findings show that the interactive element of the new exhibitions increased the degree of involvement with activities, the quality of the experience and, hence, meaningful learning experiences.

4.6.3 Assessing and describing learning

Tunnicliff (1997; Tunnicliff and Osborne 1995) studied the conversational content of schoolchildren and family visitors at the London Zoo as compared with that occurring at the Natural History Museum in London. The content of the conversations of school groups and families were surprisingly similar at live animal exhibits. However, school groups seemed to generate more affective comments as compared to families in the zoo. Comments related to different aspects of an exhibit made by both school and family groups when in front of an exhibit in both contexts were predominant. Attempts made by school and family groups to categorise different specimens were significantly less at the zoo as compared to those made at the Natural History Museum. Furthermore, both types of visitor groups interpreted the animals using their own experience while there was little 'talking science'. Tunnicliff (1997: 1052) argued that schools, in particular, miss the opportunity 'to introduce or reinforce some of their [children's] science learning, which includes not only knowledge and understanding of animal groups, but also the processes of science and more general aspects such as care of the environments and communication'.

Coe (1989: 87) used children's drawings[72] to test 'if the subjective goals of exhibit designers are realized in the completed exhibit'. He draws attention to the drawings children made after visiting the Woodland Park Zoological Gardens and suggests considering them as a research tool for measuring learning. This study is mentioned here for its implications in research and evaluation methods.

4.6.4 Zoos, aquaria and botanical gardens: conclusion

Zoos, aquaria and botanical gardens are yet another type of museum setting where not much research has been done. The UK study reviewed above offers an unusual approach since it focuses on the process of the experience rather than the effectiveness of the exhibition. However, a lot more studies are needed to cover the whole range of issues arising in visiting such museums. Until then, our knowledge of visitors' experiences will be extremely limited.

5. ASSESSMENT, CONCLUSIONS AND THE SCOPE OF A RESEARCH AGENDA

This paper has shown that most research into museum-based learning has been carried out in science museums in the United States, has been based on positivist methodologies which test pre-existing hypotheses and has focused on school and family experiences in exhibitions. Other research is far more limited. The validity of the transferability of the research into the British context remains an open question. There is, therefore, very little known about learning in museums and galleries in Britain. In addition, there is a pressing need for further research reviews that draw together what is known about the broader social outcomes of the experience of museum and galleries. The scope of the research required is very great, well beyond what can be achieved without significant funding and resourcing. We set out to define a research agenda for RCMG, but the research review suggests that a great deal more is needed.

5.1 The character of the research into learning in museums and galleries

Reviewing the research into learning in museums and galleries from a British perspective at the beginning of the 21st century, one thing jumps immediately off the page. Very few of the studies referred to here were carried out in Britain.

Most of the studies reviewed in this paper were carried out in the USA. This is not perhaps surprising as museum visitor studies as a field was first developed in America, and studies of learning in museums and galleries developed in America as a sub-set of museum visitor studies. Although a few studies of museum visitors were conducted as early as the 1930s, it was not until the 1970s and 1980s that the first systematic visitor studies were carried out. Visitor studies as an area of museum practice and research is now well established in the United States. In Britain, research into museum visitors began in the 1970s and 1980s with the pioneering and systematic work at the Natural History Museum in London under the direction of Roger Miles, and this work was followed up in the 1980s by studies by Sandra Bicknell at the Science Museum in London, and by Anne Pennington at Liverpool museums. However, visitor research was not adopted to any large degree by other museums, although basic demographic information about visitors was becoming more available by the beginning of the 1990s, with marketing officers established in most of the larger museums. This practical approach to understanding the demographics of museum audiences did not lead to the development of visitor studies on any large scale, nor to research into museum learning. This remained confined to the work of doctoral and masters students, very little of which was published.

Research into learning in museums in Britain is, therefore, far behind compared with North America, and the USA in particular. However, even the work done in America does not help a great deal in understanding the processes and outcomes of learning in museums and galleries in the UK. Differences in culture, different approaches to schooling, and different ways of thinking about social research all make comparability very difficult.

A second major conclusion is possible. Research into learning in museums and galleries seems to be qualitatively different in the UK, even at its undeveloped position at the moment, compared with that carried out in North America. There seems to be more interest in carrying out qualitative research studies using a relativist/constructivist approach and in combining ideas from different theoretical stances or fields of study. Although these kinds of studies are increasingly being carried out in North America, the bulk of the work is based on a positivist and functionalist perspective.

A third major point that has arisen from this literature review is that the vast majority of the studies are exhibit/exhibition research or evaluation rather than programme research or evaluation. There are only a very small number of studies of school field trips that could be viewed as programme research and even here the focus is not necessarily on the programme in which pupils have participated, or focused on their learning outcomes. There is an astounding lack of research into the value of objects and collections in learning. And an even greater lack of open-ended studies that ask the simple question: What is happening here?

The fourth conclusion is that the vast bulk of the research has been carried out in science museums or science centres and on the whole this has led to particular ways of theorising learning (as the transfer of facts or information) and of theorising research (as the testing of pre-existing hypotheses through methods susceptible to quantitative analysis). While this approach fits well with an understanding of educational processes as the transfer of specialist knowledge from expert to novice, it is not helpful in exploring actual processes of learning in complex social contexts. In making judgements of the effectiveness of specific exhibitions in information transfer, it ignores broader contextual issues that are likely to be of much greater significance in accounting for the actual social experience of museum visits. Some of the work carried out in children's museums and in art museums does suggest more open-ended and thus more potentially productive approaches that resonate better with constructivist explanations of learning processes.

A fifth point is significant. In a large number of the studies on learning in museums and galleries, the definition of what counts as 'learning' or 'meaning-making' is implicit rather than explicit. It has been pointed out that 'meaning should be public and theoretically supported rather than implicit and ad hoc' (Leinhardt and Crowley 1998, On-line). This, it is argued, supports a healthy dialogue, 'encourages the use of dynamic rather than static definitions', and enables the accounting of the unique social and physical context of the museum. A large number of studies which were initially reviewed were not included in this paper due to the lack of a clearly stated theoretical and/or methodological approach. In a very small number of cases, it was decided to review studies which, although they did not exactly fulfil the criteria of selection, presented useful points or interesting lessons for other museums. The studies reviewed here are very diverse in terms of the theoretical and methodological approaches employed. This manifests the richness and the variety of frameworks and tools available to conduct research, and the many possibilities for combining ideas from different areas of study which can give rise to new frameworks for studying and understanding learning. However, it poses many problems as it is often difficult to compare their findings (especially among quantitative and qualitative studies, and also between quantitative studies) and to generalise them across museums. There are only a few studies where multiple sites have been used and where findings have been validated and tested across sites. However, despite the diversity of studies across the different kinds of museums, the vast majority of them focus on a limited number of target audiences such as school groups and family groups. There are far fewer studies of young adult and adult visitors, and very young children. We did not find any studies looking at senior citizens, people from minority groups and people with special needs.

5.2 The social value of museums and galleries

This research review has focused on what is known about learning in museums and galleries. However, we acknowledge that even with a very wide definition of learning, by focusing on the educational aspect of museums, there is a danger of neglecting other functions that museums may serve in the social life of their visitors. A series of studies (Falk and Dierking 1992; Falk et al 1998; Hood 1989; Macdonald 1992, 1993 and 1995; Moussouri 1998) has shown that people visit museums for a variety of reason and view them as neutral environments that can meet a range of different needs and expectations. As governments increasingly require evidence of the social value of museums, this is an area that needs its own research review.

The therapeutic potential of museums has very recently been explored by museums and social service agencies in the USA and, to some extent, in the UK (Mastoris and Shaw 1996; Silverman 1989 and 1998). There is evidence of the indirect use of museums - and hands-on museums in particular - to fulfil 'social services missions' (Moussouri 1999; Spock and Jensen Leichter 1999). Although work in this area is gathering momentum, it has not been researched systematically. Several museums in the USA (the Children's Museum of Indianapolis; the Please Touch Museum in Philadelphia) and in Britain (Eureka! the Museum for Children in Halifax; Nottingham Castle Museum and Art Gallery; Leicester Museums, Arts and Record Service; the Open Museum in Glasgow) have run collaborative programmes with social service agencies on a formal or informal basis. The effectiveness of these projects, however, has not been evaluated systematically. In a recent study funded by the Institute of Museum and Library Services in the USA, an evaluation element was built into the development of three pilot programmes (Silverman 1998). The programmes involved collaborations between social service agencies working with older adults with mental health problems, adults at risk of psychiatric hospitalisation and people impacted by HIV/AIDS, and two museums with ethnographic and historic collections and a botanical garden. The evaluation (Silverman 1998: 21) showed that 'across the three pilots, benefits to clients were perceived in terms of self-esteem and heightened self-awareness, community integration/decreased social isolation, and increased personal knowledge and skills'. A final report concluded the project[73].

5.3 The scope of a research agenda

This research review has shown that we know very little about learning in museums and galleries in Britain. As a result, it is possible to identify with some confidence the kinds of studies that might be required to establish a basic knowledge of the processes and outcomes of museum-based learning.

There is a need for research studies that:

- Take into account in the design of the study both the unique characteristics of learning in museum and gallery environments, and the physical and cultural differences between different kinds of museums and galleries.
- Describe the multiple processes of learning in museums and galleries and show how these are the same or are different from learning processes in other sites for formal and informal learning.
- Examine both the short-term and the longer-term learning outcomes of visits to museums and galleries.
- Explore and analyse both the learning outcomes of a museum/gallery visit and also its role in the social lives of visitors.
- Acknowledge that learning processes and outcomes may vary across the diverse audiences that museums and galleries serve (which include schools, families, people with special needs, very young children, minority groups, and senior citizens).
- Are comprehensive, theoretically grounded, and multi-method (using a range of quantitative and qualitative methods), and which ideally use multiple sites which include a range of diverse museums. It would be possible to design a research study that consisted of a series of related studies, each of which informed the next one, and each of which became increasingly more focused on issues of interest.
- Lead to the development of appropriate research methodologies for studying such a complex phenomenon as museum learning.
- Could be based on collaborative research projects between different institutions with educational missions, which involve specialists from different fields and institutional cultures.
- Take account of relevant studies in a broad interdisciplinary field which might include sociology, cultural studies, anthropology, educational studies, psychology and others.

The scope of the work that needs to be done is vast. It is well beyond the reach of any single researcher or group of researchers. The cost is well beyond the funds available to most university or museum departments. While relatively large amounts of funding have been available through government departments and the university research councils for research into schooling, and for research into learning in other cultural industries such as the arts and libraries, funding for research into learning in museums and galleries has been virtually non-existent. If the understanding of the value of museums and galleries for learning, understood at its broadest, is to increase, then new funding streams and new research programmes will have to be identified.

NOTES

1 Website addresses are correct as of September 2001.

2 See for example the Hein-Miles debate (Hein 1997; Miles 1997) and Bitgood's (1997) commentary in *Visitor Behavior* vol XII, no 3&4, 3-15.

3 Lock proposed that a new-born's mind is like a piece of white paper (tabula rasa) and that knowledge comes to the child only through experience and learning. Due to the emphasis he placed on the individual's experience and the environmental influences, his ideas are usually referred to as environmentalist (Vasta et al 1992).

4 Rousseau's ideas are at the other extreme claiming that human development is the result of inborn processes. He also believed that 'whatever knowledge the child does not possess innately is acquired gradually from interactions with the environment that are guided by the child's own interests and level of development' (Vasta et al 1992: 12).

5 Pestalozzi believed that children have individual interests, needs and rates of learning and that they must be allowed time as well as direct and concrete experience to understand the world around them (Frost and Kissinger 1976).

6 Froebel recognised the importance of experience, especially during the early years. He believed that the children's natural interests and motivation should be central to their education. He also favoured children's active involvement (Frost and Kissinger 1976).

7 Dewey believed that experience is the best teacher. To him, true understanding results from a mixture of quality of experience and real life situations. Only through experience can the child's environment expand and gain momentum. For a presentation of Dewey's theory and suggestions for application in museums see Ansbacher (1998).

8 Montessori's educational approach valued experience as well. The activities that she designed were aimed at children's direct experience with a whole range of materials with the emphasis being on the process rather than the content (Frost and Kissinger 1976).

9 Project Spectrum is designed to identify and foster multiple intelligences in preschool children and it is based in Boston; student projects for the elementary level carried out by many schools in the US; and Arts Propel which is an arts and humanities project in Pittsburgh (Gardner 1993).

10 See section on research in children's museums describing the Please Touch Museum study.

11 That is, knowledge about people and social processes.

12 'What children can perform collaboratively or with assistance today they can perform independently tomorrow' (Moll 1995: 3).

13 For an application of this idea in a museum setting see the research study carried out by Crowley and Callanan (1997) reviewed in the children's museums section below.

14 For further discussion of play and its relationship to learning see Yahya (1996), Sykes (1993) and also Rennie et al (1998). The summer 1998 issue of *Hand to Hand* vol 12, no 2 is dedicated to play and early years.

15 This kind of play is often referred to in the literature as 'modal play' where children use objects for functions other than the intended ones.

16 Although 'learning' is not defined in the article, there is reference to 'formal learning' taking place in science centres as opposed to the art work-visitor communication taking place in an art museum (Dufresne-Tasse 1995: 246).

17 For a discussion on how museums can involve visitors in the interest of the main objectives of the museum, see Durrans (1995); see also Csikszentmihalyi (1988) and Csikszentmihalyi and Hermanson (1995) for a discussion on how visitors' sensory, emotional and intellectual involvement enhances both learning and discovery about oneself and making connections with others.

18 Prior knowledge is defined here, after Hein (1998: 156) and Roschell (1995: 47), as the different points of view, ideas and concepts that learners bring to an experience.

19 The Museum Learning Collaborative has brought together MA dissertations and PhD theses completed for different university departments. Visitor Studies Today, the VSA newsletter, 1998, vol 1, issue 3 has recently compiled Masters and PhD theses completed since 1995. A similar effort was made by doctorate students at the Museum Studies Department at the University of Leicester. See Museological Review, 1994, vol 1, no 1, 1996, vol 2, no 1 and 1997 no 4.

20 See Hein (1998) and Hooper-Greenhill (2000).

21 Including participatory action research and action science (Darling 1998: 2-3, On-line).

22 The first conference - Public Institutions for Personal Learning: Understanding the Long-Term Impact of Museums - took place in Annapolis, Maryland in 1994. *Public Institutions for Personal Learning: Establishing a Research Agenda* (Falk and Dierking 1995b) is the publication which resulted from that meeting. The second conference - Free-Choice Learning: Assessing the Informal Science Education Infrastructure - took place in Los Angeles, CA in 1998 and resulted in *Free-Choice Science Education: How We Learn Science Outside of School* (Falk 2001); Ways of Knowing in Science and Mathematics Series, Teachers College Press, Columbia, New York.

23 For more information see http://mlc.lrdc.pitt.edu/mlc/

24 For a further discussion of both approaches, their limitations and contribution to visitor research see Merriman (1991: 75-95).

25 This approach has been widely used by Hood (1983, 1989) in studying leisure criteria for visiting and non-visiting and Bitgood (1987), Bitgood and Bishop (1991) and Bitgood et al (1991) in the USA. Also Miles (1991) and McManus (1987, 1988 and 1992) in the UK.

26 A limitation associated with psychology as a discipline which tends to study individuals or small groups.

27 However, elements of the psychological approach have also used by these studies.

28 For a discussion of this type of site see section below.

29 It was decided to present results from all museums in this section in order to retain the comparative nature of the study. However, such choices are made for practical reasons and are arbitrary.

30 A hundred visitors were surveyed, a sample representative of the general audience of the museum.

31 And as suggested by Dewey in his book *Experience and Education: Lessons for Museums* in Ansbacher (1998).

32 Museum-going is seen as a repeated activity taking place at certain phases in one's life.

33 Museums are seen as cultural destinations representing a locale or region.

34 Museum-going is seen as a 'day out' for the whole family.

35 Museums are seen as educational institutions; places for learning about something specific or learning in general. Visitors often related learning to entertainment and having fun.

36 Although different museum types are featured in this study, it is presented in this section as two of the museums (MSIM and Eureka!) have science exhibitions.

37 Reasons for visiting related to having fun or entertaining one's self only (as opposed to having fun and learning at the same time).

38 A random sample of 88 visitors was used. It was balanced for gender and included visitors from the following age groups: nine-11, 12-14, 15-18, 19+.

39 For a review of research studies on family visitors carried out before 1990 see Brumit Kropf (1989), Dierking (1989) and Dierking and Falk (1994).

40 Known as PISEC (Philadelphia/Camden Informal Science Education Collaborative). Again the choice to include this study in this particular section was based on the focus of the project on science learning and in order to retain the comparative nature of the study.

41 After a preliminary study during which a list of 13 behavioural categories was identified, 129 families were observed at specific exhibits and their discussions were recorded. Family interviews were then conducted (Borun et al 1996).

42 For a full description of the list see Borun and Dritsas (1997: 180).

43 He carried out his study at Launch Pad in the Science Museum, London. It involved tracking a small number of visitors, using a post-visit questionnaire with 109 groups; sending a follow-up questionnaire a few weeks later; and conducting a follow-up interview about six months after the visit (Stevenson 1991).

44 This model can equally be applied for target audiences other than families. However, most of the research used to develop it comes from research with family groups.

45 See also section on motivation above. The findings presented in this section were common to all three museums studied. Findings related to any particular type of museum used as a case study will be discussed in following sections.

46 Families with fixed plans visited not only the particular museum frequently but also other museums.

47 However, this did have a learning or socialisation element as it included spending time and sharing experiences with grandchildren, passing on family history and strengthening family bonds.

48 This behaviour varied according to children's age.

49 This type of description referred to 'what happens' rather than 'why it happens'.

50 These refer to fundamental principles of science and/or material properties.

51 In this study only the gems, minerals and mines section of the exhibition was used.

52 For a description of the methodology see Falk et al (1998).

53 For a discussion of museum field trips from the perspective of teachers or schools and museum-school collaborations see Griffin (1994a, 1994b) and Cochran (1996). Also see Bailey (1999, On-line).

54 This refers to studies related to long-term museum learning rather than reminiscence studies which emphasise the therapeutic effect of museum objects or visits. For a discussion on this latter issue, see Kavanagh (1999) and Museum Practice (1996), vol 1, issue 3, pp36-76.

55 See Bitgood (1991: 9-10). Bitgood, a research psychologist by training, criticised an earlier study carried out by Falk and Dierking (1991) for its methodological approach. His views are based on an inappropriate distinction of what constitutes qualitative and quantitative research and the assumption that techniques used in quantitative research are the only way to establish validity and reliability in field research.

56 Staff at the Please Touch Museum had already developed an ongoing research and evaluation program to assess and set exhibit guidelines related to what constitutes a meaningful museum experience for young children (Sykes 1993).

57 Learning behaviour was divided into learning (which included Factual, Script, Simple Cause and Effect, Procedure, Conceptual Cause and Effect, Small Motor and Categories/Hierarchies types of learning) and learning in progress (which included Script Expression, Imagination/Creativity, Explanation, Monologuing, Exploration and Other types of learning in progress).

58 According to Gardner (1991; Haas 1996; Project Explore 1998) any topic can be approached in at least five ways or entry points: Foundational, Narrative, Logical/Quantitative, Experiential, and Aesthetic.

59 Experimental entry point was utilised even more frequently than Narrative and Logical/Quantitative ones.

60 The questions played the intervening role usually assumed by the museum educator. Through a series of questions children were asked to 'contemplate, then enter, a picture and to empathize with the feelings, forms or events in the picture' (Weltzel-Fairchild 1995: 219).

61 The methodology employed was PMM also used in the study by Falk and Moussouri (Falk et al 1998) described in the section on science museums above.

62 The exception is Merriman (1991).

63 The focus of this book is the production and consumption of the past - in its many forms including museum visiting. To do that, the author (Merriman 1991: 4) carried out a survey 'on the patterns of people's heritage visiting, their attitudes to them, their image of the past, and on other, non-museum, ways in which they experience the past'. The findings include visiting patterns to a wide range of museums but, since the emphasis is on the historical element of those museums, it was decided to include this study in this section of the article.

64 Four types of visitors were identified: frequent (three or more visits per year), regular (one or two visits per year), occasional (last visited between one and four years ago) and rare visitors (last visited five or more years ago). A category of non-visitors was also included (Merriman 1991: 49).

65 Also see Moussouri's (1997a and 1998) study in section on motivation to visit science museums above.

66 This includes the therapeutic effect some of the exhibits at the ARC had on visitors.

67 This is the main message of the exhibition at the ARC.

68 This has also been the case with research carried out in children's museums as Sykes (as quoted in Freedlander Gibans and Kres Beach 1999: 3) has observed.

69 For more information on the Discovery Rooms of the National Zoological Park and a presentation of research carried out before 1990s, see White (1990).

70 Although the survey questions were based on a predetermined set of categories, the design was based on previous research. Thus, visitors often had to choose among set answers.

71 Visitors were asked to choose five out of the following seven activities they were involved in at the exhibitions: 'stopped and looked at an animal; 'carefully examined the features of a reptile or amphibian'; 'discovered something about the animals in here I never knew before'; 'found the answer to something I always wondered about'; 'had a meaningful discussion with my group about something I saw or did here'; 'tried out an activity'; and 'read information' (Doering et al 1994: 49). Visitors were asked to justify their choices by providing an example.

72 For a discussion on the use of drawings as a research tool see Hein (1998: 122-123) and Moussouri (1997a: 68-69 and 1997b).

73 Silverman, L and McCormick, B 2001, *Museums and Therapeutic Agents: an Integrated Approach to Theory-based Program Design and Evaluation*, Institute of Museum and Library Services and Indiana University, USA.

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North America

Museum Learning Collaborative	http://mlc.lrdc.pitt.edu/mlc
Visitor Studies Association	http://museum.cl.msu.edu/VSA
Association of Science-Technology Centers (ASTC)	http://www.astc.org
American Educational Research Association (AERA) Special Interest Group in Informal Learning (SIG)	http//darwin.sesp.nwu.edu/informal
Visual Understanding in Education	http://www.vue.org/home/methodology.html
Institute for Learning Innovation	http://www.ilinet.org
International Center for the Advancement of Scientific Literacy, Chicago Academy of Science	http://www.icasl.org
Program Evaluation and Research Group (PERG) at Lesley College	http://www.lesley.edu/gsass/79.html
National Endowment for the Arts	http://www.arts.endow.gov
Institute of Museum and Library Services (IMLS)	http://www.imls.fed.us

Great Britain

Arts About Manchester	http://www.aam.org.uk
The Management Centre, Work, Interaction & Technology Research Group, King's College, London contact: Professor Christian Heath e-mail: Christian.Heath@kcl.ac.uk	
European Studies Research Institute, University of Salford	http://www.gemisis.co.uk
Campaign for Learning Through Museums contact: Toby Greany tel: +44 171 930111 fax: +44 171 9301551	

Australia

Australian Key Centre for Cultural and Media Policy	http://www.gu.edu.au/centre/cmp

Europe

HANDS ON!- Europe	http://www.hands-on.nordm.se