D1.1 Learning Strategies for the MIRROR Community of Practice

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1. Introduction

1.1 Project outline

The MIRROR project explores the mirroring of the learning interactions of individuals within *communities of practice* (CoP) through the use of technologies. The specific context explored within the project is that of museum natural scientists and, to provide sufficient focus for the size and duration of the project, specifically those exhibition teams and communities of practice engaged with the production of exhibitions.

The aim of the MIRROR project is to provide communities or groups involved in exhibition building with a MIRROR CoP and software platform to make use of knowledge arising from CoPs. In order to develop appropriate software investigations into current practice have been undertaken at a number of European natural history museums (EU NHMs), specifically with regard to working patterns and their relationship to mature theoretical understandings of CoPs.

The aim of the first phase of the field research has been to explore the concept of CoP in relation to exhibition developers communities and to document the knowledge – both explicit and tacit - available to these communities, their interactions/relationships as well as the practices they employ within the culture of their own organisations.

> 'Communities of practice are groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis' (Wenger *et al* 2002:4).

CoPs are relatively coherent groups which share common endeavours, may work, live or share leisure time together and who derive a sense of meaning and learning in the world from their membership of the CoP. Communities of practice are different from diverse (in terms of knowledge base) groups which work to produce a specific outcome such as an exhibition. The exhibition is useful for the purposes of this project because it is a spatial medium and provides opportunities for interfacing between CoPs and other groups, and the spatial medium of the exhibition has itself been suggested as an appropriate metaphor for facilitating CoP interaction. The exhibition also exposes the boundaries between CoPs – it is the meeting point of numerous CoPs (scientific, educational, technical, managerial, and so on) – and thus is capable of revealing how institutional outcomes relate to CoP interaction.

Communication within and between groups which either can be seen as 'communities of practice', or project teams where individual members rely on other CoPs, is the focus of the focus of the qualitative research. That is

learning within CoPs but also the ways in which CoP-derived knowledge can then feed into team-built exhibitions.

1.2 User groups

Exhibitions are the product of team interaction and bring together a diverse group of skilled individuals. Each participant may be associated with his/her own core CoP. The exhibition team itself derives strength from shared skills and its own diversity, that is from not being a CoP. Though in a small museum or within a museum department a group of individuals may share institutional knowledge and so on in a CoP-like fashion. The exhibition team may, as a consequence, be close knit or might derive a sense of unity through extended working. The number and diversity of individuals involved in exhibition production, and the production process itself is dependent upon local circumstances and although most tasks are universally found in museums exhibition building across Europe, there is considerable variation in the organisation patterns and working practices put in place to achieve them. The team may in one museum be a single curatorial specialist and designer, in another it may consist of 10 or more individuals (not including subcontractors). Even though specialist curators are likely to be located in the museum itself others may be brought in specifically for the project. Again this depends upon the size and nature of the institution. Because roles cannot easily be defined in terms of job titles (a specialist curator or keeper in a national or university museum may primarily be a postdoctoral researcher, whereas in a regional museum he/she may be a multi-skilled collector, manager and communicator) it is more useful – as CoP knowledge sharing in these circumstances relates to role rather than job title – to define the roles of participants in the exhibition building process.

Potential users of the MIRROR product are:

- **Museum director**. Particularly in smaller museums where the manager occasionally participates in, or oversees, exhibition development, he/she will influence the development of the exhibition so that it conforms with the museum's overall profile and strategy.
- **Exhibition coordinator/project manager** (maybe a curator or keeper, exhibitions officer or someone brought in for the purpose). His/her role is to coordinate and manage the team, ensure all tasks are scheduled and outcomes delivered on time. He/she takes an overview of the project, manages budgets and may be responsible for overall decision making. He/she needs to be aware of cutting edge developments in exhibition work – this knowledge is acquired by visiting and talking to other museums and other team members. Exhibition reviews and listserv discussions may be useful. Where exhibitions travel between institutions, or are prepared in co-operation with other museums or clients, it is useful to know what is available, its components, size, etc. to aid visualisation, installation and arrangement.

- **Narrative production.** May be undertaken by the above or a separate curator, or a writer brought in for the project. A process of fact checking, proofreading, etc. may also be involved here, and may be undertaken by other individuals as appropriate.
- **Object provision.** A task for a curator but may involve the collection manager/registrar, and a photographer. This may involve the negotiation of loans from other institutions. Object handling and shipping companies may be involved as well as insurance or indemnity arrangements.
- **Conservation support.** Museums may employ their own conservators but regardless of this someone within the museum will evaluate objects for display in terms of their vulnerability to the destructive forces to which they will be exposed (light, inappropriate humidity, exposure to dust, etc.). Other individuals (collection managers, curators, registrars) may be involved in collection care and management issues. Conservation support may participate in exhibition teams as permanent members from beginning to end or be more task-oriented persons, or separate units in the museum.
- **Design support.** Receives a brief and coordinates much of the production process. May be an external company. Designers often have considerable power within the exhibition production process and can be a point of political tension within the process particularly as all participants tend to find exhibition production highly stressful. Designers may be 3D or graphic but may also include lighting designers and other technologists. Designers are essentially problem-solving creatively.
- **Educational support.** Involved in vetting text, contributing ideas for educationally effective exhibits, developing a support programme which could involve explainers, schools programmes and so on.
- **Infrastructure building.** Painters, technical suppliers, lighting engineers, etc. tend not to be part of the core development team but are managed through the coordinator, a contracts manager and/or the designer. Buildings engineers may also be involved where the building is affected by the changes caused by the exhibitions.
- **Marketing support.** Tends not to be central to the building effort, though may contribute to overall strategy and key aspects of front-of-house.

1.3 Distributed CoPs and scientist networks

Museum natural scientists contribute only a small part of the exhibition effort but they are excellent examples of CoP-using professionals. These tend to be distributed CoPs as, for example, in the case of CASTEX, CETAF, ECSITE, ICOM, ENBI, BCG, ASTC, ENSHIN, and so on.

2. Key community of practice concepts

2.1 Structure

Wenger et al (2002:27) introduce the three fundamental structural elements of CoPs as Domain, Community and Practice: 'domain of knowledge, which defines a set of issues; a community of people who care about this domain; and the shared practice that they are developing to be effective in their domain'.

2.1.1 Domain

An evolving set of problems, creating a sense of common ground and identity, it is both purpose-giving and legitimising. Natural science CoPs might discuss the status of their profession, the best glassware for the preservation of spiders, information on threats such as fraudsters.

2.1.2 Community

Seen as 'the social fabric of learning' (Wenger at al 2002:28). The community does not need to be homogeneous in terms of *cultural capital* (Bourdieu) or values, but they often share knowledge and interests as in a fairly homogenous *field* (Bourdieu) of, for example, natural scientists with similar overall research or curatorial focus. Size affects relationships: <15 members is intimate; 15-50 fluid, differentiated; 50-150 subgroups around topics and localities; >150 strong local groups. However, even large groups may have an intimate core with a diffuse and less participatory peripheral membership. The Geological Curators Group has a membership of around 500 but an active core which rarely exceeds 50 and is perhaps only half that number.

2.1.3 Practice

All aspects of interaction from the language and information used, to the toolkit members share.

2.2 Interaction

2.2.1 Sharing

The key concept here is a shared creative learning experience and environment. This may be formalised and institutionalised in some way – such as in a specialist museum department – or may remain entirely informal and link individuals in different institutions which otherwise have no formal bonds. However, the interactions themselves will be similar (informal, complex, cross linking) and unlike that found within a chain of command.

2.2.2 Action.

Interactions are purposeful and future oriented, initiated either via collective group decisions or by members pushing. The CoP provides a loose sub-structure from where the exploring 'agency' of *action* (Arendt, 1958) can

depart. The acting may be strictly procedural, but CoP *action* is more likely to be of an exploring nature '(wo)men acting together in concert' (Arendt), which may produce material outcomes such as a manual of best practice – CoP knowledge written down – or be without a clear outcome other than change in some form.

2.2.2 Tension and harmony

Interactions are natural, and are therefore likely to include the political dimensions present in all social interactions. Tensions and conflict may be as probable as harmony, i.e. the community keeps itself alive between conflict and mutuality / disagreement and consensus / tension and harmony. A community may develop or disappear in times of crisis and disagreement as in times without any debate or conflict. Each community differs in balancing out these forces. Frequently these tensions are played out in the formation of factions and cliques.

2.2.3 Habitual and innovative

CoPs develop ways of doing which become embedded and taken for granted (Bourdieu, 1990). But practices can also be more thoughtful and inventive. Exhibition building is a practice which demands innovation and which can push individuals to use their CoP contacts to satisfy this need. But within the CoP itself things are re-thought, habits de-masked, new ideas unfolded. Continuous change in the context of the CoP implies continuous change.

2.2.4 Circulation of information

Information flows through the CoP, circulating what is known and what is debated in oral, written, virtual and material forms between members (Wenger et al 2002). Listserv's such as NHCOLL (centred on US natural history curators) pass on established knowledge to the new and naïve but also debate best practice or established practice with others, particularly those who are undertaking research and experimentation in their own institutions into new methods.

2.2.5 Negotiated meaning

Less a system of absolute knowledge, and more about negotiated meaning: negotiated, debated, tested, experienced (Wenger, 1998). Practices are, as knowledge, not produced or given, but always unfinished, continuously moulded and rearranged according to contexts and the 'run-of-life'. They are not a simple response or meaning (as in structuralist reading, e.g. Levi Strauss), but *strategic*, in context, not invariant but deeply adaptive and organic (Bourdieu 1974, 1990; Wenger and Lave, 1991: 18). The negotiation of meaning can as well cause dilemmas for members individually. This means that each member negotiates and develops meanings internally among, often contradictory, personal conceptions and experiences of, for example, the use of technology such as touch screens or past experiences of exhibitions. This is the case particularly when it comes to knowledge which cannot be considered absolute or 'hard' (explored later) but is, as earlier mentioned, continuously moulded in dialogue. Exhibition building has associated with it a considerable

amount of research into audience behaviour, learning styles, design effectiveness and so on but little of it is in any sense absolute and the requirement for innovation continues to push the boundaries of knowledge.

2.2.6 Tactical and strategic

The CoP may be used as a 'back-against-the-wall' tactical adaptation to a more powerful context, a getting away with the offerings of the moment, doing things as good as we can in the *modus operandi* of a difficult and not ideal world (what we commonly call 'fire fighting'). More positive and controllable tactical practices can be viewed as forms of *action* (in the Arendtian sense), explored earlier. The production of an exhibition will derive much from the existing strengths of team members which arise from experience and training. But exhibition building also takes place under time, financial and logistical pressures which require rapid solution and customised solutions which may only be found through the exploitation of a much larger sample of experience, as through contacts with CoPs in particular domains: the visual effect essential to a diorama, a supplier for a model, a fieldwork location for collecting a specimen, etc.

Alternatively the CoP can be exploited strategically, using carefully considered and thought-through moves prior to execution. An *opus operatum* thought out almost outside the flow of time (Michel de Certeau, 1984). A *surveillance* practice (Foucault, 1975) where a range of future moves are planned from a distanced and controlling perspective. This may be in the case of larger museums more procedural and well-organised exhibition development stages.

2.3 The CoP knowledge-base

2.3.1 Knowledge as shared learning

Knowledge is not a body of information on a database but what is known – that possessed by the individual in the community. This must be communicated in some way – in CoPs this tends to arise from a process of negotiation. It is shared knowledge.

2.3.2 Tacit and explicit knowledge

Explicit knowledge may exist in various forms, it can be recognised and accessed from a known source or through training. Explicit knowledge is often more easy to describe or define, e.g. exact disciplinary knowledge, or well known structures or procedures of meetings and group interaction. Tacit knowledge tends to be transmitted through conversations which often relate to the act of 'doing'. The boundary between tacit and explicit knowledge is not concrete. Hildreth et al use the rather loaded terms 'soft' and hard'. The point is that knowledge can be differentiated into various forms, each of which can be measured or assessed in some way. Tacit knowledge tends to be enunciated or unfolded from the histories of action in a community, gradually reshaping habitus, and altering practices. This form of knowledge can be differentiated, from an analytical point of view (in practice they will be

moulded together), from knowledge that is more instrumental or fact-like. Situated learning is, by its very nature, generated by modes of co-participation (Lave and Wenger, 1991: 16), and must necessarily rely on tacit as well as explicit knowledge. An understanding of communities of practice is therefore dependent on both forms and is thus most amenable to qualitative evaluation, as used here.

2.3.3 Information vs. knowing

Individuals may gather information in order to perform tasks or advance learning, but at the risk of not being able to distinguish valuable from less useful information, or cope with the amount available. The risk of investigating an exhibition-related task – such as an IT application or a peripheral academic field – is that rather than being enriched one may end up confused, overloaded or daunted. CoPs mediate information, and distil useful knowledge in ways that exploit individual need, receptive abilities in particular areas, and common practice. As a consequence CoPs maintain not only a body of useful knowledge but also individuals who can explain it to someone less informed or new to the field/domain/community. Exploiting this knowledge exhibition builders can use new technologies or more effective methods without knowing in detail how the knowledge was derived or its technical underpinnings.

2.3.4 Dynamic knowledge

'[O]ur collective knowledge of any field is changing at an accelerating rate.' However, there are 'baselines' and 'core knowledge' that we might require, and one of the primary tasks of a CoP is to establish this 'standard line': '… what makes managing knowledge a challenge is that it is not an object that can be stored, owned, and moved around like a piece of equipment or a document. It resides in the skills, understanding, and relationships of its members as well as in the tools, documents, and processes that embody aspects of this knowledge' (Wenger et al 2002:10).

2.4 The CoP community

2.4.1 Bound together via topics in the domain

The community is centred around particular themes and issues relating to their subject interest or general academic education, i.e. something more specific than the general direction and aim of the museum (Jo Kim, 1998: 5). The domain gives an underlying commitment, topic or basic structure upon which practices take place. The CoP is not like other communities, e.g. not just a neighbourhood, a functional unit, a project, or an informal network, or reporting relationship, but instead it is a particular sort of community based on: collegiality and developing knowledge and cohesiveness and intentionality (Wenger et al 2002).

2.4.2 Bound together in doing / joint action

Joint actions and a shared 'doing', rather than simply conversation, hold the CoP together (Jo Kim, 1998: 5). They 'offer an underlying layer of stability. They provide a welcome "home for identity" where practitioners can connect across organizational and geographic boundaries and focus on professional development …' Stocks of shared experiences form a collective identity and source of learning – the CoP establishes a shared history which again brings the community together (Wenger, 1998, Hall and du Gay, 1996). Some of the most successful museum CoPs, such as the GCG, have adopted a vigorous campaigning stance. Their publications mark a shared sense of achievement.

2.4.3 Bound together by collective creativity

CoPs are not just acting together in the common sense, but are the outcomes of collective and purposeful, and perhaps experimental, engagement (action). A vital CoP is inherently and existentially curious and seeking knowledge and always oriented towards the future and, to some extent, prepared for change/invention (Arendt, 1958).

2.4.4 Bound together as a hot or cold collaborative environment

Hot distributed collaborative work is a form of co-operation that is closely coupled and highly interactive, while cold collaboration is loosely coupled where members to a larger extent work or perform tasks individually.

2.4.5 The CoP is necessarily political

Though underplayed in the management literature, a CoP operates within a clearly defined *field* where overlapping or shared forms of social capital (knowledge) may be used for political ends (Bourdieu, 1990). An individual may seek power within such a grouping – to become influential, controlling, a key player.

2.4.6 The CoP has associated with it a place

For the distributed community this may be a virtual entity – a listserv, website or a newsletter. Or it may be an event – an annual conference. Or it may be a geographical locality, a place of work such as a museum (Kim, 1998). Members' spatial conceptions and use of space, constrains or expands the scope of CoP practices. The space may be concrete, physical material space or imaginary, or metaphorical and explorative – suitable for intervention and interchange (Parry, 2002 using Lefebvre) such as in the virtual science laboratories for CoP (Chin, 2002) (see also section on virtual communities, 2.6.5).

2.4.7 The CoP in relation to task groups, project teams (exhibition teams)

Task-centred groups within museums, such as exhibition teams, are on the edge of the CoP definition, since the community is likely to be very heterogeneous and more 'instrumental' (each member performing specific tasks in a defined process) than 'organic' (shared knowledge and 'growing'

where the seeds are the interaction and a common language and work practices). However, in another sense team members do belong to a CoP as they share an understanding of the exhibition building process, of institutional history and philosophy, and all the tacit and explicit knowledge associated with that domain.

2.5 CoP boundary management

2.5.1 Boundary definition

CoPs are inclusive but only to a limited degree. Their effectiveness relies as much from their exclusivity. Again this relates to domain, which is not delimited simply as a 'subject area' but also by the nature of those that participate within it (expertise). For example, collectors of all kinds have an interest in how collections might be acquired through collecting and how they might be managed, but a broad domain interested simply in collecting would not reflect the nature of CoPs. Museum personnel, for example, would wish to communicate with others like themselves, charged with public duties, institutional standards, and scientific or academic traditions. They consider the amateur collector to exist within another world – freer, unscrupled and often less informed. To open the CoP to those outside its 'natural' group would be to destroy it.

2.5.2 Boundary protection

The CoP will tend towards informal comradeship as it is not a world of liability and obligation in the sense this is found in the workplace. It is a 'level playing field' not a hierarchy. This private world may be protected by the limits placed on disclosures about it – things said within the CoP become secrets to the world outside. Language may then be guarded to the point of not being entirely accurate. Knowledge and shared truths within an CoP may not be shared externally. Even so the operation of this private world may permit individuals to operate more effectively and thereby contribute more effectively to institutional goals.

2.5.3 Boundary crossing

CoPs do not exist in isolation. Their effectiveness can depend on how they connect with others. As individuals work within multiple CoPs and teams, individuals are often responsible for knowledge and practice transfer from one CoP to another group (including his/her own institution or an exhibition team). Boundaries can also be seen as points of possible connection and different CoPs share overlapping interests as these interests shift (Wenger, 1998). These boundaries also exist within individual members discourse and conceptions where new insights, language and knowledge is gradually taking shape. These processes of internal and external boundary crossing and negotiation may be frustrating, causing dilemmas (as explored earlier, e.g. when considering new technologies), as well as suggesting particular steps forward.

2.5.4 Co-operatives of power

CoPs can act as a source of power. Power understood not only as a united singular force, but also as a tension between what is shared and what is contested. They can become pressure groups for change.

2.6 The distributed communities

2.6.1 Distributed museum CoPs

In most museums there is perhaps one individual working on a particular subject area – such as biology curation – thus to form a CoP in this area relies upon contact with individuals in other institutions and, perhaps, countries. Museum natural scientists have been good at doing this.

2.6.2 Distributed agenda

CoPs revolve around shared agenda, but the agenda must become more general and less locally specific as the CoP extends its community. Thus while American natural scientists may share ideas with European curators on general matters such as preservatives, discussions on the reliability of suppliers, on government programmes, funding agencies, or political topics may become localised and concern only a small group of the overall CoP.

2.6.3 Technological replacement for meeting

CoPs thrive on face-to-face interactions where trust can be built up through personal contact. Through one-to-one emails and also listservs it is also possible to get a sense of a person and build up personal relationships. However, as Wenger et al (2002:116) note, those who remain silent on a listserv also remain invisible. Whether this is materially different from an audience member who remains silent in a debate is open to question.

2.6.4 Craft intimacy

Wenger et al (2002:122) also suggest that it is difficult to get a sense of 'craft intimacy' – i.e. that members are all doing the same thing – in large distributed communities. However, in the museum sector, areas are well delimited and practice at a fairly mature stage of development. Titles of posts can also be broadly indicative of area of expertise. This should not present a problem for the MIRROR CoPs.

2.6.5 Virtual communities

The replications and reconstructions of physical spaces that we continue to build using 3D space would best belong to what Lefebvre calls material space (physical space around us), while spaces where the objective is to provide the user/visitor with an accessible and recognisable space to navigate and interact with and use to order information belongs to a more imaginary space (Lefebvre), where we use the virtual as an intuitive and effective means of organising and interchanging knowledge. This is where MIRROR should develop the appropriate platform tools (Parry, 2002 after Lefebvre).

3. Methodology for fieldwork

3.1 Methodological approach

The qualitative study undertaken here exploits a range of research methods. The approach employed in this study relates to the objectives and the design of the MIRROR project which aims – among other things - to explore how CoPs work and function; how they create, share and apply knowledge within and across their 'boundaries'. The research involves extended contact with members of CoPs and exhibition teams within European museums of natural sciences. The diversity of CoP and team, and the physical and social context of their work environment, have to be considered in order to understand and interpret their actions and meanings. Although most of the decisions about the main focus and aims of the study were made at an early stage of the research, the approach remained flexible and allowed for new perspectives to be included during the field research.

The analysis of the data collected is partly based on ideas from the grounded theory approach (Strauss and Corbin 1990) and Miles and Huberman's (1994) approach to qualitative research emphasising the importance of empirically grounded conceptualisation and theorisation. Though, we incorporate the critique from, for example, Bulmer, 1979 in Burgess, 1984) in the sense that our data gathering and conceptualisation are not constructed from a *tabula rasa* view of inquiry (Burgess, 1980: 180-1).

3.2 Research aims and design

The main aims of this study – which covers the first phase of the MIRROR project - are:

- to explore the concept of CoP and apply it to communities operating within museums of natural history.

- to develop a methodology for the study of CoP that relate to museums of natural sciences in Europe but could also be adapted and applied in communities operating in different settings.

- to document the knowledge – both explicit and tacit - available to these communities, their interactions/relationship as well as the practices they employ within the organisation culture they live.

- to make suggestions regarding how to develop the MIRROR knowledge management system to facilitate the forming and developing of communities of practice in museums of natural science with particular focus on exhibition work.

In order to achieve our aims, we need to study natural history museum professionals as they engage in their every day activities. In particular we have looked at the profile of the members of communities in natural history museums; how they create and disseminate knowledge; how they develop ways of working together effectively; the value of the community to its members and to the organisations the community members represent; what makes natural history museum CoPs sustainable; and how they can be supported in a constantly changing environment.

Given that different members of the CoP operate within specific organisational cultures, it is important to study these cultures to understand how they would have shaped the community members' interest in learning and applying a common practice. The focus is on describing the particularities of the local environment of a selection of European natural history museums. It is important to gain an insight into the perspective and world view of the members of the different communities found in museums of natural history. An emphasis will be given on documenting the activities of the community at a local, national and European level; the outcomes of those activities with respect to the creation of knowledge; the development of relationships between community members; the ability to access the information and resources developed; the value the community creates for individuals, teams and organizations; and the integration of knowledge to everyday work.

3.3 Case studies

3.3.1 Possible Case studies: CASTEX and other European natural history Museums

The study will capitalize on an existing European network of museums of natural sciences, namely Common Approach for Scientific Exhibitions (CASTEX). However, it will also study museums which are not members of the CASTEX network in order to present a more holistic picture of the way knowledge is created and disseminated within and across natural history museums in Europe.

CASTEX[1] is a thematic network supported by the Raising Public Awareness Programme of the European Commission. It has close links with the European Collaborative for Science, Industry and Technology Exhibitions (ECSITE), a European network of science museums and discovery centres. CASTEX was set up in 2000 and its members so far include: the Royal Belgian Institute of Natural Sciences in Brussels, Belgium; the Museum National d'Histoire Naturelle in Paris, France; Naturalis in Leiden, Netherlands; the Natural History Museum in London, UK; and the Swedish Museum of Natural History in Stockholm, Sweden. It aims to develop a common methodology for the development of travelling natural history exhibitions. Issues that are of

[1] The information presented here on CASTEX is based on personal communication with Olivier Retout (25/04/2002).

particular interest to CASTEX members are the legal, technical, cultural and user requirement aspects of exhibition development projects set up in partnership among museums located in different European countries.

CASTEX represents a good example of a community that aims to develop a shared practice which, in turn, will directly affect the behaviour and abilities of each member. The domain of this particular community is the development of successful natural history exhibitions in partnership with other European museums of natural science. Members of the community have developed close relationships with each other. These relationships were based on already existing links but were also further strengthened during the development of a new travelling exhibition, *Fatal Attractions*. The members of the CASTEX community may well represent different communities of practice as their background, training and role within each organization are varied.

Other European natural history museums that have been asked to participate in this study include: the Natural History Museum in Verona, Italy; the Natural History Museum in Prague, Czech Republic; the Museum d'Histoire Naturelle in Neuchatel, Switzerland; the Zoological Museum of the University of Cumbria in Portugal; the Geological Museum of the University of Copenhagen and the Natural History Museum in Århus, Denmark; the Goulandris Natural History Museum in Athens, Greece; and the Natural History Museum of Sweden (Riksmuseet), Stockholm. Further data has been gathered from the National Museum of Wales, Cardiff and Leicester City Museums, England.

3.3.2 Choosing a sample: natural sciences related communities

The research team started by identifying a number of communities directly related to natural sciences which could be the focus of this research. These included: museum researchers, collection managers, exhibition developers/coordinators, conservators, interpretation staff (education and/or communication specialists, 'explainers/enablers') and enquiries services.

In an effort to narrow down the scope of the research, the community of exhibition developers/coordinators was chosen as the focus of this study. This choice was based on the following criteria:

1. Due to the nature of their work, the members of this particular community are more likely to have developed relationships – both formal and informal - with a wide range of internal and external communities related to natural sciences. This includes natural history museum visitors since exhibitions are a key museum-visitor interface. Mapping these relationships could illuminate the complex net of interactions and the different levels of participation (e.g. core and peripheral members) existing within CoPs.

2. There is an existing example of a distributed community of exhibit developers forming CASTEX. CASTEX was created on the grounds of –

among other things - creating and sharing knowledge by encouraging participation, sharing and making resources available, developing professional and personal relationships and removing cultural, physical, social and psychological barriers.

3. Exhibition production poses particular challenges for museum personnel and relies upon innovation and communication. CoPs in this area may be dynamic and active, and the MIRROR product could act as a useful tool for diverse knowledge management and communication.

4. Exhibition production is a core activity bringing together the full range of museum personnel. Each staff member exists within his/her own community of practice. A study of exhibition-related CoPs provides a cross-section of CoP diversity to be found in natural history museums.

Members of local exhibition development teams interface with each other as well as with colleagues working in different departments and with the external world (other museum professionals, natural science related communities or visitors) including numerous CoPs. These networks are very important for at least two reasons: communities tend to build on existing networks in order to evolve; and they provide a forum for a dialogue between inside and outside perspectives which can lead to innovation.

The following NHM agreed to participate in this study: the Royal Belgian Institute of Natural Sciences in Brussels, Belgium; and the Goulandris Natural History Museum in Athens, Greece; the Museum National d'Histoire Naturelle in Paris, France; the Geological Museum of the University of Copenhagen; the Natural History Museum in Århus, Denmark; the Natural History Museum of Sweden (Riksmuseet), Stockholm; and the Natural History Museum in Verona, Italy; the National Museum of Wales, Cardiff and Leicester City Museums, England.

3.4 Data collection

This is a naturalistic research study using a mixture of methods of data collection. The main aim was to explore the exhibition developers' perspectives of how their community operate and how they create knowledge, or engage in knowledge exchange, at a local, at a national and at an European level. Different methods have been used to investigate different aspects of their activities, their sharing and application of knowledge in order to improve practice and the value this community creates for its members and the organisations. Table 3.4 provides a structural overview based on key CoP elements (Wenger et al's 2002).

Community	1. Community members' profile	Who are they? Departments they work for, background, memberships (professional bodies)
	2. Roles	Subject-matter covered: roles played & how they are introduced to their roles; newcomers: baseline knowledge needed, training; old members: up-dating knowledge; barriers to relationships and how they are managed
	3. Values and beliefs	What keeps them in a community; what makes them leave; what connects/binds them to each other; how trust relationships are built; level of engagement with the community; value of community to its members, to the exhibition development teams & to the organisation
	4. Subgroups	Clans, clubs, committees; Official and unofficial leaders; process of group development around specific individuals (characteristics) or locality
	5. Rituals	Handshakes, holidays
Practice & beliefs embedded in practice	6. Place (actual, virtual)	Where people meet; what they do/talk about (story telling, conversations, coaching, apprenticeship); how (i.e. face-to-face, electronically) and how often they interact with each other; what kind of resources they use/share)
	7. 'Community history/memory': a. Etiquette b. Events c. Policies d. Community repertoire e. Archives	a. rules in use (tacit & explicit) b. formal & informal meetings, performance, competitions, professional conferences/meetings c. documentation, tools, procedures, sets of standards, performance indicators, accountability, standards of ethics; (look at how they are produced: top-down approach or product of debate; who signs them) d. terminology, codes of communication and behaviour, common approaches, frameworks, models, principles, lessons learnt, examples of best practice; resources (books, articles, knowledge bases, web sites) e. archival material associated to exhibition development work
Domain	8. Boundaries: content and scope of the domain	Activities members pursue; ideas they share; problems & solutions proposed; ways of presenting and communicating ideas & information; specific discourse used; contact with the science itself
	9. Leadership	Value of the domain to the community members, to the institution, and to the field; influence of community within the institution and the field

Table 3.4. *Fundamental elements and characteristics of CoPs*
(Source: adapted from Wenger et al (2002), Kim (2000) and McDermott (2002)).

3.4.1. Interviews.

A semi-structured questionnaire was built around the key themes of Community, Practice and Domain in the Wenger model, table 3.4. Field notes also commented on the themes and questions developed. Interviews aimed to give an insight into the value the community creates for its members and their organizations as well as the context within which knowledge is created and applied.

Data collected through interviews at this stage will also form a baseline against which we can compare interview data in work package 5, the evaluation of the MIRROR Knowledge Management (MKM) system. This will reveal the impact of the MKM system has on individuals, the community, and organizations.

Form of data collection: In-depth interviews were conducted with a selected number of key and peripheral members at each participating museum. Each interview took 1 ½ hour on average with a maximum of 4 hours and a minimum of 45 minutes to 1 hour. Interviews were transcribed and all interviewers used an agreed transcription symbol system. Some of the interviews were transcribed in more condensed form, concentrating on CoP issues.

3.4.2 Observation and exhibition exploration

This involved visiting museum exhibitions, laboratories and the work locations. Knowledge of the exhibition styles and the particular exhibition profiles of the museums led to more dialogical interviews, where sub-questions around particular exhibitions were addressed.

The observation provided a basic sense of the setting and the exhibition styles and means and the material conditions for the work the community members are undertaking.

Form of data collection: field notes based on surveying exhibitions, observations, informal discussions with community member, document gathering and analysis.

3.4.3 Secondary data

Collecting papers, documents and other archival material available in a text form – both paper and electronic material and taking photos of labs and exhibitions. The analysis of this material supplemented the field data and interview data collected. Secondary data represent the explicit information that is created by and is available to the members of the community of exhibition developers.

4. Data management and analysis

The data collected (filed notes and interviews) was imported into QSR NUDIST[2], computer software used for qualitative data analysis. QSR NUDIST is a particularly powerful theory building application. Data has been coded and analysed looking for patterns and themes.

In some cases data has been coded and analysed manually, where the researcher keys or marks the same set of themes. The reading or analysis of the transcripts is based on a common set of key themes or categories departing from the Wenger model, table 4, and which includes related conceptualisations and additional key issues in relation to CoPs that occur in the course of the fieldwork.

The purpose of the analysis is to provide a framework for developing the MKM system and a supportive MIRROR CoP, grounded on the particular problematics and conditions of community co-operation, exhibition development and CoP exploitation, as these can be interpreted from the data.

5. Case Studies

Each case study has been presented individually to locate differences and similarities between the participating museums. The following presentation includes a description of the museum (size, history, exhibitions, structure) and a summarising text presenting the particular functioning of the communities, practices, and values located. The findings from the case studies are then compared in order to suggest what forms of MIRROR support and software can be useful to stimulate existing CoPs and to create platforms for linking and sharing.

5.1 National Museums and Galleries of Wales (NMGW), Cardiff

5.1.1 Museum profile

The NMGW was established by Royal Charter in 1907 as the National Museum of Wales. Today it is one of Wales's major heritage organizations and receives its funding though grand-in-aid from the Welsh Assembly Government. The NMGW currently operates museums in eight locations across Wales.

The underlying purpose of the NMGW is the advancement of the education of the public. According to the Charter (1907, revised in 1991), this is to be achieved 'primarily by the complete illustration of the geology, mineralogy, zoology, botany, ethnography, archaeology, art, history and special industries

[2] For more information visit www.qsr.com.au or www.scolari.co.uk.

of Wales and generally by collection, conservation, elucidation, presentation and publication' (NMGW Corporate Plan 2003/2004-2005/2006: 17).

NMGW shares a broad common vision with its sponsoring body, the Welsh Assembly. It plays a leading role in delivering and developing the Welsh Assembly Government's cultural strategy, *Creative Future: Cymru Creadigol,* and its aspirations for the growth of the tourist industry as well as its lifelong learning agenda, *The Learning Country*. NMGW has recently identified a number of priority areas through its own strategic plan, *Plan for Wales 2001*. These areas include: developing the learning county; a modern economy; where we live; identity; modern government; and promoting ICT.

NMGW in Cardiff receives an annual capital grant of £775,000 since 1996/7 while the cost of its ongoing maintenance is estimated to be in the order of £1.2m per annum (Museum Corporate Plan 2003/2004 – 2005/2006). Additional funding is sought from different sources and funding bodies. NMGW has implemented a policy of 'free museum admission for all' sponsored by the Welsh Assembly Government. This resulted to an 87% rise in the total number of visits. In 2001/02 NMGW welcomed 1,430,428 visitors as opposed to 765,000 the year before. It has a wide range of collections: archaeology and numismatics, art, science and technology, and social and cultural history[3].

5.1.2 Respondents' profile

Four members of the staff were interviewed at the NMGW's main site in Cardiff. All of them were involved in exhibition development at the time the interview took place or had been involved at some point in the past. An effort was made to talk to people[4] from different backgrounds, departments and at different levels within the Museum: the Assistant Director (Exhibitions and Interpretation); the current Departmental Manager for the Department of Biodiversity and Systematic Biology (and former Exhibitions Coordinator) (MBSB); the Head of the Marine Biodiversity Section (HMB); and the current Exhibitions Administrator (AE). Both the Departmental Manager for the Department of Biodiversity and Systematic Biology, and the Exhibitions Administrator were new to their current roles but they had been with the Museum in different posts for 12 and 2 years respectively.

5.1.3 Domain

5.1.3.1 Boundary management

The domains within which this group of individuals operate are diverse. Some work in a cross-disciplinary exhibitions department which involves developing and managing a wide range of exhibitions from natural sciences to archaeology and art. Their shared knowledge suggests the presence of a CoP. Others are subject matter specialists (marine biology) and are brought in only

[3] More information is available on-line at: http://www.nmgw.ac.uk/nmgc/
[4] For more information on the role, background and career patterns of the respondents see Appendix.

when the subject of the exhibition is relevant. These, too, may be distinguished as a CoP, sharing knowledge in general biology, though the marine biologist will also belong to more specialist CoPs in that field. When these individuals come together to form an exhibition team, they bring within them their own specialist areas of knowledge, yet may, because of their shared understanding of the museum and changing positions within it, also act – at one level at least (that of the philosophy of the museum) - in CoP-like fashion, though it may be fraught with tensions. The CoP literature tends to make clear distinctions between goal focused teams and CoPs but in practice, and from wider social theory, there is good reason to believe that exhibition relationships act both as a (relatively weak) CoP and as (stronger – though not necessarily cohesive) teams of individuals who each belong to other CoPs (see Fig. 5.1.3.1a).

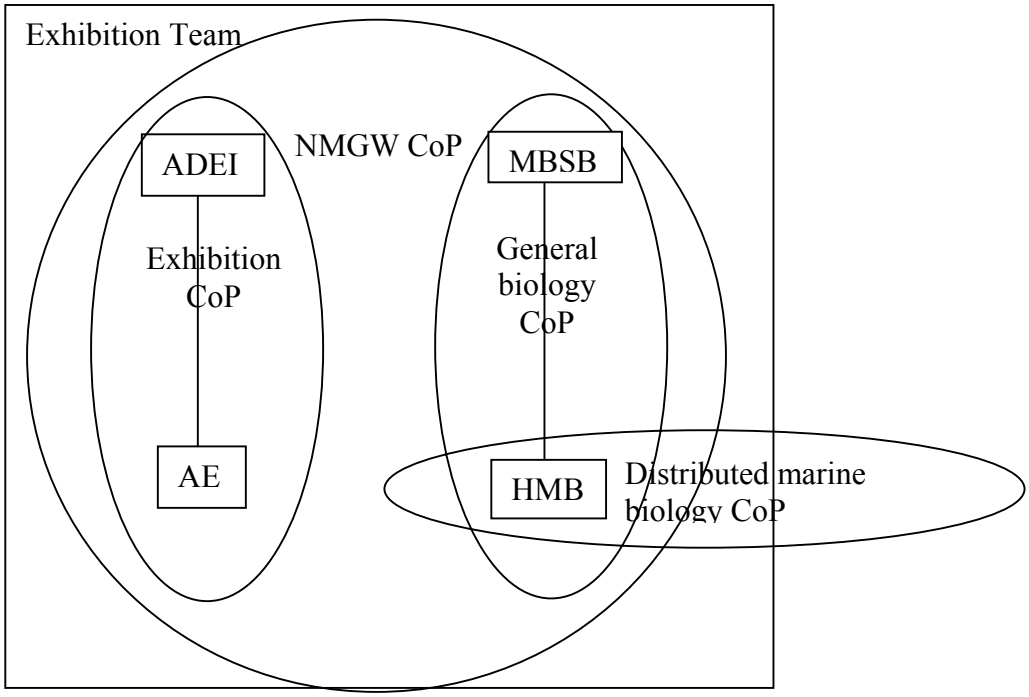

Figure 5.1.3.1a Distinguishing managerial hierarchies, domains and CoPs at NMGW. The ADEI and AE operate within the exhibition department, in a line management structure and as exhibition specialists in a CoP; the MBS and HM have a similar relationship centred around biology. Each, like HMB, will belong to distributed CoPs in varying degrees. But as all belong to the same organisation there is a sense in which they all belong to a notional NMGW CoP.

Core specialist domains are well defined and protected (i.e. marine biodiversity). For example, marine biologists have developed and used databases on new research projects that are only used within their Department. They usually share findings of new research in more formal ways, through publication and conference presentations. This ensures that they are active research-wise but it also enriches the Museum's collections.

The specimens in the collections can then be used and shared by different communities (i.e. for exhibition purposes within the Museum or by researchers from other organizations).

Staff working on the exhibitions and interpretation side often help enhance boundary activity. These are people who are members of multiple communities both within and outside the Museum. They work on projects that fall within multiple domains, as for example the *Flight* exhibition where the Exhibitions Co-ordinator had to bring together and communicate with people from different departments as well as groups outside of the Museum. This is not an easy task as that person has to enter and operate within different 'worlds' (entomology, malacology, and so on) and also manage and deliver the project. Objects such as the *Exhibition Manual* or the *Exhibition Proposal Form* can also enhance boundary activity as they are used by different communities both within the Museum (when working on joint exhibition development projects) and outside the Museum (i.e. with a design firm or with the City Council).

As all the staff interviewed participate in exhibition making they might also all be considered to belong, in varying degrees, to a broadly defined exhibition CoP (see Fig. 5.1.3.1b)

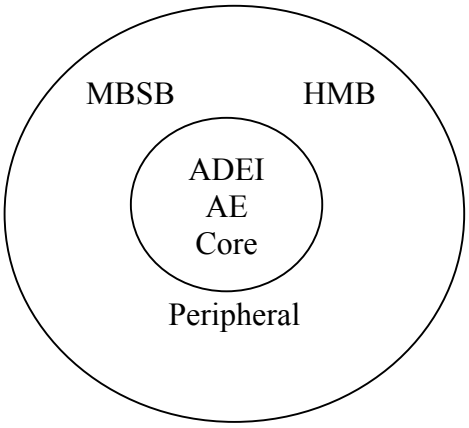

Figure. 5.1.3.1b. NMGW exhibition team as CoP.

5.1.3.2 Beliefs and values

Sharing a common domain – developing a natural science exhibition – is what brings the community of exhibition developers together. The members of this community value their domain for different reasons depending on their role within the Museum as well as their background. For the subject matter specialist, doing field research and collections research is what he values most. This research is then used to produce scientific publications as well as exhibitions for visitors. The people who work on the exhibitions side have a different perspective. They see exhibitions as a way of 'enriching people's lives'. They are committed to delivering an educational service that has a long lasting impact on people's lives. This includes both internal (personal and

professional development of Museum staff) and external users (visitor learning, and working in partnership with other likeminded institutions to promote research and learning). These different perspectives seem to run in parallel with the two main functions the Museum is perceived to have: academic research and a cultural/educational function. Finding new ways of using and presenting the results of collections research (including new technologies) is what keeps museums alive, according to a respondent.

This 'dichotomy' within the Museum – and all museums for that matter – came up again when people offered their views about the internal structure of the Museum. Although the subject matter specialist interviewed could understand why his time has to be divided between doing fieldwork, working on the collections, contributing to exhibition development and so on, he would rather concentrate on doing research (neutralise?). Recent changes within the Museum structure have resulted in it being a much more flexible and inclusive organization. Museum staff at different levels can have a say and be heard by management. There was some criticism of the way exhibitions have been managed in the past which have caused extreme stress for some individuals, particularly in relation to the timing and provision of adequate resources. There still does not seem to be a clear way of progressing in the exhibition area, and as a result some people have moved away from involvement in exhibition work.

Despite the low points, what brings people together is their shared commitment to their domain. This commitment has often been build for years through a strong personal interest in a particular subject matter related to some aspects of exhibition development.

5.1.4 Community

5.1.4.1 The exhibition development team

Although the team of exhibition developers as described here tends to perform as a team rather than a CoP, it is important for understanding the context within which its members operate and what they value about their role.

For the biological specialist, the most satisfying part of his job is the idea that he has made a contribution to scientific knowledge and the communities related to it through publishing his research findings. Making information available to his scientific CoP as well as to his colleagues at the Museum 'makes it worth doing'. Others found rewards from working with people both inside and outside of the Museum; that they could apply skills and knowledge that they had gained from working in a different field in innovative ways; that they could work collaboratively with other people, groups or institutions; that they could move on to doing different things within the Museum that they found challenging and working towards creating something concrete; that they could share their own and other people's knowledge with the public.

Challenges include undertaking a labour-intensive task with very limited resources; spending a big part of their time looking for funding which takes them away from other Museum-related tasks and often results in being opportunistic rather than strategic; doing 'a bit of everything' instead of being focused on a specific subject; a lack of opportunities to work creatively; working within an organization that is 'divided by different personalities and beliefs'; and foreseeing every eventuality and delivering an exhibition on time and within budget. In many cases, people have developed ways of resolving these challenges. Looking for collaborative projects can bring in more funding to pay for resources and extra staff to do cutting edge research. This is good for the Museum as it brings new people in who are enthusiastic about what they do, it creates new links with different institutions and keeps the Museum in touch with what is going on in the field. Knowing the social, physical and political context within which the exhibition development team works is also very important in resolving difficulties. It is important for one to know who can do what, who one can communicate effectively with and who one can rely on during the development of an exhibition. This is something that one can learn from talking to other people, from experience, and from creating mechanisms that can help people work together. Trust and mutual professional respect also become major issues here.

Training and professional development have been used as a way of preparing people to work within a very diverse environment and to work with others. There is internal training which is mainly done on the job and through a series of 'awareness' sessions - curatorial, conservation and educational awareness days. Museum staff also attend external training courses related to their work (i.e. project management, DNA analysis, IT packages). Other forms of training include going to conferences and seminars or doing field or laboratory research in a different country.

5.1.4.2 Internal CoPs at the NMGW

Formal groups: Although different departments or groups work with each other collaboratively, they do not form a CoP. For example, there is the 'Management Forum' which consists of the Head of Departments who meet regularly and work on the corporate functions of the Museum, the 'Web group', a 'Welsh language group', a 'Museum-wide exhibitions group'. On the academic side, different groups may organise workshops and lectures (such a joint event is planned for October and is organised by the Biodiversity Department in collaboration with the Geology Department and the Open University).

Informal groups: These groups seem to be closer to CoPs although they are very loosely formed (this needs field research, and cannot be determined through interviews only). The community which seems to have most regular contact is the one meeting at the café which includes people from exhibitions, the Biodiversity Department and IT. Almost the same people meet every day for lunch at the Museum restaurant and sometimes – when an important

issue has come up – they may arrange to meet for coffee. Discussions are work-related and revolve around day-to-day issues and more generally how the Museum is run. All respondents seemed to value talking to members of the staff who had been with the Museum for a long time and could pass on information related to the history of the organization. They also valued the opportunity to exchange information, to share inspiration and to mix with and relate to other people. Respondents mentioned that they would like to have more time and a space to meet on a regular basis and invite people from different sections within the Museum to be involved.

There is another informal group consisting of staff of the Biodiversity Department who meet at their own coffee room. There was also an informal group of people from geology and biodiversity who would meet regularly for squash or for lunch outside the Museum. This has now broken down as its members have had other commitments. There is no indication that these groups form a CoP even loosely, although more research is needed to determine this.

5.1.4.3 Distributed CoPs

Only two of the people interviewed were individual members of professional or scientific bodies as well as a network of professional friends in different organisations: the Assistant Director, Exhibitions and Interpretation, and the Head of Marine Biodiversity Section (should we take this out?). Both of them were quite active members of at least a couple bodies. At this particular point in their career the main value to them was the opportunity to exchange information and keep in touch with new developments in their field, getting satisfaction from helping younger researchers, using the knowledge and experience of other people to inform their own work, finding parallels between the different disciplines and building strong professional, and sometimes personal, relationships. On an organizational level, distributed CoPs (DCoPs) provide professional development for members of the staff, expertise that they share with other colleagues, links with other institutions and raise the image of the Museum. The Departmental Manager for the Department of Biodiversity and Systematic Biology was also a peripheral member of a number of scientific groups on behalf of the Department.

Determination of an active or peripheral role in these organisations relates to such things as particular interest in the subject matter, the stage of someone's career and other commitments such as having a family. Contact is maintained by attending meetings, annual conferences and workshops, via newsletters and other publications as well as by email.

5.1.5 Practice

This section refers to all aspects of interaction between the members of the exhibition development community at NMGW.

5.1.5.1 Institutional memory

Events: The exhibition development process if facilitated through different forms of interaction the most common of which is team meetings. That is how they share knowledge and expertise, create a common understanding, keep track of all developments and generally ensure that they are 'on the same page'. There is an agenda and minutes for each meeting. They also communicate via email in-between meetings.

Community repertoire: Examples of best practice are provided during the internal training sessions and also are told in the form of stories when they meet for lunch or coffee. During these exchanges, a shared 'way of doing things' is developed. There are also other resources available such as databases, and the Exhibition Manual which states how exhibitions are developed within NMGW.

Policies: Policies are usually developed by senior management in consultation with Museum staff. Final decisions, however, are made by senior managers. Occasionally, outside consultants are brought in to evaluate existing policies and make recommendations.

Exhibition development projects: Respondents offered their views on what makes a successful exhibition development project in terms of the process. These include: having enough time (approximately two years since the team is brought together) and adequate resources; recognising what kind of skills and expertise are needed to deliver the exhibition and putting together groups of people that have the knowledge and skills as well as the right personality and a sense of commitment to the project; ensuring the person in charge has project management skills, can make decisions at the right time and can inspire people and take them with him/her; effective communication between team members; communicating effectively with outside firms or partners; holding weekly meetings and keeping everybody on track; sticking to deadlines; and wanting to do it again. Respondents mentioned that one of the criteria for success for an exhibition is its popularity with visitors. Popular exhibitions tend to be those with a broad topic (such as *Flight* or the *Evolution of Wales*) which appeal to a wide audience. In terms of exhibition development this mean having a bigger and more diverse exhibition development team which makes the whole process more difficult to manage.

5.1.5.2 Using technology to support existing communities and improve practice

Respondents talked about how technology - and the Mirror Knowledge Management System in particular – can be used to support their community and help them improve practice. This is a summary of their ideas:

- Creating a 'virtual thinking & discussion' space. Users would like the Mirror Knowledge Management System (MKMS) to include a catalogue

of tools – i.e. internal policy documents, research data bases, expertise, listservs, funding body information, on-line journals, internal training CDs (such as health and safety, collections management) - and objects within those tools coming from different servers. Both tools and objects should be presented in ways relevant to the users (exhibition development team members). The 'virtual thinking & discussion' space should be made available in more than one language (i.e. English, Welsh, French). So users can choose whether they would like to access databases available in French, for instance, or if they want to speak in Welsh to each other. An idea was to be able to 'think in pictures' and have all the data and information 'hidden' behind pictures. The users can provide a list of existing tools (i.e. databases created by their own organization and by other organisations) that they would like to have access to via the MKMS.

- It was suggested that data and information that is regularly updated (such as invitation to tender for new projects and funding opportunities) should also be updated on the MKMS (for example, sending alerts via email or having it running at the bottom of the screen).

- Providing easy access to other institutions like museums, universities, research institutions, the industry, the EC that are doing similar research or share similar concerns (such as finding ways of formalising the exhibition development process or creating work flow systems).

- Being able to visualise the final product – be it an exhibition, a poster, an outreach activity kit, a leaflet etc – and modifying it before it is produced.

- Providing the context within which exhibition developers can set up procedures that will enable them to organize, manage and run exhibition development projects smoothly. This includes all phases and aspects of the exhibition development process from initial conception through to delivery of the project.

- Having both a personal and a private space seems to be very important for researchers in particular. A personal space provides access for single individual user where they can access and save their own resources while a private space provides access to a group of users who have agreed to share knowledge and expertise in a specific subject.

- For the interpretation and education members of the exhibition development team a forum space for sharing problems and solutions, building mutual confidence and respect, and developing things in parallel which can satisfy the needs of different markets would be a particularly important development. This can create a sense

transparency and accountability to different users both within and beyond the bounds of the organisation. It can also give the organisation the chance to build and sustain relationships with different communities (like museum professionals, researchers, local communities of existing and potential visitors). The National Museums and Galleries of Wales has been experimenting with video conferencing for the last eight years and staff feels comfortable using that medium.

5.2 Naturhistorisk Museum (Natural History Museum), Århus, Denmark

5.2.1 Museum profile

The Museum is a private institution subsidised by the Ministry of Culture (approx. 60 % percent of total income), the municipality of Århus, the University of Århus and by its own income. The Museum is increasingly finding money from private sponsors to sustain its activities. State support pays for the employment of the 25 staff in the Museum. The total budget is 15 million Danish kroner (1.5 mill GBP). The Museum has had an average of approx. 60,000 visitors per year over the last five years, not much less than Zoological Museum in Copenhagen. The number has been over 70,000 for the last two years.

The Museum was established in 1921, in 1941 it moved into the present buildings on the university campus site. The Museum is planned to double in size, in terms of physical space, over the next few years, moving to a new site close to a science and astronomy museum. The Museum last expanded in 1978.

The exhibitions are generally oriented toward the history of Danish landscapes, flora and fauna from the ice age until today, in two older permanent exhibitions: Denmark's Animals and the Denmark Hall. There is also an Africa exhibition and animals from all over the world. One temporary exhibition, Tales of the Sea, is currently running.

With no single national museum of natural history in Denmark, the museum in Århus sees itself as occupying the premier position, though this is threatened by the possible joining together of the more academic museums at Copenhagen University[5].

5.2.2 Respondents' profile

Five interviews were conducted with core exhibition team members, an education and IT officer and the director. Exhibitions and labs were visited

[5] For more information visit : www.naturhistoriskmuseum.dk

and written material collected including material from the institutional website. Being a small and relatively close knit group with a strong public ethos, the museum acts much more like a CoP.

5.2.3 Domain

5.2.3.1 Boundary management issues

When contracted to undertake external work, such as the creation of external exhibitions with a client/partner, the museum's exhibition developers often find themselves facing a different imaginative culture. Clients often have different images in their heads, whereas the exhibition group at Århus tend to know what a colleague (within the museum) means when he/she uses certain words (as one would find in a CoP). The result is misunderstandings with external partners late in exhibition development. They acknowledge there is a need to work more with visualisations, and Mirror 3D technology might help here for Århus to 'map' and give body to their ideas, at an early stage.

The IT and education officer is organising an IT group. There is also a nature facilitator at a nearby island and a school service unit. These work with the exhibition group in a slightly more peripheral way - particularly the school service which links events to exhibitions. Events programming for schools is closely related to temporary exhibitions.

5.2.3.2 Beliefs and values

Boundary issues also come to light with regard to exhibition philosophy. Exhibitions at Århus are slowly moving towards a discovery/experiential approach, although there is still much discussion and disagreement about how learning and discovery can be put to the forefront rather than following a collection driven mode of development. The value of a significant collection, in terms of research value and documentation of biodiversity, falls to the ground if the message and medium are not thought through. The mode of delivery seems to be particularly important to achieve a consensual domain. The museum differentiates itself from science centres, which lack collections. One respondent defined the Århus experience based approach: "Experience is something produced in peoples heads" by the means of providing a museum selection bound up with narratives and concepts people assimilate. This form of learning should then work as a stepping stone to search for new knowledge. The museum want to work towards more open exhibitions, less concealed display, let people get closer to material, let the exhibition surround the visitor rather than having the visitor in detached position in front of a shelled display. One of the recent temporary exhibitions is called *søforklaringer,* 'Tales of the Sea' in literal English translation. This exhibition has no interactive exhibits; Århus staff think carefully about what they want to achieve the methods by which a message is to be communicated.

But as in Cardiff there is also the pressure to research and Århus's staff think they are falling behind in this regard, the new director wants to improve this. In contrast they are quite good on the communicative side, well-known as "ask Århus". This balance, with its greater emphasis on public service (at a cost to research effort) is fairly typical of museums of this size elsewhere in Europe.

5.2.4 Community

5.2.4.1 Exhibition development team

The exhibition development group consist of 7 people; a biologist and fact responsible (content/subject matter specialist), a cabinet maker and a technician, two designers (graphic design and illustrator/draughtsman/drawing), and two conservators. There are no other designers or conservators at the museum. The leader of the school service, a biologist, occasionally participates when exhibitions are prepared. Together they do not form a true CoP in Wenger's sense, but adopt characteristics in terms of closely coupled work, knowledge exchange, collective practices and actions, but it is better characterised as a heterogeneous conglomerate of different knowledge wrapped up as a task group. It is, though, more or less the same core group from exhibition to exhibition.

The lack of homogeneity in the exhibition group is its strength and weakness, as one explains. It can be difficult to speak from an equal footing or platform, but the fact that all are on board, working tactically forward, up for the offerings or possibilities of the moment, makes everybody able to, and forced to, learn in areas where they are not responsible or experts. This, by adapting to the situation and listening to others. At Århus, the design is not developed after a script is completed but as part of the conceptual development. The conservators and carpenters are also on board at the outset to provide information on what is possible.

5.2.4.2 Distributed working

Scientists are members of various international organisations. However, such international exhibition links are not the norm; the network seems to be largely national: if someone wants to borrow something or seek some knowledge, they call people they already know at another museum. They co-operate a lot with Zoological museum.

One staff member feared that a new umbrella organisation (National Natural History Museum) combining the Copenhagen museums of Zoology, Botany and Geology could become a threat to Aarhus. The director thought it was purely a "*papirtiger",* an illusive plan on a piece of paper that wouldn't become reality: they are three different university institutes; they don't think as one museum; and, although they will compete for money, the market is big enough for them all, including Århus. The director still saw Århus as

remaining the natural history museum of Denmark, still too zoological in his mind, but he is interested in reinventing the institution, and European partners and exchange is part of his plan.

When it comes to co-operation with other museums there is an unwritten rule of conduct. When another museum calls you help them, and people help you, lend material, exchange visits. "We scratch their backs, and they scratch mine", as one says. A huge informal museum network is necessary in order to exist. And to know about what other similar museums think, do, have, search for, and work, would make life easier.

5.2.5 Practice

5.2.5.1 Communication and drive

There is a lot of chaos but they could use more structure, they say, but the fun is also when everything is boiling, they all say. To have contact with people and to create something in the end. The conservator interviewed would not like to work privately or in a factory and the designer would not like to go back to a firm, where end products disappear when they are done. The biologist can do research, do biology, and at the same time communicate, give something to people, at the museum. They all seem happy in their jobs.

The exhibition group meets weekly to exchange information, keep in touch, adjust to minor changes, and in times of exhibition development to co-ordinate the tasks and issues at stake at the present job, this can be internal exhibitions at the museum as well as external jobs where they are hired by a client to prepare and install or co-operate on an exhibition at an external institution.

The fact person (content/subject matter specialist) is responsible for being a driving force in terms of ideas, but in practice the exhibition is conceived from a more or less blank piece of paper, or an open start, where everybody contributes, talks, though aware of the different competences: biology and natural history, pedagogy and communication, design, conservation. Meetings are held even though there is no job or deadline. The co-operative spirit is kept alive, as one says, so that the group is kept moulded together when they reach more heated times. They are very different in terms of the kind of knowledge they carry. They cannot just click when the task is there. It is not a homogenous *field* (Bourdieu, 1979) and, in this sense, it does not fit with Wenger's ideas of shared knowledge, but the differences to some extent become shared, or are shared across the table, in the corridors, almost daily. It is a *hot distributed collaborative environment* in the sense that it is closely coupled and highly interactive, but cold distributed in the sense that some people are rather alone in their field and perform a lot of tasks on their own. The designer is a part here but, as he explains, he doesn't have "colleagues". There is no one else with the same education (background?) as him. He is originally educated (has a degree?) in commercial design (advertising, drawing) while there is a graphic designer as well, but she is seen as a

graphical person, not a designer, there is a difference here. He fits in where the other is lacking. But this sense of being, to a degree, an outsider has its advantages believing that if 'he understands [what the texts and exhibition says], the audience also will'. Each person has a role, but they are flexible; they ping-pong, do boundary crossing in terms of formulating ideas, visions and try together, with the different expertise around, to turn practical obstacles into workable solutions for the particular job, depending on the availability of time, money and materials. The fact responsible will change role during the construction of the exhibition and become more a 'practical man', as he said.

Internal exhibition work has, over the last 4 years, mainly been focused around creating new temporary exhibitions, rather than permanent exhibitions. Large permanent exhibitions are demanding in terms of money (i.e. huge investment), time and staff. Temporary exhibitions are easier to set up, they take less resources in the short run. Sponsors are more likely to help if the total investment is smaller, and it temporarily provides potential for linking with events, and attracting different target groups for each temporary exhibition. In the long run, though, the temporary exhibitions turn out to be more expensive, they say. But short-term payments from private sponsors and the Ministry of Culture/the state often make this the best strategy.

5.2.5.2 Use of technologies

The use of touchscreens and computer technology is one area where there is no consensus within the museum. However, their more positive attributes were perceived as: several languages are possible in less space, easy access to information, visualisation, linking to other resources. MIRROR may be able to suggest software that can help the open-minded sceptics, always willing to try something new (this is how all respondents in general can be characterised) to get them properly over the IT doorstep. The museum is putting an effort into developing the website. They ask for coordinated databases, ways of findings images fast and they are keen to join European exchange/network: this is why we joined MIRROR, the director says. But when it comes to what kind of software, they can't really put it into words.

5.3 Geologisk Museum (Geological Museum), Copenhagen, Denmark

5.3.1 Museum profile

The Geological Museum is a part of Copenhagen University. After the new museum law of 2001 the Museum became a part of the new State Natural History Museum together with the University's Zoological and Botanical Museums and the Botanic garden. As a university museum the institution can be dated back to 1772 where it was launched as "Natural Theather" of the University. It 1810 the mineralogical and zoological collections were bought by Count Moltke who added his own objects before later returning it to the University together with money to fund its maintenance. Until 1976 it was known as the Mineral Museum. The formal name is Grev Moltke's Universitetet Tilhørende Geologiske Museum*.* but is just known as 'Geological museum'. The Museum has been in its present buildings since 1962, which used to be shared with Geological institute and Greenland's Geological institute.

The Geological Museum has approximately 35 employees. It is visited by around 30,000 people a year. The museum exhibits minerals, meteorites and fossils. It has exhibitions about volcanoes, the making of salt, continental drift, the geology of Denmark and Greenland, North Sea oil and gas, crystallography and origin of man[6].

5.3.2 Respondents' profile

Two interviews were undertaken with a deputy-director and researcher (who was involved in the planning of future exhibitions) and a curator/researcher involved in a range of permanent exhibitions. Written material is included. Exhibitions were visited before the interviews.

5.3.3 Domain

5.3.3.1 Boundaries, beliefs and values

For the two people interviewed - a meteorite curator and Geophysicist and the deputy-director, professor in palaeontology - the domain of their communities and practices is collections research. For the geophysicist it is a privilege to have one of Europe's largest meteorite collections at hand. Both respondents came here because of the research environment. One emphasises the fact that he had a meteorite collection around him and the country had no other meteorite-related position where he actually had "a treasure" at hand. The other interviewee moved from Ireland to work full time in a museum context doing research that interested him.

5.3.3.2 Exhibition

The development of the exhibition domain and of the core value of research can be summed up in three points:

[6] For more information visit: www.nathimus.ku.dk

- A change underway from an emphasis on curation to research, e.g. the previous incumbent just took care of the collections, while the new one (the respondent) is doing research into them, and trying to communicate the knowledge they reveal.
- A move away from "*andægtigt*" display, religiously devout in literal translation, but carrying a connotation of old-fashioned stylistic classicism, not necessarily understood in any religious sense. The respondent notes that the museum moves slowly away from the classical and static display to more dynamic exhibitions. The mineral and meteorite collections will stay classical, though, with "no disturbing touch screens and weird technology", while origins of the universe, solar systems, and new material on volcano's, will be more dynamic. Already, there is "some action" in the volcano section. Some exhibitions need to be renovated, some are "deliberately old-fashioned". Among these are what they call systematic exhibitions, things lined up, and "our audience reviews are positive about this", one says.
- Both respondents indicate they need to produce exhibits with less informative, factual text, and instead more questions, involving the spectator in other ways. It also has to be in two languages, though this will only worsen the problem of too much text, both respondents noted. Respondents at some other museums said that Geological Museum has a tradition of too much text, while Zoological has too little. In Stockholm some displays have touch screens where the visitor gets a few different language options.

5.3.4 Community

5.3.4.1 Team and community working

The fact that the museum is a part of the university defines the community and its practices to an extent that make it slightly different in comparison with other participating museums in the MIRROR project.

No particular CoPs seem to be formed around exhibition responsible or scientists/curators and/or conservators and designers internally. People have, at the museum, had a tradition of working *"enevældige",* in solitude. He uses the Danish word for 'the absolute monarch'. The curators have in the past been working with the specimens and sections they were responsible for and doing their research and teaching. The Geological Museum reveals, as expected, that CoPs may be found among the different scientists and throughout their informal networks of scientists outside the museum. These appear to be some of the best defined CoPs – i.e. those that relate to professional role and training.

There is no explicit structure or community among the scientists/curators, nor any informal internal CoP. Staff meetings are rare as is talk over the lunch in the canteen. The scope of the fieldwork cannot reveal to what extent

scientist-centred CoPs are formed. People in general work on their own, the meteorite curator said, though indicating that this is under change. However, more detailed fieldwork would probably reveal structures they are not fully aware of themselves. Many scientists don't seem to recognise the existence of a network or *community* before it is actually explicitly set up, while the talk and interaction among colleagues, which the respondents vaguely express the existence of, could indicate CoP formations. The meteorite curator explains that the disciplinary circles overlap and people engage with colleagues in the overlap informally. He outlines three groups, 1) mountains and solar systems and meteorites, 2) palaeontologists studying fossils, 3) biologists concerned with ice age landscapes, a total of 13 people.

5.3.4.2 Distributed communities

Externally there is the new Geocentre. which will "share common laboratories and libraries with Geological Institute and Geographical centre". It will "create synergy, research and teaching". It opens in September. There is the State Natural History Museum umbrella under preparation, which was "dictated from above" though "nothing has really happened", though the deputy-director remains positive about its future. The State Natural History Museum attempts to unite the three disciplines in one financial and administrative structure: "maybe one management board in the future", "a platform for policy statements, aspirations, general plans", he says. At the moment contacts are with Zoological museums, though individual members of staff have their own networks which extend outside Denmark.

5.3.5 Practice

5.2.5.1 Skills shortages

The renewal of exhibitions, including establishment of new ones, has been further burdened by the fact that those responsible for exhibitions have not been sufficiently skilled in pedagogy (education/learning), communication or museum work. Exhibition work has been undertaken by lecturers and professors rather than by individuals trained in communication and exhibition methods. There is no head of exhibitions here but a post is in the process of being developed. The meteorite curator would prefer a person who is an external and a communicator/museum educator, and not a scientist.

5.2.5.2 Academic priorities

Internally, actions are difficult to take because of the very democratic structure, the deputy-director explained. Getting type and figured material on database is a key initiative already underway. "We have got marvellous things, but are not streamline, the way we actually store, display, type and figure", the deputy director says. They are eager to get access to type and figure material, that is what they are always looking for in other museums.

5.2.5.3 Use of technologies

Renovation, as well as preparation of new exhibitions, presents a general problem. They would like to be able to update information much faster. One of the respondents is very keen on the option of being able to use technology to insert/replace information quickly, "you can't make a permanent exhibition on Mars", he says, and later adds that it would be "the dream" to be able to download information on meteorites quickly and use it in exhibition work and research. This is the same person who earlier talked derogatively of "weird technology". All respondents in the research, including those in Stockholm and in Århus, seem to have an ambivalent relationship with technology, particularly in the exhibition spaces, less in research and knowledge exchange. It is an area of much contention.

For the Geology of Denmark they had plans for touch screens, but the person in charge "didn't come up with anything good", so they did not implement the plan. The deputy director had no problem with this pointing out that he "is a sort of specimens person". The specimens are "what drives… the fascination, the sense of wonder".

Regarding MIRROR they expressed interest in hearing "what kind of IT is available", though without being able to indicate specific wishes. The director who was not interviewed was also very keen to participate in the project.

5.4 Naturhistoriska Riksmuseet (National Museum of Natural History), Stockholm, Sweden

5.4.1 Museum profile

The museum is a state institution under the Swedish ministry of culture. It has had an average of approximately 800,000 visitors every year for the last three years, half of them under 16 years of age. The exhibitions are visited by a stable number, while the science centre, Cosmonova, within the museum, has seen a decrease in visitors over the last few years.

The museum is one of the country's major tourist attractions. The first national museum of natural history, from where this museum is descended, was established in 1820. In the early years it was more a zoological museum, but it has evolved into a museum of natural science. During the 1990s the museum was forced into major cost cutting. Staff numbers were reduced by one third. There are major unsolved problems in areas of operation which have safety issues, and difficult to function in and modernise, according to the annual report. Furthermore many of the museums old collections, some several hundred years old, are costly but important to preserve and keep accessible.

Thirty seven percent of the coverage of research expenses come from private sponsors and research bodies. The Museum has 2000 guest researchers every year. Museum staff teach at universities in Sweden and elsewhere. The collections on display have decreased over the last 5 years. Present exhibitions are: 4.5 billion Years, Polar Tracts, Senses of Man, The Nature Cabinet, Expedition in Space (Cosmonova), Life in Water, and Nature in Sweden, the latter being the latest permanent exhibition.
The museum is made up of 6 major departments: research, exhibitions and programme/events, Cosmonova, administration and services and finally a regional department. (These main units are below the director, finance, personnel, IT and marketing in the organisation diagram). The research department has 16 subunits of research with responsibility for different collections and teaching areas. 63 % percent of the museum's approx. 200 employees are working in the research units (including collections/curation)[7].

5.4.2 Respondents' profile

This was also a minor case study with only two interviews undertaken with the head of research and deputy director of museum, and a project manager (exhibition developer). Exhibitions were visited before the interviews and the interviewer had a tour around exhibitions and labs with project manager. Written material and website information has been used as well.

5.4.3 Domain

5.4.3.1 Exhibition philosophy

This is a much bigger museum than Geological in Copenhagen or the museum at Århus, leaning towards a science and discovery centre approach, and – in comparison with the other two– the collections of the museum did not seem to take centre stage. It appeared similar to Århus in its emphasis on contextualising its material, and structuring specimens in order to trigger stories, rather than just regimented taxonomic collections in closed mahogany displays (as with several of the Geological Museum's exhibitions). The head of research repeatedly expressed his main concerns: linking the research with the museums collections, and profiling the research as a whole, uniting the difficult departments in a common policy and direction, partly in order to be more effective financially, to chase sponsors, and fit in with the state money provided.
The head of research came to the museum "not because it was a museum, but because they had good research going on".

5.4.4 Community

5.4.4.1 Community management

The Museum has been recognised as Major Research Infrastructure by the EU (London, Paris, Amsterdam, Madrid and RBINS as well). This gives them 1

[7] For more information visit: www.nrm.se

million Euros over 28 months to support young scholars, visits etc. The research units/departments used to function independently, but they now have a coordinating function on top, trying to get a "total grip", as the director repeatedly points out (i.e. be strategic rather than responsive fire fighting). The scope of the research cannot reveal to what extent CoPs have been formed in the separate units but it is likely. It is less likely, however, that CoPs cross between the research units, since they are organised around different disciplinary areas and collections.

5.4.4.2 Exhibition communities

The exhibition group can to some extent be framed as a CoP, even though shifting memberships and many peripheral members make it more like a project group with different functions and a given, institutionalised relationship, rather than an informal, collective knowledge-sharing environment. Different project groups work on different exhibitions, each project or exhibition tends to form its own temporary hot distributed collaborative environment where common aims are pursued in an experimental, knowledge searching and sharing manner, with an aim in sight. This can to some extent be framed as a CoP in Wenger's sense, but closer to what we call a task or project group rather than a lasting CoP.

The second interview was with the Project manager in the Department of Exhibitions, Events and Education. The interview indicates that several often competing CoPs or task groups form, compete and change over time.

5.4.5 Practice

5.4.5.1 Team working

On 'Nature in Sweden', a recent permanent exhibition, the manager worked with a *"fakta ansvarlig"* a fact responsible (term used in Swedish case only, though understood at Aarhus and probably in most other exhibition building museums), a pedagogue (museum educator) and an external designer over a year with meetings every fortnight. They formed the "core group", he said. The project involved an endless number of external contacts participating temporarily with the construction of particular models, and other installations and so forth. The project was conceived in the early 1990s, after the museum was emptied and renovated, and it has developed slowly over many years. It has had another project leader before the present one. The present project leader emphasised the importance of a combination of different competences, a core group and continuous meetings to get the exhibition development running properly. This is the approach taken in most modern exhibition-oriented museums.

Content/concepts and design is co-ordinated from the beginning, and particularly the construction of objects and design which has involved many external contacts, while the core group has concentrated on the shape and concepts.

As a part of the visit the respondent and researcher spend some time walking around seeing labs and exhibitions and talking about successes and failures. Nature in Sweden, his latest project as manager, is a traditional exhibition, he says, in comparison with the Senses of Man, a neon and lights Experimentarium installation. Nature in Sweden illustrates flora and fauna, ecology, ecological processes and art illustrations. All material is created specifically for this exhibition. It uses touch screens where visitors can access text in different languages and download or bring forward different layers of information from a hard disk. He points that the technology helped them to save some space, have several languages, and to add or provide additional/optional sections of text. This makes the visitor concentrate on the exhibition he says. He adds that it was not cheap. Several of the key animals, such as the moose and a fox are on loan, but they fit perfectly in with the stereotypical image of Sweden. The audience get what they expect.

They had an excellent contact with the conservation unit, and no particular problems, and they didn't spend one hour more than planned, he says, with a great deal of surprise himself - though with the usual "panic in the end". His first exhibition on the development of man was far more problematic, he says. He overtook it from a project leader who had left. He had to take forward a half-built exhibition, had to take parts down, improve, and fit in to an unrealistic schedule. The final result appears in general fragmented, unfinished, with lack of finesse, empty corners and rooms or settings that often appear as a neutral physical surrounding rather than providing the right atmosphere for the objects. He shows his dissatisfaction. We walk through one of the few exhibitions which look more like a collection lined up. He criticises the pedagogy, there is no learning in displaying 8 similar bones from some animals, he says and counts mockingly, 1, 2, 3…

He walks through an exhibition space, during the visit under construction. It is under the control of another member of staff. The diifferent exhibitions has to share the funding available and that can sometimes create some competition between staff here, the respondent indicates.

5.4.5.2 Relationship between research, collections and exhibitions

The head of research deputises for the director in his absence. Besides his research manager function he is professor in isotope biology. He is keen on seeing his researchers as collection-orientated people as well but states "there is not much in the present exhibitions coming from the collections". But the "collection is an important resource, a treasure". In order to attract more youth the museum has moved in the science centre direction, he says, and in the recent years the audience number has grown steadily. He adds that some people, including the present director, wants to return to a more "classical exhibition ideal". We should not make old-fashioned exhibitions again, he says, but instead connect collection exhibitions with "*folkverksamhet*", a Swedish term that can be translated as "activities for, and interaction with, the people". Interestingly, this is in line with what the smaller Aarhus

achieves through the nature facilitator system. It is a common desire – all but the most academic museums are aware of their social responsibilities but want to move forward in a way that also respects the unique asset of the museum. Clearly there is development potential here which can be supported by the MIRROR knowledge management system.

The Swedish government wants the museum to "document all species" and illustrate the "biological diversity" of Sweden, an aim he seems to approve. The systematic, taxonomic research has been given less emphasis recently and instead "more modern types as ecology, environmentally sustainable city environments and so forth, has taken over. It is important stuff, but…".

5.4.5.3 Size matters

Exhibition development at the museum seems, despite of changing project leaders, and very different exhibition styles, more institutionalised and planned than Aarhus, more strategic in character, financially able and willing to juggle with new technologies, and with experts around who can handle it. It is a more fragmented house, whereas Aarhus appears more as a family and the Geological as a family who do not talk. Size is clearly a factor affecting the social dynamics of the museum which has implications for the ways in which a museum will use the MIRROR system.

5.5 Museum National d'Histoire Naturelle (National Museum of Natural History), Paris, France

5.5.1 Museum profile

The Museum, founded in 1793 and widely regarded as the parent of the modern natural history museum, is a government institution with the mission to develop research, collections and education in the field of natural history and human sciences. It has been a publisher from early on and since the *Annales* were established in 1802 it has produced journals and monographs steadily. Currently they publish three research journals and six collections of monographs. The museum has 5 main permanent galleries (evolution, palaeontology, geology, entomology and l'homme, on 10.000 m2 exhibition space) plus a handful of temporary galleries. The museum has 400 researchers[8].

5.5.2 Respondents' profile

Shortened transcripts of three interviews with employees at the Evolution gallery undertaken by RBINS partners are analysed here: the director, the director of museology, and a museologist in the service of exhibitions. Additional material was located on the web.

[8] For more information visit: www.mnhn.fr

5.5.3 Domain

5.5.3.1 Values and beliefs

The director finds exhibitions policy work most rewarding, as well as other public programmes such as a project with excluded youth. He is an entomologist "*de coeur"* (by heart), and has undertaken PR and science work. His current interests have evolved from his scientific background to a public interest: "*j'ai vire ma cutie"* (The TB vaccination has been successful). He had his "cultural revolution" when he came to the Evolution gallery and discovered museology and audio-visual production. "We work for the public", another respondent said.

The same tensions were found within this museum caused by exhibitions and communication becoming increasingly interactive, and the degree to which the specimen takes on a subsidiary role.

5.5.3.2 CoP boundaries and conflicts

Some conflicting domains are revealed. Scientists on the project have difficulties accepting the communicators, and there are always problems between exhibition and conservation, one says. In general they prefer people with double competency, science plus knowledge on communication. They have the DEA in museology so the spectrum of candidates increases as they now understand what is required; the first recruitments – as the director says - were made "*au pifometre"*, (with the nose, meaning by instinct or by years of experience).

Despite the museologist vs. scientist problem, one respondent emphasises the importance of "the yang and the yin, from scientists to architect we have the chance to have contact we could not have otherwise." One respondent says she will be working with renovation of palaeontology galleries because, "geology is boring", which would be the alternative (N.B. palaeontology was invented as a largely biological science at this museum in the early nineteenth century; in England fossils were invented as stratigraphic tools and remained central to geology, though are less so to the modern science today).

One respondent talks about some experiences of working with scientists, it is important to work with the right people, but they can be difficult to find because they "publish in very confidential [specialised] journals". Another scientist had "corrected our texts 20 times and at the end it is non-understandable". Another, very pedantic, was "very exhaustive". All three interviewed comment on this problem. One respondent phrases it as a question of "*blocage intellectuel"* (mentality).

5.5.4 Community

5.5.4.1 Exhibition communities

Exhibition development is formed around a task group with a coordinating head, a museologist, a person with a background in education or museum studies and often a science background as well. S/he runs the project, involves the relevant competences in the course of the project, and interacts with the subject mater specialists when appropriate. The material available indicates that the production is ordered, procedural with different bodies/units involved and clearly defined roles. When a project operates with many internal people, there is less to write, more face-to-face interaction in the community. You can rush down the corridor and say: "Hi Sacha. I have got a genius idea". In general the material suggests that it is a more procedural community, and less experimental, tactical and collective *action* oriented than in some of the smaller museums (e.g. Denmark).
They find it important to have an internal museologist as project manager to "ensure a house style".

5.5.4.2 Collaboration and distributed working

Co-productions are done as well, as e.g. *Fatal Attraction* (a Leiden, Brussels, Paris co-production), "Never again" a respondent said. "Interesting one time, but it is too heavy". Language is a problem here, dealing with externals who speak another language. Also the fact that all decisions have to be made between all partners. Paris are good for audiovisuals, Brussels good for communication and promotion. But in *Fatal Attraction* each partner brought the same competencies, there was no break down of tasks. Each museum brought a third of all. Co-production is time consuming: "I am frustrated". This must be an area for MIRROR to link and create transparency.

The director has learnt "the sensible equilibrium between secret and transparency". He explains that it is important to separate affairs and keep secrets. When they look for specimens they use their informal network of curators, not the Internet.

5.5.5 Practice

5.5.5.1 Exhibition philosophy and development processes

There is a belief that an exhibition is a success if it expresses a strong concept, meaning that risks have been taken. If it is too consensual, without controversy, it will lack communication. Science and communication are two different words, 2 groups of pre-occupation.

The exhibition developers are called 'museologists'. Their role includes: *scénographie* (design) and content-creation of the exhibition. (The term 'museologist' used in this sense is rather limiting and does not conform to its widespread use in training courses where issues of object preservation and management are also involved, and may be strong scientists; the usage here

may conform to the role of exhibition leader/head or developer. They conceive ideas, develop a story and research the subject matter to find means of telling and supporting the story, find objects, audio-visual means, games, *manips* (manipulations, experiments), and display which lead to a pre-programme, a synopsis, and then the programme; the scenario or detailed storyline.

The work is done in co-operation with a scientist, a designer, internal or external, depending on the exhibition and team. The museum changes the team for every production because the museologist and designer have their own personal style. They involve scientists as advisers, here the role of the scientists as *advisers* is important. The museologist who is responsible for "popularising" the subject mater. Subjects and ideas, i.e. proposals, come from scientists which then are looked at by a commission for knowledge diffusion composed of staff from Action Pedagogique, Collections and Museology, but no scientists. Their proposal is then sent to the Scientific Council who have the last word. No exhibition submitted has been rejected, one says. The director says "Whales" was rejected because of problems between scientists and museologists (see Domain, for notes about conflictual domains). There is a procedure, light dossier, to the scientific council and finally to the administration council.

The rewarding aspect is the team work and exchange of ideas and the downside is the *charette* or usual late delivery of jobs (but keeping budget and quality) between the different jobs/people involved. This is common in temporary exhibitions where deadlines have to be made, and which can be hard to handle. In permanent galleries they can postpone the opening date. Another issue hard to handle is the administrative management and public service aspect, according to one respondent. Another one says that the most problematic in the internal network/exchange is with logistics and administration. Work with labs, where they find competencies for exhibitions, animations and conferences, does not seem to be a problem.

5.5.5.2 Exhibition planning and strategy

The "museological programme" (the programming of exhibition and educational activities) is planned 5 years ahead. The Museum is at the end of the 5 year plan at the moment and people do not know what will happen in the future.

In some ways decisions and practices seem to lack its apparently planned and strategic character: some meetings with AV and WEB are not put into minutes, and decisions are immediately translated into the programmes. With external partners they produce minutes.

5.6 Institut Royal des Sciences Naturelles de Belgique (Royal Belgian Institute of Natural Science), Brussels, Belgium

5.6.1 Museum profile

The Royal Belgian Institute of Natural Sciences is a state federal institution under the Ministry for Science, Technology and Cultural Affairs. It aims to provide a resource at national as well as international level. The museum has 9 permanent exhibitions covering the "world's natural richness", but it aims also to create large temporary exhibitions, 2 per year. They have had an average of 250,000 visitors a year over the last decade. The Museum's collections consists of approximately 35 millions of specimens

RBINS is active on a national and European level, and as well outside Europe. It co-ordinates the CASTEX network, has developed partnerships in Africa mostly with website-related work, is involved in a range of European multi-disciplinary research projects, e.g. INCHECO (aiming to understand chemical means of defence), ABC (Access to Belgian Collection), Europ@ncestors (cyber-musum of first Europeans), OCIDAM (an interactive display on Earth-Ocean Climate interaction) 300 pearsls (a virtual collection of the best specimens of Budapest , Leiden and RBINS), PASCALIS (on underground water biodiversity), and others. The staff amount to 400 people[9].

5.6.2 Respondents' profile

Shortened transcripts of three interviews undertaken by RBINS: one from the educational service, one from from IT, and the third from communication/PR employee who is also in charge of exhibition development. Some website material has been used for this presentation.

5.6.3 Domain

The museum emphasises the development of large temporary exhibitions, 2 per year. For one respondent a ground value is popularisation and the type of organisation is less important, i.e. it did not have to be a museum.

5.6.4 Community

5.6.4.1 Exhibition teams and communities

Good coordination is crucial, each performer plays a role, if one fails, the project collapses. Scientists and exhibition coordinators, for example museologists, belong to different CoPs, according to the interim report produced by the RBINS partners. The exhibition developers (scientists, museologists, architects, designers, workers) are a heterogeneous group were each member possesses different skills, handcraft, research skill and

[9] For more information visit: www.naturalsciences.be

education and communication skills, the latter the domain of the museologue. In the actual exhibition development knowledge is exchanged, though, or as the *Fatal Attraction* case report claimed: "they create a team in which ideas and knowledge become a shared property". "They share the excitement of being creators of the final product (exhibited knowledge)".

This indicates that the exhibition development process does not take the form of a CoP, but a heterogeneous task group, with some features of a CoP, e.g. boundary crossing and knowledge exchange (as seems to be the case in other institutions). The material available suggests that the process is largely procedural, structured and not closely coupled. The process differs from exhibition to exhibition but in general they conceive projects step by step (see below) where each member individually performs a defined role at a certain stage of the development. One of the problems highlighted in the interim report is the relationship between museology and education services where "the present lack of communication seems to be causing troubles and revealing a need for more transparency".

5.6.4.2 Distributed working

Fatal Attraction is a co-production between Paris, Brussels and Leiden currently underway. It links up different communities: scientists and exhibition people in three museums. On the boundaries are scientists, advisers and referees (consultants) commissioned to perform particular tasks. Furthermore a variety of internal and external expertise is brought in to deliver (research or conserve?) specimens, IT services etc. for the project.

For Fatal Attraction the direct exchange between a core task group of 3 directors, excluding experts and dedicated tasks, amount to 32 meetings over the last 2 years, plus the creation of an intranet for the management of the collection of specimen to be presented in the Fatal Attraction exhibition.

5.6.5 Practice

5.6.5.1 Exhibition organisation

As a general exhibition development pattern, the main task is to set down a team who is co-ordinated by the museologist. A museologist is a communicator/educator with museum studies background, and maybe also science background, even though this is not in the foreground of the disciplinary identity. S/he develops a scenario; a storyline with schedule, calendar and roles to be played by designated actors, i.e. scientists, advisers, technicians etc. They communicate scientific knowledge using different media such as objects, text, computer interactives, panels with suggested visitor paths etc. The museologist is the creator and project manager.

In the exhibition development process the scientists play the role of content providers. The museologist then uses this content to develop the exhibition story line.

One of the respondents, working in the educational service, says that smaller exhibitions with a smaller task group works better because of the limited number of people involved. In general he thinks that the people preparing the exhibition should consult education staff more. Coordination and frequent meetings are the keys to good preparation as well as the compatibility of people's personalities, e.g. tacit knowledge is important too, to avoid problems arising from groups of people who are not used to meet suddenly having to work together.

The person in charge of the development and coordination of the exhibitions has been hired as a museologist. She is a sociologist by training and in her current role within the Museum she works on developing the concept, and storyline of the exhibitions. Furthermore, she co-ordinates the whole exhibition development process. She has tried to let things run smoothly by clarifying the tasks each team member has to perform and to solve conflicts arising – by providing an "ally", i.e. another person to mediate. Her community seems instrumental, task oriented. Discussion partners and deep dialogues do not take place internally, but with people in Musee et societe en Wallonie, an external partner. These are her resources. Internally the cooperation is mostly with Education Services (There is a Communication and Promotion Cell directly linked to the director. They are responsible for communications, PR, promotion etc).

Fatal Attraction is for her an example of a successful exhibition project where a team has conceived the exhibition and developed it. There was a clear procedure and each one's role was well established. The procedure followed includes consulting the subject mater specialist (a scientist usually), having a proposal and a concept for an exhibition, and supporting it with material and resources. The resources are not put together at the beginning of the process. First, research is carried out followed by a draft of the story line developed by the museologists. Consultation meeting with the subject matter specialist follow last. An example of a problematic exhibition was that of "Copains caches" as there was no project leader and the subject matter specialists were not in place. The 3 people, two scientists and a historian, "had no affinities". The director rejected it, the museologue was fired.

The museologists has suggested a standard process: first the scientists bring material or ideas for the content, the museologist gives it shape, then process of production follows.

5.6.5.2 Exhibitions and institutional culture

The museologist criticises the working spirit and those who do not value systematic practices including: lack of minutes for meetings, no leadership, no respect for dead lines, lack of professional spirit, lack of overview despite working plan. She suggests using a PERT, a working plan chart to enable people to overview the project and see their task, and having a project leader to coordinate people and their contributions. MIRROR should provide a

platform for people to connect, exchange knowledge and exchange information. The museologist mentioned that she rarely uses the Internet.

She also criticises the lack of a brainstorming culture at the museum. She thinks it needs to be institutionalised. It is difficult to cooperate with the Education Service because they don't accept confrontation easily, she says. In general, the museum is a non-flexible institution. It takes a lot of time to put things into practice. She mentions Canada where they had ad-hoc teams not affected by problems inherent to the institution.

Her own values have grown towards a greater interest in the collections. She is also very much interested in contemporary art exhibitions which now centre on conceptual art, a concept which is processed in space. She tries to find out which mechanisms can be involved to put a concept into practice.

She wants to banish the term 'commissaire', one director/head, exhibitions are collective work, she says.

5.6.5.3 Transparency

The process of exhibition development could be enriched and made more transparent by different MIRROR CoP initiatives, which could also link task groups and research related CoPs. e.g. virtual tools that could link to resources, experiences and responsibilities are on the wish list. This is common for most museums participating in this study.

5.6.5.4 Use of technology

Current database developments are made in the perspective of a future web access to all digitised data, including digitalisation of the Museum specimens. This may be a potential element for the Mirror system. They wish to have a programme that would enable the visualisation of exhibition actors in time and job involvement in the preparation and a virtual tool showing where the different exhibits are to be displayed.

Some are negative about new technologies despite a deep involvement: claiming "no future to evolve" which encourages people to "stay in their nutshell". The rewarding aspects of the job is the subject mater. Technology specialists in the Museum have a relationship with museology, educational service and "a little bit" with scientists. The head of IT is leading the web questions and working with graphic designers and other in exhibition related developments. He hopes in the future to be in a more co-ordinating function, rather than a *doing* function. He endorses the idea of virtual tools, as expressed above.

5.7 Leicester City (New Walk) Museum, Leicester, UK

5.7.1 Museum profile

New Walk Museum and Art Gallery is situated within the historic New Walk area of the city of Leicester. Dating from the mid nineteenth century, the New Walk Museum is the central museum of the diverse Leicester City Museums Service. It is a regional centre for European art, and noted for its biology and geology collections. It has 130-140,000 visitors per year. The service is fairly typical of the English provincial museum which forms the backbone of natural science provision in that country[10].

5.7.2 Respondent's profile

One member of the staff was interviewed at the New Walk Museum in Leicester. The interviewee is the Managing Curator and, although he and his team are involved in exhibition development, the main reason we talked to him was because of his active involvement in different professional communities and bodies. The New Walk Museum and the Managing Curator personally are also actively involved in outreach work and in forming partnerships with different environmental communities and groups in Leicestershire. The interview focused on those relationships and what impact they have on the work of the Museum. This, however, will be presented in the context of the domain and practice within which the community operates.

5.7.3 Domain

5.7.3.1 Boundary management and values

The domain of the community of exhibition developers at the New Walk Museum seems to be more focused as compared to the other museums studied. The core members are natural science curators who work with the internal team of designers - and sometimes with outside design firms – to develop new exhibitions. Although they still do 'single discipline' exhibitions, they plan to develop more multidisciplinary exhibitions in the future. This is expected to bring the art and natural science side of the Museum closer. It will also enable the Museum to plan for all exhibition projects more effectively. At the moment, exhibitions are seen as individual projects. There is already a lot of interaction between the two departments on a higher planning level but also on a personal level between staff.

The respondent particularly values working with the Museum's collections and with other people, as well as the idea of doing more interdisciplinary work. He finds working with people from other disciplines very satisfying as it brings new perspectives, sparks off interesting discussions and creates innovative exhibitions.

[10] More information is available on-line at: http://www.leicestermuseums.ac.uk/museums/newwalk.html.

The Museum is also committed to communicating with the public, forming partnerships with local communities and making the collections more accessible. This is a value shared by the respondent and many other members of the staff. However, there are still people within the Museum who work in isolation and within the boundaries of their own discipline. Working within an old and, in many ways, fixed structure with many layers of management, helps people carry on like that. It is hoped that the new group of consultants brought in to evaluate the existing structure will help change that and help the museum services within the Leicestershire City Council move forward.

5.7.4 Community

5.7.4.1 Internal CoPs at the New Walk Museum

Formal: There are formal groups consisting of senior managers who make decisions about all the projects the Museum Services – including New Walk Museum - develop. These projects are then given to the next level down of project managers. There is a very hierarchical structure coupled with political interference from the City Council which suggests that these groups do not form a CoP.

Informal: There are informal personal relationships between members of the staff. Staff do meet informally and not so long ago, when the staff in each department was far larger than it is today, informal lunchtime meetings were almost daily events. Currently, there is no evidence that there are groups of people who have such meetings – formal or informal – to talk about their domain or practice.

5.7.4.2 Distributed CoPs

The respondent is a member of different groups and networks related not only to natural sciences but also to exhibition work. The best example for the purposes of this study is that of the Biology Curators' Group (BCG). He is a core member of BCG where his role is that of the events organiser and editor of the newsletter. The BCG was set up about 27 year ago and he joined about 9 years ago. The BCG has changed and evolved over the last few years. New roles have been introduced (such as that of the events organizer), new training and professional development activities have been introduced for its members (study trips abroad) and meetings to talk about 'theoretical issues' to do with the domain of curating biological specimens.

As a core member of BCG, the respondent attends two annual meetings – one on training and another one on theoretical issues – the annual conference, training sessions that he helps organise as well as study trips. When he first became a member it was mainly for networking and professional development reasons. He did not have a museum background and did not understand collections, and he felt isolated in his job. Meeting other people and learning from them was the main value of joining BCG. He particularly valued getting

problem solving tips from other BCG members (such as how you deal with members of the staff, which contractors or fabricators to use for new exhibitions, identifying specimens in the Museum's collection). As his knowledge built, he became more and more involved with BCG so when the need for an events coordinator was identified he accepted the role. He stills values the opportunity for networking and sharing knowledge and experiences with other colleagues. He feels that as his expertise has grown so has his ability to draw on other people's expertise but also to contribute to the domain.

He also seems to enjoy being in a position of sharing his knowledge and expertise with younger BCG members and giving something back to their domain and area of practice. He understands how important it is to share knowledge and experience and as an events organizer and newsletter editor for BCG he has set up a system of doing that on a more systematic way through the newsletter and papers. He shares the knowledge that comes from being involved in BCG with his colleagues at work and introduces new staff members to the activities of it by sending them to the annual conference or training sessions. He believes that there is an indirect value – as well as direct value – in sharing knowledge and experience. It creates a kind of reciprocity.

The BCG conference seems to play a central role in creating a sense of community and belonging which you cannot get through reading or talking on the phone or via email. It is the key to building and sustaining relationships. There is also a value on an organizational level as speaking at conferences contributes towards performance indicators.

It seems that getting the right balance between introducing a structure and keeping the community organic is very important. Although he believed that communities need a formal structure in order to operate effectively and survive, he thought that formality introduces a degree of obligation which goes against the spirit of a CoP. Having a small group of leaders and active members who change every now and then and are replaced by new people seems to be working well for BCG. Not having a very formal and rigid structure seems to be crucial for building and sustaining strong informal relationships and a sense of reciprocity which brings community members closer together. This is beneficial to all CoP members (core, active and peripheral) as junior biologists can interact with senior ones and keep the activity at the periphery of the community going.

5.7.5 Practice

Policies are developed by senior managers and implemented by project managers within the Leicestershire Museum Services. The project managers in each museum service develop forward strategies that fit in with the Museum Service's Strategy, the Council's Strategy and the National Strategy. Key documents are the Community Plan and the Cultural Strategy that set out the broad aims of what the Leicester City Council does.

IT, and the MKMS in particular, are seen as a way of improving practices. This could be achieved by:

- Being able to communicate with other museum professionals (not just in natural history museums) and subject matter specialists and exchanging examples of good practice. Having accessibility to concrete examples of other exhibition development projects that have worked and being able to talk to the team members is a good way of achieving that. Also looking at projects that have not worked and finding out why seems to be equally – or even more - important.

- Helping make the exhibition development process more systematic by introducing and using project management programmes.

5.8 Goulandris Museum of Natural History, Athens

5.8.1 Background information

The Museum Goulandris of Natural History, located in Athens, is the oldest museum of Natural History in Greece. It is a private Museum and was founded in 1964 by Mr. and Mrs. Goulandris as a "laboratory for research and action" (Gaia, 2001, p.4). Its mission is "to promote the Natural Sciences and 'public awareness' of the environment, as a unique source of life" (Museum, p.3).

Its collections cover botany, terrestrial zoology (reptiles, birds, insects), geology and palaeontology, as well as hydrobiology, and number hundreds of thousands of specimens. As is cited in *Gaia* (2001, p.4), these collections "are a precious national capital, the data banks of the country, the basis for every scientific research and application in the fields of environmental policy, agriculture and forestry". The *Annales Musei Goulandris*, published since 1973, presents scientific papers based on the museum's collections and other relevant issues.

In 2001 the Goulandris Museum of Natural History founded the Gaia Center of Environmental Research and Education which is dealing with environmental issues. The permanent exhibition of Gaia Center is based on the active participation of the visitors and aims to "encourage them to review their behavior towards the sources which support life" (Gaia, 2001, p.31). Two new laboratories were created, one of bioanalytic chemistry and another one of soil ecology and biotechnology.

Since its foundation, the Goulandris Museum of Natural History has developed many collaborations with different European museums. The Museum of

Natural History of London is one of its closest partners. It developed the Herbarium for the Museum and the whole exhibition for the Gaia Center[11].

5.8.2 Respondents' profile

The absence of dedicated exhibition developers in the museum created some discussions on the profile of the persons to be interviewed. The final selection was done with the help of the president of the museum on the criterion of the involvement in exhibitions development. The following four persons have finally been interviewed: the president of the board and co-founder of the museum who also plays a key role in every day matters and decisions; the artistic director of the museum who, since the foundation of the museum, takes part in the development of every exhibition; one of the heads of the entomological department of the museum; and the head of the Geological – Paleontological department who is actually developing an exhibition on Greek volcanoes.

Beside the artistic director, the rest of the interviewees had a scientific background related to the field they were working in. Initial studies on biology or geology and further specialization in a discipline (e.g. paleontology) seem to be the typical background of the curators. It is worth mentioning that none of them has background in museum studies. The absence of similar studies highlights the fact that none interviewed intended from the beginning of his/her professional career to work in a museum. Getting a museum job seems to have happened by chance.

5.8.3 Domain

5.8.3.1 Values and beliefs

Two aspects have been presented concerning the value attributed by the interviewees to their job in the museum: the research and the educational role of the Museums of Natural History. The contribution to the research on the biodiversity of Greek nature has been one of the main targets of the museum since its foundation. The educational role of the museum is an element stressed particularly by the persons who are more actively involved in exhibition development. The artistic director of the Goulandris museum's exhibitions suggests that beyond the transfer of knowledge, museums can influence the aesthetic ideals of a society. The aesthetic rules/views adopted in the Goulandris Museum's permanent exhibition have contributed, following the artistic director, to its success.

[11] For more information visit: www.culture.gr/4/42/421/42106/42106b/e42106b1.html

5.8.4 Community

5.8.4.1 The exhibition team

The analysis of the data collected shows that, in spite of the fact that all interviewees are involved in exhibition development, they don't form a CoP, following Wenger's definition. Certainly many relationships, professional and personal, exist between the people concerned and many discussions take place when exhibitions are prepared. However, these elements are not enough for forming a CoP. This is perhaps due to the fact that none of the interviewees is a dedicated exhibition developer. Besides the artistic director who is involved in all exhibition development projects in the Museum, the others do exhibition work occasionally. It is also worth mentioning that many of the exhibitions of the Goulandris Museum are developed in partnership with external consultants such as museums and other institutions. For example, as mentioned above, the whole exhibition of the new Gaia Center was developed by the Natural History Museum, London.

Although a CoP cannot be identified in this case study, the analysis brought to surface many elements connected with this concept. Hence the research findings highlight characteristics of potential members of a wider European CoP of exhibition developers and identify their needs and expectations. They also give us a picture of the function of a European museum of natural history, with its particularities and its goals.

As mentioned above, the interviewees were not dedicated exhibition developers. Thus, their role in the organization covered many different types of activities.

In spite of the plurality of the activities developed, the researcher in the museum seems to be rather isolated in his scientific work, with little contact with the other departments. This situation changes when the staff who are dealing more directly with exhibitions development are concerned. Then their role in the museum becomes more central as they have to contact and coordinate different persons and departments.

There is another element that characterizes the function of the Museum which is worth mentioning. It is a kind of "family spirit" that is very present there. Particularly the staff members who work for many years seem to be involved in many sides of the museum's life. This "family spirit" is due to, on the one hand, the fact that the museum is a private organization and in the other hand to the personality of its foundators (family spirit is found in other museums in the project as well, for several reasons).

5.8.4.2 Distributed communities

All interviewees belonged to many professional bodies or scientific societies. For example, the president of the museum is a member of the French Academy (Sciences politiques et ethiques), of the Academia Europaia, located in Vienna, of the Canadian Organization Technology and Science for the

Developing World, who is dealing with the adaptation of the technology to the needs of the local societies, and of the Greek Foundation for Foreign Policy. Beside these, she is member of the international organization Friends of Peonia (a flower, genus *paeonia*), of the Union of Botanic Painters and of the Friends of Orcheideus. She is also very engaged in the associative life as member of the Orchestra of Colors etc.

The above rich catalogue reflects the multiple faces of a very active personality, widely recognised in her country and abroad, who develops activities in many different fields. However it is a rather exceptional case. The other interviewees belonged to societies related to their discipline or to their profession. To give an example, the officer of the Herpetological Department is a member of the British Herpetological Society, the Austrian Herpetological Society and the Chameleon Information Network located in USA. She has also taken active part in the foundation of the Greek Herpetological Society, in which she is the secretary and which numbers 40 members (at the time of the inteview).

All the societies mentioned above are not directly related to Museums of Natural History or in general to the museum world. In fact, only one interviewee, the artistic director, said that he is member of the ICOM. This is probably due to the fact that this person is involved in exhibition development on a permanent basis. The others, as we have already said, are dealing only occasionally with exhibitions development.

Finally, the Museum is an institutional member of ICOM as well as a member of the European Museum of the Year Awards. Within the latter body, the Goulandris Museum of Natural History represents the Greek museums.

5.8.4.3 Internal and external communities

As was already mentioned above, the finding suggest that there are not any internal CoPs within the Museum. Individual staff members have developed many relationships, both professional and personal. More fieldwork may shed more light and give a more complex picture.

However, the interviewees are members of different external communities related to their special professional interests. The officer of the entomological department for example, who is actually undertaking research on chameleons, would like to be able to meet more people - either academics or natural history museum research staff - doing research with the same species. She commented that communicating via email forms the basis for the creation of a community but the visual contact plays a key-role in its further development.

This last element could be considered in the development of the Mirror system. To have a picture of the other community members seems to facilitate any collaboration between the members of a CoP and to support the development of personal relationships. This is at least what happened in the

CoP here concerned. *"In some cases",* continued the interviewed person, " *we even became good friends, we visit each other, spend together some holidays".* But in any case, the members of this community build on their interest on chameleon common activities: they exchange data, organize common researches and write articles together.

3.5. Values and beliefs
The participation in communities, informal or formal ones, is very important for the persons who participated in this study. They all referred on how far their memberships have contributed to their professional development. Increased scientific knowledge, easy access to information and, in consequence, considerable gains in terms of time, seem to be the most important outcomes for the officer of the entomological department.

However, beyond the personal improvement, the outcomes of the participation in formal and informal communities are also profitable for the organization. This aspect was referred to by the president of the museum who, as mentioned above, is a member of many scientific bodies and societies. Being a member of these bodies means having contact with many different persons. Through these contacts, the activities of the Museum become known to a wider cycle of people and an international recognition is gained. On the other hand, the scientific and personal development obtained through participation improves the general function of the Museum. This outcome is probably not relevant for bigger NHMs with a long tradition as they are well established. However, it seems to be important for the new museums which must gain their recognition from the wider museum's community.

5.8.5 Practice

5.8.5.1 Communication and information
The interviewees indicated articles, papers and conference proceedings as their main source of information on scientific issues related to their work. They all declared reading carefully the proceedings of conferences organized by the scientific societies and bodies which they are members of. However, participating in these conferences and meeting is rather rare.

Another source of information related to museum databases and recources is the Internet. Museum web sites seem to be visited very often by the interviewees. Exhibitions, contact persons and information from the databases, when existing, are the most searched elements. The president of the museum is very concerned about this issue. The existing site of the museum is not satisfactory any more and a new one is being developed.

However, most of the interviewees were not satisfied with the level of information available, especially when development and issues of the field of museums is concerned. Lack of time to digest all the available information or to search on the Internet was often mentioned. It seems that the researchers

consider developments in their discipline as a high priority issue, while museum related issues comes second. The president of the museum referred to an initiative developed by the Natural History Museum in London which is very important for further training and professional development.

5.8.5.2 Training

As far as training is concerned, the researchers have the opportunity to spend sometime in different European museums and work for or undertake research in the relevant departments. This training in other museums is very important for the researchers. The head of the departments are in charge of the training of the newcomers. There is not a common training policy so every officer develops its own strategy. Whatever the training method used, all interviewees agreed that a newcomer needs about a year to enter the spirit of the museum.

The Goulandris Museum of Natural History offers also training opportunities to students and unemployed persons. In this case also the officers of the departments are in charge of their training. The results depend very much on the motivation of the trainees. On the other hand the museum offers training to volunteers who want to work there. Once a year, usually in October, a meeting is organized for them. During this meeting the personnel of the museum presents its work in order to inform them about the activities of the museum and to help them to choose which department to join. The most of the volunteers join finally the education department and follow some training in school guidance. The ones who ask to work for the research departments get also a training by the relevant officers. However, the experience with the volunteers seems not to be always positive, specially in the research departments. Low degree of reliance, since volunteers can leave anytime the organization, is the main problem.

5.8.5.3 The use of technology

While the permanent exhibition in the Goulandris Museum of Natural History is rather traditional, the exhibition in Gaia Center is based to a large extend on new technologies. For example the "Geosfera" is a giant screen which looks like the earth and animates pictures of the earth shot in space. Based on the new technology Sky Vision, the screen shows 225,000 pictures with each one of them consisting of 9,000,000 pixels.

Nevertheless the introduction of new technologies in new exhibitions seems to be a rather controversial issue. Its contribution is certainly considered to be of high importance but there are also some limits. Many aspects of an exhibition can not be communicated through computer exhibits.

All interviewees as well as most of the Museum staff, have a PC. They all said that they use e-mail as a main communication tool. It is worth mentioning that e-mail is mainly used for external communication, e.g. with other museums, institutions, partners etc. Its use for internal communication is

extremely limited. However, they are not all equally skilful or even willing to use IT. It seems that the age plays an important role. Indeed, the younger persons feel easier with new technologies and are open to follow changes and evolution in this field. On the other hand, older persons are more resistant to IT and do not want to change their way of working.

Nevertheless, they all seem to be very interested in the MIRROR Knowledge Management System. Although most of them were not able to make concrete proposals concerning the structure of MIRROR, the following opinions and requirements were expressed: the main target of MIRROR should be the facilitation of communication between European Museums of Natural History and other institutions as well (i.e. other museums, universities). The improvement of the internal function of the museum is a secondary issue. Access to exhibitions in 3D and to the data bases of other museums, if available, would be very helpful. Another issue that came up was that of the working language of MIRROR. If English is imposed as unique language, many potential users would be excluded. A multilingual environment would be very much appreciated by the users.

5.8.5.4 Organizational memory

In Goulandris Museum of Natural History staff meetings are not very common. More common are meetings between the different research departments, and between the different research departments and the educational department. In these cases the department which calls for the meeting prepares also the agenda. However, they all accept that the internal communication could be improved. In order to overcome the isolation and to improve the communication, an internal newsletter has been created recently. Another proposal to improve the internal communication is the organization of social events which take place out of the Museum, like excursions.

There are various committees within the Museum. The Board plays a key role in the museum and takes all important decisions. It is very active and calls on the officers of the departments to discuss relevant issues. Its members are often present in the Museum and are well informed about what happens. The Board is also responsible for Museum strategy. There is a one- and a five-year strategy. Each year the annual strategy is reviewed. At the end of each year, the different departments are asked to give a report to the Board who make an evaluation of their activities already completed and plan the new ones. No evaluation on personal level is undertaken.

5.8.5.5 Places

In the Goulandris Museum, there are different places where people meet or take a break. For example, the new restaurant of Gaia Center and the space in front of the permanent Gallery were often mentioned by the interviewees. The absence of a common meeting place reflects the problems of internal communication referred to above. Another factor is the recent opening of Gaia Center. The Museum space has been reorganization and whole departments and laboratories have been moved to the new building. This

reorganization provoked a certain unease among Museum staff who have not still adapted to the new situation.

5.9 Verona Civic Natural History Museum

The short transcripts of 4 interviews undertaken by RBINS, arrived in Leicester for analysis on the 27 August. The case study summarises some of the main points related to CoPs, primarily concerned with issues particular to this Museum and not covered in other case studies[12].

Exhibition development can evolve from the curators themselves, who are scientists. Exhibition teams are set up as in other case studies, with different knowledge forming a temporary conglomerate, though these people may in some cases all be internal, know each other well and used to function as a team, and therefore also take on the some of the features of a CoP.

In terms of IT development, the museum is underway with digitisation: 10,000 of the over 1 million specimens are now digitised. One respondent requests a tool for simultaneous visualisation and description of the different task groups or curators abilities, knowledge and responsibilities, i.e. to make it transparent what the staff want to do and are able to do. Geology and palaeontology request digitisation of pictures.

The internal network and communication are made difficult because of a physical separation of the museum into two units with 15 minutes walk in between.

There is no training for curators in Italy. The researchers have peer contact through scientific associations, colleagues with similar specialisations at other museums or at universities. They learn through contact with colleagues and corridor exchange.

[12] For more information visit: www.centroambientalearcheologico.it/home.htm

6. Conclusion: Natural science museums, exhibitions and CoPs

While individuals working within exhibition development teams share fields of interest and, in the sense of Bourdieu, may form a definable social community with shared knowledge, which may feed into exhibition development processes, the core of the exhibition building activity – interaction between team members – is not centred around a single CoP. The boundaries between the production team and the operation of an informal CoP, appear, however, to be blurred. Overtime a team will develop the same shared values that will begin the process of CoP-type communication and a shared learning in certain areas.

The exhibition development team may consist of a core group of mainly internal people who are habitually, and in practice, well -known and compatible in their ways of supplementing each other's knowledge and can use that overlap to fuel and mould ideas into form, i.e. some practices will in action become shared, re-configured (Ricoeur, 1983) through dialogue, over time, amongst different disciplinary identities who in that very process learns.

The clearly identified needs for organisation, developmental information, training in areas of museum communication and so on, indicates that a knowledge sharing environment, along the lines of a CoP would be extremely beneficial. Exhibition development has, despite many individualised tasks, features of a *situated learning* process through the co-participation in structured but adaptive networks (in Lave and Wenger's sense). Exhibition development in EU NHMs tends to form a temporary and often conflictual *third space* (Bhabha, 1994) within the museums, where differences and different capital forms come together and are negotiated, rather than a more lasting, knowledge sharing, closely knit and balanced out community of practice where members bring similar social and disciplinary capital forms and interact over an indefinite period of time. In this sort of coming together of differences, each voice is not equal, and members are drawing from different sources 'behind them', which might be CoPs in Wenger's sense. The MIRROR CoP may try to connect these different sources and provide the helping tools that can balance out some of the differences.

The MIRROR CoP does not, then, already exist. (In contrast natural history curators participate in numerous professional and scientific CoPs). The reason for this is that exhibition projects tend to be internally developed (though drawing upon information from outside) and even where exhibitions travel they are rarely constructed collaboratively like *Fatal Attraction*, for the reasons participants in the project identify. Travelling exhibitions usually spring from a single reliable point of origin (development) though perhaps with guaranteed hire from other museums. Exhibition work is clearly episodic – especially so for those who work as scientists and outside the core of

exhibition development. Thus one tends to go in search of CoP-type knowledge when the need arises, while at other times interest in exhibition building may become a less earnest interest. Many involved in the exhibition process clearly are affected by the politics and stress of the activity, and are, perhaps, even less likely to maintain a constant interest in the process.

The nature of exhibition work, then, and therefore of participation in a related CoP, is such that the MIRROR KMS would need to cater for participation where individuals remain on the periphery of the CoP until such time as they need specific information and tools to facilitate exhibition activity.

Currently, team members use the most informal and direct methods to locate solutions to exhibition building problems (face-to-face visits and the telephone). Technologies will need to be as immediate, intuitive, current and informative. Museum appreciation of technology is also variable. Large institutions with considerable resources to maintain such technologies are inclined to be less resistant to them. However, MIRROR could act as a forum to develop reliable museum applications and installations.

The same patterns of best practice are widely recognised across Europe, though training and expertise can sometimes be difficult to locate (Paris's attempts to locate an appropriate communication specialist) or lack order (the museologue's complaints at RBINS). Århus and Stockholm probably demonstrate best both the modern philosophy of exhibition provision in relation to public need, and the methods by which this can be achieved. Most other museums in the study show innovative practices which demonstrate that natural history museums contribute significantly to developing new practice and justify – because this development takes place on the ground (at museum sites) – the desire of the MIRROR consortium to build a resource exploiting situated learning and knowledge sharing.

Tensions between research and exhibition are also universal but also diverse in their characteristics. Research-heavy institutions are perceived as conservative in the modern museum context, often because researchers can be inflexible about the needs of communication and scientific detail. However, there is clearly a tendency to see the isolated researcher as simply self-indulgent which is a misrepresentation. There is certainly scope for a resource capable of mediating between research, the interpretation of scientific evidence, and audience and communication studies.

Where a MIRROR CoP may also be useful is to knit or provide a platform from there differences can more easily be connected and illustrated. Since the exhibition developers don't form closely coupled homogenous communities, they may benefit from a common, supportive software which makes the differences and the overlaps more transparent and which thereby could ease the learning processes.

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