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Communicating science to adults

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ABSTRACT

In the 1970's and 1980's science museums pioneered active discovery learning in museums, and science centres devoted to interactive exhibits opened in their hundreds, and are still opening today. All of this activity was focused on the learning needs of children, and science museums rather overlooked adult audiences. This article examines some reasons for this, and the debate in the science community today about how to communicate science to adults. It further explores how adults learn in museums, what science museums currently offer the adult public, and what they might expect to find in the future.

Key words:
Scientific museums, education, adults, communication, hands on, lifelong learning.

RIASSUNTO

Comunicare la scienza agli adulti.

Negli anni '70 e '80 i musei scientifici hanno iniziato un forte attività dedicata al discovery learning nei musei, mentre gli science centres inauguravano centinaia di exhibit interattivi che continuano ad essere presentati anche adesso. Tutta questa massa di attività era finalizzata alle necessità educative dei bambini mentre venivano abbastanza trascurati gli adulti. Questo articolo esamina le ragioni di questo stato di cose e analizza il dibattito attuale sulla comunicazione della scienza agli adulti. Il lavoro inoltre esplora come gli adulti apprendono nei musei, che cosa offrono oggi i musei scientifici al pubblico adulto e cosa ci si può aspettare dal futuro.

Parole chiave:
musei scientifici, educazione, adulti, comunicazione, hands on, educazione permanente.

DARWIN HAS A COLD

While I was doing the research for this article I revisited museums that I hadn't seen for a while. One Thursday in May 2006 I entered the Natural History Museum in London and approached the reception staff 'Good Morning. What have you got on for adults today?' 'Not much for adults, madam' came the reply 'The special things are for kids really'. I tried again. 'I see from your website that Charles Darwin roams the galleries and interacts with visitors, can I meet him?' 'Not today, madam' they replied politely 'He's not in today, he's got a bad cold!' We all laughed, and one member of staff added 'You could do the architectural tour, that's for adults'. I could and did, and very excellent it is, but what I was actually looking for was the possibility to interact with the collections myself, to make my own new discoveries, and hopefully to feel that wonder which a person can only feel when they engage with real objects and through the experience find a higher level of understanding. I must now admit that I am not a scientist, and that I do not have the background to look at specimens in glass cases and make interesting connections, as I can and do in art, archaeology and history museums, without much help from the curators. For science and technology I need help. I need connections with my life today, and I need to feel that I am catered for, that I am part of the valued audience of the museum. In most science museums for an adult without children that can be difficult. Perhaps talking to 'Darwin' would have helped. Looking at the architecture was a pleasure, but that for me was close to home territory.

Adulti a misura di bambino nella hall d'ingresso del Pavilhao do Conhecimiento di Lisbona.
Foto di V. Vomero
Playing "childhood" at the hall of Pavilhao do Conhecimiento in Lisboa

PIONEERING ACTIVE LEARNING

Museums of Science and Technology and Natural History (from now on referred to as science museums) have in many ways pioneered a modern hands-on approach to understanding and learning from collections, or learning about science The movement has been international, giving rise over the last 20 years to both Science Centres or Discovery Centres that offer interactive learning without original objects, and to Discovery Rooms and interactives within museum galleries which interpret the original objects on display. The Exploratorium in San Francisco opened in 1969 and since then hundreds have opened around the world. The movement came late to Italy but in the last 5 years it has gained strength, and cities such as Trieste, Trento, Perugia, Genova, Bologna, Roma and Napoli have opened new hands-on science attractions. In 2005 La Città della Scienza science centre in Napoli won the European Museum Micheletti award for the best industrial or technological museum.
International bodies such as the Association of Science and Technology Centres (see www.astc.org) and the European Collaborative for Science, Industry and Technology Exhibitions (see www.ecsite.net) link these two different types of organisation, museums and science centres, offering each the chance to work on travelling exhibitions, to take part in joint projects, and to learn new approaches from each other not only through networking but also a professional development programme. Other museums have adopted this interactive approach, in particular archaeological museums and the so called 'Time Rides', and lately historical museums, but it has been science museums that have led the way and concentrated on explaining science through the active participation of, and experimentation by, the visitor.

CHILD FOCUSED LEARNING

Nearly all this effort has everywhere been focused on children, to meet the needs of schools and families. The interactive acti-vities in both types of organisation have been developed to meet national school programmes, and the very special social lear-ning that families like to do together at the weekends and on holiday. Indeed some of the new institutions, such as the Città dei Bambini di Genova, divided in sections by age groups 3-5 years and 6-14 years are explicitly reserved for a very young audience, and it is difficult to think of a single recent interactive display in a science museum developed with solely adults in mind. Of course nearly all the old type of displays that simply placed objects in cases, on a pedestal, or on open display, with an accompanying label that identified the item and possibly gave it a date, were intended for all visitors. But in these days of a far greater understanding of audience segmentation and different learning needs and different learning styles, target audiences in new displays in science museums appear to be children with accompanying adults, whether teachers, babysitters, parents, relatives or friends. To a certain extent this is also true for other museums, but the degree is different. Historical museums, art museums and others are actively developing their adult audiences, providing special activities, courses and displays while science museums remain largely child focused.

THE CHICKEN OR THE EGG

Why should this be the case? It is difficult to get hard statistical evidence but surveys do suggest that one important difference between science museums and all others is that they attract a far larger number of children with accompanying adults. A recent Market and Opinion Research International survey (MORI, 2004) in the UK of the visiting habits of a sample of the population found that; "just under nine in ten (88%) say they are particularly interested in historical subjects in museums and galleries, while 70% mention the arts, 56% like scientific subjects, and 53% mention cultural topics. Those aged 45-64 tend to be the most interested in each of these broad subject areas, apart from science, which attracts a slightly younger age profile. This is presumably partly driven by the presence of children in younger households - 45% of those with children say they are most interested in 'science and technology', compared with 36% of those without children". This would suggest that research could back up our observation that science museums are full of children and accompanying adults, and indeed cater specifically for them. Re-visiting the science museums in London I was struck by the huge numbers of kids with adults, and noticed very few single adults like myself, and even fewer adult couples enjoying their visit. The UK research is complemented by a contemporary survey in Lombardia in Italy (Fondazione Fitzcarraldo, 2004) where researchers found that the Museo di Storia Naturale in Milan attracted 40% of visits from family groups, while other museums attracted nearer 30% of these groups. It is not clear whether this is cause or effect. Were science museums always the terrain of children brought by adults, or has the huge growth in hands-on displays and attention to the demands and learning needs of children created this effect?

Children are of course an important audience for all museums, not least because they tend to come from all parts of the social spectrum in schools groups, and are therefore a democratic way of targeting the community. They are also far easier to cater for. Children are occupied in formal learning and the requirements of national schools programmes and family social learning are not difficult to identify, understand and meet. The former is focused on the needs of the school, and the teacher acts as advisor to the museum. The latter is always focused on the learning of the children and the museum's effort goes into providing the accompanying adults with the information and resources to facilitate the children's learning. The requirements of adults without children however are far harder to gauge or to cater for. The museum must find a replacement for the teacher and the parents and others, in order to identify the needs and interests of adults, and to take their pre-knowledge into account. Even if such people can be found the attendant dialogue that must ensue is highly controversial.

FROM PUBLIC UNDERSTANDING OF SCIENCE TO PUBLIC ENGAGEMENT WITH SCIENCE

Communicating science to a wider public has been promoted by most governments in recent years. The phrase the 'Public Understanding of Science' was put about by the scientific community, in universities, in national and international institutions as well as museums, as a catch phrase for turning the public on to science and to its value to our everyday lives.

Putting this to effect in museums has meant presenting facts, sometimes exciting facts, in interactive ways so that carers or teachers can be sure that children learn these facts through hands-on experience, and so come to understand them. Typical displays of this type include the bicycle next to the skeleton where the pedalling child can see which bones he or she is using and how his or her joints are working at the same time as wor-king out how the bicycle operates, (as for example in the Snibston Discovery Centre in Leicestershire UK) or, plunging the hand into a bowl of water lit from below and observing the mirror effect (as for example at POST Perugia Officina per la Scienza e la Tecnologia). Although very much designed for the school curriculum passing adults are also able to use and learn from them if they so wish. Even as science museums of this type continue to open at a fast rate, and to cater largely to schools, the thinking behind them is changing. This sort of science, though fun and useful to schools and to kids is also limited in its approach in a sense very didactic, as it involves fixed exhibits which children learn through experience, but the science remains expert to novice interpretation. Science is so much more than that, and what may inte-rest adult audiences (and indeed child audiences) far more, are the complexities of interpretation and the cultural constructs involved in scientific research, discussion and the interpretation of results. Constructivist learning which focuses on learners rather than the exhibit, and social constructivist learning which sees the visitor as an interpreter of science and culture and encourages the personal narratives of learners offer alternative methods of engaging audiences. They are particularly pertinent to engaging adults who are autonomous and self-directed and bring accumulated experience and knowledge to the museum. Adults are also motivated to learn to improve their performance at work and in the community, and may seek a qualification, but also seek to learn for social reasons, to make friends or to consolidate ties of family and friendship (Hein, 1998; Thompson, in press). In the UK 'Public Engagement in Science' is the catch phrase that has replaced the earlier 'Public Understanding of Science'. The emphasis has changed from offering facts to an audience, even through the active discovery method, to engaging them in dialogue and seeking new ways of presenting science in mu-seums. Above all the debate rests in the presentation of science as a human activity, in the interaction of science with society, in science as a process, and in science as a human construct (Souhami, 2006). This is a welcome change of emphasis but adult participation in the creation and development of displays remains extremely problematic and resource consuming.

It means first finding a science ambassador, a member of the target audience with whom to open a dialogue, or to work with a focus group of members of the target group in order to explore the ideas the museum has for attracting them and engaging them in the museum's programme. This can be labour intensive, and the necessary experimentation with exhibits and constant renewal to keep explanations up to date is expensive. Further, the museum needs to engage in continuous discussion with the academic science communities to remain informed, and needs to develop partnerships and networks among similar museums so that they do not duplicate their efforts.

The debate in the UK among the science communities as to how best to approach new ways of communicating science to adults is taking all this into account. This debate is interesting for all science museums not least because it clearly identifies the science museum community as being rather late in seeking to deal with these issues. It is no less problematic offering dialogue and debate about historical or artistic themes and seeking new ways to di-splay them, as this means taking all of the steps mentioned above. Yet even national museums such as the Victoria and

Albert Museum in London have done just that in redisplaying their British Galleries, along with hundreds of pioneering small museums in countries all around Europe. Perhaps science museums have found it difficult to enter into dialogue with non-specialist adults in particular because science has been held to be about experiment and result, about empirical fact, and the active discovery method seems fitting for these types of explanations? Some science museums are already working in new ways. The Franklin Institute in Philadelphia, for example, has a major project called CASE (Community Ambassadors in Science Explanation) in which the museum is training 88 science ambassadors to offer science workshops in community based organisations in the languages spoken by those communities. The Science Museum in London developed its Wellcome Wing using freelance audience advocates who acted as a link between the target audiences and the museum staff to create displays which took into account the needs and preknowledge of the expected audiences. No doubt there are other excellent examples, but on the whole there are fewer than there are in other disciplines and types of museum. Clearly science museums are considering what to do for their adult audiences and their potential adult audiences. They are debating about the sort of displays that will engage adults in science rather than merely presenting it. But while the discussion continues, what do science museums currently offer to adults? Here are some examples which are by no means exhaustive but perhaps offer a flavour of what adults might expect to find in science museums.

GUIDED TOURS AND AUDIO TOURS

Guided tours are a popular way of bringing the displays alive for adults. While some guided tours are very good, offering the opportunity for the adult to interact with someone who knows the collections well and is trained to explain science and the processes of science, most are the dreary imparting of facts with little interaction with the group, and hardly a chance to ask questions. It can even be difficult to look at the objects when it seems impolite not to look at the presenter. Further, unless a session using objects is fitted into the tour they never offer the opportunity to engage with the collections directly. Many museums are finding it difficult to offer tours to different language groups as well as to different age groups, and are opting for slightly different methods of interpretation, such as the touch screen tour, or the audio or audiovisual tour. These tours allow the adult to visit at his or her own pace and to go back to selected exhibits which makes the experience freer, but they are still about the expert imparting of knowledge to a viewer or listener. Touch screens in the Natural History Museum in London, for example, enable all age groups to find out about selected exhibits in 12 languages. A Turkish visitor could tour the museum using the screens as labels not just for individual objects but also to each section. The audio tour "Technological Revolutions" for adults at the Deutsches Technikmuseum in Berlin offers a 90 minute tour in English, French, Polish and Turkish as well as German. The tour focuses on the way technological developments over the past 200 years have changed our world view, our pace of life, and the way industrial societies live. In addition to numerous original recordings, including some of Ernst Reuter and Konrad Zuse, the audio guide contains interviews with contemporary witnesses and archive material, like the BBC Second World War sketch about Germany's ban on listening to foreign radio stations. The route is suitable for wheelchair users and there are induction loops plus a written text for those who are hard of hearing. Back in the Natural History Museum the architectural tour, which I used on my visit, offers the visitor even more. It is an in-depth specialist tour using a PDA (Personal Digital Assistant) which includes film clips and still images as well as sound. This does more to bring the building alive and uses more than one sense as it incorporates visuals. The visuals do demand the user looks at the PDA and this might perhaps for some people take the place of looking at the architecture. Science museums will most likely develop many more tours like this, though they remain to a large extent a way of informing more than engaging. Until the classic guided tour is created and developed in dialogue with adult groups and involves handling sessions and interaction with audiences it will remain largely a top down, expert to listener experience.

LIVE DEMONSTRATIONS

Drama has been part of museums' repertoire in interpreting collections to the public for decades, but it is relatively new in European science museums. In the US though, in the early 1970s, Sondra Quinn launched the Science Museum of Minnesota's theatre programme with the intention of bringing scientists and inventors to life, to present the many sides of an issue and to bring an audience into direct contact with scientific objects. As the programme developed through the 1980's the museum began to create plays around medical, social and racial issues such as a 30 minute play 'Sara the Scientist' on sexism in the scientific workplace. Surveys demonstrated that such issues played well with the museum's visitors and the museum has continued to produce plays written by playwrights working with museum staff who check the

work for accuracy and the information conveyed. Topics have included genetic prophecy and population growth, and other museums largely in the US have taken up the trend. As well as these major theatrical spectacles, animateurs have long worked in historical and art museums engaging the public by playing roles from the past or bringing alive personalities from portraits and paintings. The advantage of theatre is that it enables science museums to deal with everyday issues about the human condition such as those mentioned above, and through the use of objects in theatre to link scientific collections to people's lives. Moreover, actors are trained to interact with audiences and to seek visitors views on these issues, to raise the level if debate about them. When it is done well theatre and animation in the museum can be both enjoyable and enlightening. In Europe there is a recent and growing emphasis on bringing scientific personalities to life through in- role gallery demonstration. The Istituto e Museo della Storia della Scienza in Florence offers live demonstrations for school groups, but also provides what it calls 'Encounters with History' at the weekends for all visitors. Demonstrators in the roles of Galileo and Leonardo da Vinci explain their inventions and discoveries to the general public, though they are in fixed positions and do not roam like Charles Darwin in the Natural History Museum in London. The Museo della Scienza e la Tecnologia in Milan offers a rich range of such theatrical spectacle at the weekends, for the general public. All visitors can meet two great scientists of the past, Guglielmo Marconi e Thomas Edison, who show the public their inventions and discuss their ideas and opinions. Another drama takes the public aboard the Trinidad, Ferdinando Magellan's ship in the company of a caretaker. He sifts through many original items such as maps and materials and gilded cups and shows the public the captain's secret cabin.

In the Franklin Institute in Philadelphia, and in many American museums live demonstrations are to be found most days in the galleries. One of these, the Liquid Air Show, for example, explores 3 different states of matter and uses volunteers from among the visitors to take part in experiments with liquid nitrogen. The 'show' lasts 20 minutes and clearly aims to engage visitors in science through exciting experiments.

Science carts and discovery rooms

Though such shows aimed at adults or the general public are not so common in Europe, science museums have introduced demonstrations from carts, trolleys or workstations. Visitors are invi-ted for example to test out their knowledge of the heart, to handle bugs or to dissect (plastic) eyes, at various points in the galleries, helped by a trained demonstrator.

Many more science museums have opened a discovery room or centre. Unlike the science centre with its didactic interactives, the discovery room within a science museum offers direct access to collections, and a freer process of experiment for the user, adults as well as children. The Natural History Museum in Budapest, for example, opened the Amateur Naturalist room opened in 1992, and everything can be touched, observed closely and even drawn. Apart from tasting all the senses can be used. The room is full of tactile experiences from the bristles of the hedgehog to rocks and minerals. A great variety of animal sounds are played from records, while identifying scents released from small vials is another experience on offer. A guide is on hand to assist the visitor and answer questions, and there is even a small library which offers rest for guests who become tired. These rooms and carts provide the visitor with the opportunity to browse freely among selected objects and enjoy a process of discovery either by themselves, with their companions or with the guide if they so wish. Where museums prefer to keep di-splays traditional, or to deal with different types of explanation and interpretation in the galleries, they also allow the museum to ensure the public has improved access to the collections in a se-parate area.

Esposizioni "mirate" al Natural History Museum di Londra. Foto di V. Vomero
Target oriented expositions at Natural History Museum in London

COURSES, WORKSHOPS AND SOCIAL EVENINGS

Science museums have traditionally provided special courses or workshops for adult learners. Almost all science museums offer courses of some kind, ranging widely over topics from 'Basic Organic Gardening' to 'Herbal Medicine' at the Science Museum of Minnesota, for example, to Measuring Heaven and Earth at the Istituto e Museo della Scienza in Florence. Workshop participants in Florence are able to act as architects, topographers and geographers and take measurements with replicas of the principal instruments. Other museums offer science and nature travel programmes, such as those offered by the Denver Museum of Nature and Science, in which participants can study the geology of the upper Colorado River in the river itself, or take a coach tour to the Yellowstone Park to examine the full spectrum of geological and ecologic controls on landscapes between Denver and north-western Wyoming, with a principal focus on the birdlife and geology of the Tetons and Yellowstone, led by specialists. Examples in Europe include the Bristol Museum and Art Gallery which organises city bird walks and nature walks in a more modest programme of local itinerant activity. Certificated courses in science are another growth area, as adult institutes and universities join up with museums to provide lifelong learning opportunities. In science museums basic and more advanced computing skills courses are particularly common.

Another new and growing trend is to invite the adult public to come to the museum, usually in the evening to meet and discuss scientific topics with like-minded people. In doing this science museums are seeking to provide both a social and a scientific experience, enticing people with the idea that they will meet others with similar interests. The Boston Museum of Science and the Science Museum in London both do this on their websites. Moreover, there is a further tendency to wine and dine adults as well as offering some science. The Boston Museum's Friday Night programme from 6.00 pm to 10.00 pm starts with a martini and an appetizer and is followed up with a film, and then free stargazing at the observatory, weather permitting. Science museums are moving away from the formal lecture to a more relaxed social atmosphere to attract more and different adult audiences to engage with science in the museum environment. They are beginning to experiment with adult group evenings focused on hands-on experience of collections guided by a trained member of staff, rather like the Museo di Archeologia e Storia Naturale in Montebelluna recently invited a group of local entrepreneurs to enjoy the experience of handling the mineral collection, assisted by a member of staff to stimulate discussion and answer questions. The group led the session and used their own experience and preknowledge to direct the discussion, which was wide ranging, and all the time expertly informed and controlled by the member of the museum staff.

This is different from the 'visit with like minded people' invitation mentioned above for it involves a group already formed to enable local business people to get to know each other through cultural activities, followed by dinner together. In common with family groups they want primarily to socialise in a cultural environment and a relaxed atmosphere.

SCIENCE MUSEUMS ON LINE

Science museums are also using their websites to attract and inform adult visitors and non-visitors. The range of on-line activities for adults is growing everywhere and includes, science blogs, such as the journal of scientists in the Antarctic, or watching webcams of the movement of animals or bugs. Many sites also offer videos, quizzes and games and interactive educational activities and exhibitions.

The Finnish Museum of Natural History is closed for refurbi-shment but its History of Life exhibition from the birth of the solar system to the Quaternary Period, remains available on-line, showing us one important use of the internet, to maintain a presence and information flow even when the museum itself is inaccessible. The Museo della Scienza e la Tecnologia in Milan is open but its web presence is important for it enables the museum to explain to the general public, as well as to specialist users such as teachers, some special science topics in more depth, and to offer a taste of what is available at the museum's physical site. The on-line exhibits are closely related to the museum's work including one about the gigantic bronze horse that Leonardo da Vinci designed for the Sforza family. The Science Museum in London has one of the richest web presences. Its on-line exhibitions include Antenna a constantly-updated exhibition devoted exclusively to science and technology news, and more than 20 other shows dealing with topics such as Genes, the Story of Energy, and Lifestyles. It also includes Ingenious a new website with over 30,000 museum images making connections between people, innovations and ideas.

Science museums are probably taking the lead in the museum world in parading their wares on line and generating internet based interpretation. They probably have better access to this expertise than other museums and in any case need to lead the way in new communications media.

A NEW TYPE OF SCIENCE CENTRE

Science museums are also beginning to look to forge collaborations to deliver a different type of science centre to the public. The dana centre for example was established in London by the Science Museum in collaboration with the BA (British As-sociation for the Advancement of Science) and the European Dana Alliance for the Brain to meet similar requirements. It is a sty-lish, purpose-built venue, complete with a café bar, appealing to adults. It is a place for them to take part in exciting, informative and innovative debates about contemporary science, technology and culture. Here science is delivered in a very different way, with everything from Edinburgh-Fringe-style stand-up comics debunking science myths to updates on radical research, handling sessions of rarely seen objects from the Science Museum's collection and challenging debates on modern science.

This sort of new centre enables museums to provide an adult space where adult issues in the field can be aired, and discussed. This is a solution which is probably only open to national or international institutions, smaller museums will have to inge-niously divide the space and the interpretation they already have.

WHAT CAN ADULTS EXPECT TO FIND IN SCIENCE MUSEUMS IN THE NEAR FUTURE?

It is difficult to say if science museums will catch up with the others in engaging adults in the development of new, more inte-ractive, and more self-led displays. If the physical museum exhibit remains firmly focused on young audiences for the near future, then it seems certain that many museums will take up se-veral of the techniques described here to improve their product for an adult audience. This will likely mean more specialist, and skills based science courses, more drama and demonstration, more on-line exhibitions and interactivity. I myself should like to see much more hands-on activity for adults, perhaps on science carts and in discovery rooms, or in special workstations in the galleries. I firmly believe that adults too should have access to the unique role of museums, to interpret objects, and nothing beats direct handling, with a trained member of staff on hand to an-swer all the questions.

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