

Elements of a Methodology for Museum Evaluation

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Introduction

There was a real gamble involved in reopening the Museum's renovated Grande Galeries de Zoologie with all its decorative ironwork, giving everyone an opportunity to observe some of the millions of animal specimens collected over the centuries. The Galerie renovation, made possible through the French government's Major Works program (that also created the Musée d'Orsay and the Grand Louvre), called for respecting the architectural spirit of the late 19th Century natural sciences exhibit area while moving from an 1889-style Galerie de Zoologie to a *Galerie de l'Evolution* appropriate for 1993.

The stakes were so great that it was decided to mount a preview exhibition in order to test museographic decisions and museological concepts. But what elements of the future 6,000 square meter exhibition should the preview focus on? Should it offer the public a sample of the vast legacy of collections hidden away since the Grande Galerie closed in 1965? Should it present man as a product of evolution as well as being a social actor in evolution? The theme finally decided on was "We Walked on Land," covering the chapter of the evolutionary story when living creatures emerged from the seas to live on dry land.

Such a theme serves to highlight the dynamic profusion of evolution. The emergence from the seas is in fact a long series of events where each species drew on its animal or vegetable possibilities to adapt – here a better skeleton, there wood which can endure. There were no great inventions. Complex innovations such as the seeds of higher plants, the reptile's egg, or the sophisticated rules of water conservation are all products of successive anatomical, physiological and genetic "tinkering" as organisms adapted to their new home between sea and land. These varied evolutionary experiments can be observed in fossil remains as well as some present-day

species that remain attached to a water environment. Moreover, the "emergence" theme of the evolution exhibit offers a new perspective on the environment. An ecological will to preserve the present, as well as the past, underlies the dramatized archaeology of this major step in the evolution of life on earth.

The Principle of a Preview Exhibition

Setting up a preview was part of the museological program of the Museum's *Galerie de l'Evolution* from the outset (See Note 1). The decision to do so stemmed from the anticipated relation between the visitor and the exhibition: ~~An emotional and intellectual journey among three-dimensional objects serving as attention-getters for the delivery of additional information by a varied mix of media.~~ This design makes it a meta-media exhibition (See Note 2). We felt that our evaluation work should focus on the process, with its time and space constraints, of controlling the attention and emotions of the public along their journey through the exhibit. The existing preview exhibition meets this objective and can be classed as an "in action" evaluation process (See Note 3).

The museological objective is to optimize the deployment of narrative elements and, in particular, to ~~assess the emotional and intellectual attraction power of specimens within a museography of science.~~ Since the late 1970's, museography has been reduced to interactive displays in which support from computer-based media is considered essential.

It seemed essential for this in-action evaluation to consider the exhibition in a functioning context, a place where communication is occurring.

Our evaluation approach is based on the accepted tools of museum evaluation and on a broader overall perspective.

The tools include both concepts and methods. At the conceptual level, three notions are used. There is the idea of "publics," which diverges from the notion of "general public." There are notions of "attractiveness," "holding power," and "museum fatigue" which refer to the components of the exhibition. And there is the notion of "visit" as opposed to "visitors," which identifies the conditions of the visit (such as non-solitary visits – family, pairs, or organized groups). Methods include questionnaire surveys, semi-directed interviews, observation, and tracking.

For the most part, traditional evaluation research remains analytic and empirical – a certain aspect of an exhibition is evaluated with reference to a range of available concepts and techniques. The result is that angles of approach are fragmented and the overall view is limited.

This is because while concepts and methods have been developed, they do not form any overall vision of an exhibition, nor do they provide a full understanding of visitor strategies and practices. In a word, we can draw on an arsenal of concepts and techniques, but not on a theoretical framework

which lets us think about the visitor interacting with the exhibition devices. This lack is reinforced by the dominance of a communication model that equates communication with a transfer of information from source to receiver. For this reason, the key word is efficiency. There is a constant effort to optimize this information transfer and measure the results. In this perspective, one can understand the success of certain measuring techniques borrowed from the education sphere. Also, with constant reference to the notion of "effects" that we are trying to control, the evaluation of an exhibition more often becomes an evaluation of the visitor and his or her performance.

Our approach reformulates the viewpoint of traditional museum evaluation.

It is based primarily on an attempt to view the exhibition as a whole – as a specific environment with an arrangement of its own – and secondarily on the visitor's relationship to this whole as the unfolding of a process. This perspective puts less emphasis on what the visitor understands or remembers from a visit compared to predefined goals, and more on clarifying the process of appropriation or interpretation engendered by the visit, which ends with a construction of meaning. We are thus trying to catch the visitor in his situation and in the act.

Our intervention strategy then becomes one of employing all proven methods and inventing new ones which let us examine the process at work. We are trying to understand how visions of the world come together. The exhibition contents are as much subject to the "professional" concerns of exhibition designers as they are to the scientist's world vision of which they are message-bearers. They are also a cultural matrix developed by visitors. In other words, the exhibition defines a space of negotiation among presentations.

The rules governing this negotiation are central to designing the exhibition. Its methodology reveals how this negotiation takes place, and its particular tools which combine quantitative and qualitative methods.

The Evaluation Program

Preliminary Studies

We now have partial information on the potential publics of the future museum (*Galerie de l'Evolution*). While the project involved renovation of a 10,000 square meter building that had been closed since 1965, other galleries on the same site had remained open (See Note 4).

The study of the site's current publics is one of the elements in understanding the new potential public of the gallery. This information does not negate the possibility of further sociological changes stemming from the inauguration. As observed at the Cité des Sciences et de l'Industrie, this effect does not appear to have persisted more than four years; the social structure of the public then tends towards the "sociological

norms" of other science museums in Paris – that is, an extremely cultivated public (Eidelman, 1990; Allaire, 1991).

The public at the Museum's permanent and temporary exhibitions are made up of two vastly different categories in terms of their museum practices: (1) youngsters in school groups; (2) random publics (See Note 5). Children represent one-third of the visitors in the second group, and combined with the school public, children represent from 45% to 60% of the total overall according to the galleries (Eidelman, 1990).

However, the children's practice varies depending on whether they visit the museum with their parents or as school students, as does their sociological representation. The social origin of the children who come on a family visit tends strongly to be that of the most cultivated, middle-class, largely children who are scholastically on stream. Children who are behind scholastically, representing the bulk of the student public, are characterized by profoundly different representations (Van Praët, 1988).

These initial studies, developed beginning in 1988 with students and the public at the site, utilized the elements of knowledge for purposes of the museological operations: evident and accepted facts, surprises, parallogisms, obstacles.

In our studies, the "evident facts" correspond to early scholastic knowledge or basic cultural information such as the origin of life in water. These were considered as confidence-creating points or, otherwise, to possibly reduce some of the exhibition's content. The "accepted facts" correspond to a certain level of study which forms the foundation for more sophisticated information.

The "surprises" include unknown information (either new or not taught) that can be readily conceived. These can constitute the attraction points of an exhibition. The "paralogisms" are particular hindrances – faulty reasoning – which stem from a fragmented mastery of information. The "obstacles" are unknown elements, not credible to the visitor. This leaves it entirely up to the museologist whether or not, or how, to present them. The resulting synergies from the placement of themes, the interplay of obstacles against evident and accepted facts, may generate surprises, at least for the largest possible segment of visitors.

Current Studies: Visitor Theory "In Acts"

Two groups of data must be put in perspective: One concerns the structure of publics in the specific context of the visit to the preview exhibition and its conditions; the others, the knowledge and presentations.

Publics "in situation" (See Note 6)

In 85% of cases, the visitors are informed and in 65% of cases have planned their visits; hence they have a visit plan. Most often, in seven out of 10 cases, the visitor is actually part of a subgroup of visitors. The visit

has a friendly, non-solitary character, with children included 50% of the time, which adds a first element of distortion to the initial plan. Finally, the visitor, within the unit group, is part of the general flux of other visitor subgroups. In the preview exhibition, this flux ranged from 30 to 210 visitors per hour. It still manifests a visit plan, dependent on density.

In other words, the visitor's socio-cultural characteristics (See Note 7) – approximately equal male and female, average age 35 years, exercising an intellectual profession, professional or senior management in the private or public sector, well-educated, residing in the greater Paris area – are immediately classified by the context of their visit. The visit plan varies depending on the objective conditions which determine the context of the person's visit – the subgroup and the density. It follows that the visitor's points of focus and spontaneous interest interact with those dictated by the exhibition's format and by the path taken.

Moreover, the museum layout is harmoniously balanced between a virtual arrangement, in the sense of being designed in terms of the idealized visitor – positively or negatively – and a real arrangement, in the sense of responding to anomie (random) behavior. The arrangement for real behavior – wandering, waiting, avoiding, taking a linear route, going off-limits, going back and forth – particularly depends on proximity relations. Hence, the exhibition's design – its narrative grid and how it is staged – will generate "in situ" practices.

Note that the visitors here are both loyal attendees at the site (9/10) and regulars at other science and technology museums in Paris (two-thirds had already visited the Palais de la Découverte and the Cité des Sciences et de l'Industrie). The museum plan – museology of objects and ideas – is as readily classified by the practices developed in other contexts (the same or different types) but rarely done on site.

Acculturation strategies make it possible for distribution and appropriation procedures to be aligned. The "actors" play a role in both cases. At the same time, how the visitors use the exhibition space demonstrates both compliance with and integration of the museologist's intentions, and is a manifestation of the acculturation process. Insofar as the topographic orientation overlaps the conceptual orientation, the linear, zig-zag, loop and return paths are euphemized forms of this joint acculturation effort. The principal paths (most frequently linear), which visitors can readily reconstruct from memory (See Note 8) with their stop-points, surprise-spots, discovery-points, secondary paths, incomplete but rarely wrong (see Note 9), gave us the holding-points.

Educational presentations

The context of the visit, familiarity with the institution of the museum and its archetypes, and a defined path serve to delineate the negotiation space of presentations. These were defined when the exhibition was designed

during the various studies among visitors to the site. They were re-analyzed after inauguration of the museum.

Prelude to the Exhibition

First it was necessary to do a mapping of the visitor knowledge underlying the concept of evolution (See Note 10). This revealed the areas of consensus, hesitation, and absence of indicators.

There is consensus on the aquatic origins of life, the precedence of plants over animals, the first land conquerers, the key role of breathing air, the role of the skeleton as a support structure, definitions of the egg and seed, the appearance of the reptilian shell and identification of the major vertebrate groups. Clearly, certain notions about evolution have been disseminated, are absorbed, and these form a basis for the exhibition plans.

Some hesitations arise in: Identifying the embryonic development fluid (in one study, 22% of the visitors answered that it is blood rather than amniotic fluid); the harmful role of solar radiation in development of life on earth (more than half the studies suggesting that the melting of the icebergs was an insignificant event); the definitive role of the ability to resist gravity (1/2 of the studies) and dehydration (1/3 of studies); of the existence of a certain type of skeleton among insects and arthropods (notably, 6/10 of cases indicated the dragonfly would not possess a structure comparable to a skeleton); of the role of the skeleton among species with an internal skeleton (notably in regard to protection of nervous and respiratory systems, where clearly more than half of those surveyed did not perceive a function) or external (there was virtual ignorance about the role of the cuticle among insects); the equivalent role of the seed and the egg (while being totally accurate in identifying the function of each, 1/2 of the visitors made mistakes in knowledge association); the factors enabling plants to take hold on land (the role of the stem was a determining factor for only 1/3 of the cases and was perceived on the same level as the "appearance of the color green" in exactly the same proportion of answers). These average answers show the public's limited ability to state the most common notions and give more precise details.

But perhaps the most troublesome point is the *almost total lack of indicators* in respect to species linkage following reptiles (the first mammals being nearly always considered as more recent than the first birds).

Achieving a framework for the exhibition with an overall coherence and specific detail centering around the Theory of Evolution demands knowledge of an integrator principle and of those elements which ensure integration.

Designing the Exhibition

These bits and pieces of knowledge have no doubt been indexed by classical sociological variables. As such, they are in "raw" form.

Moreover, the formative evaluation phase of the panels (see Note 11) gave us an initial insight into their effectiveness. In fact, this type of situation where potential users of a future exhibition feel they have an evaluation role is itself a methodological lever for updating the socio-cognitive processes involved in construction and deconstruction of the presentations. (For a description of the exhibition, see Appendix.)

Example: “Where did the reptiles go?”

The first approach was to establish the forms of learning and reception of a panel project (see Note 12) setting forth the kinship relations between the terrestrial tetrapods – the reptiles appearing there as a heterogeneous group sharing a distant origin with the mammals and a close origin with the birds.

A first analysis of the results provided information on the visitors' immediate conditions of reading and comprehending the panel. This included the surprise effect of the content; the attention-getting qualities of the title and its consistency with the panel as a whole; the role of the written material, complementarity of the sketches, layout, viewability and explanatory power; and the degree of complexity of accompanying texts. These different processes help formulate the concept of the script-visual support's “reading route.” It is worth recalling that the studies on the understanding of the texts have thus far dealt with the readability and familiarity of the vocabulary, but readability goes beyond the length of the words and phrases. It is the entire organization of the text, the type of information and its logical sequence, as well as the related visual elements. Our approach takes into account this information and seeks to reconstruct the cognitive path.

Another complementary stage consisted of posing a synthesis question concerning the panel content (See Note 13). While the analysis of the results of the first part of the investigation showed that the composition of the panel was generally regarded favorably, this question revealed misunderstanding of its didactic objective in half the cases. To elucidate this point, we undertook an analysis to find out, on the one hand, those concepts mobilized by the studies, and on the other hand, the elements and notions provided by the panel which support, convey or oppose them. This served to reveal two groups of concepts which lent support to the reasoning either in isolation or synchronistically. In all cases, their mobilization played a part in understanding the panel. So the joint mobilization of “kinship” and “chronology” in the first group were generally deemed successful, while the second group, “living environment,” was nearly always misinterpreted and the concept of “evolution” confused the logical reasoning somewhat. As for these “notional” elements provided directly on the panels, only the isolation and mobilization of the notion of “amniotic egg” reinforced or conveyed the role of previously isolated groups.

In other words, factors which in the first analysis could be imputed to the museographic effect (inadequacy of the cladogram reading guides), were actually logical aspects of the social presentations. On the one hand, the bulk of perceived evident facts is seen to derive from common sense and is reinforced by the prevailing traditional model of representation of the animal kingdom (which, in this case, is upset by the bird-reptile link [see Note 15]). This first obstacle is reinforced by the deleterious effects of the popularization of the Theory of Evolution which focuses on and stresses the idea of "adaptation to the environment," thereby blocking the notions of kinship and temporality.

It is not overemphasizing the social dimension of the thinking to the detriment of the individual dimension to point out that such logic belongs to the thinking which is still partly "wild." It retains some functional structures – primacy of sensible intuition, the importance of concrete fact – that are associated with aspects of the thinking that is partially "domesticated" by modern science.

In the Exhibition

As we pointed out earlier, the ~~path through the exhibition~~ is highlighted with ~~stop-points and discovery-points~~. Some of them were predictable from preliminary studies. For instance, more than half of respondents in the first study were skeptical about the existence, in our own era, of a coelacanth (a fish with feet) and a dipnoan (a fish with lungs). Thus, a presentation of specimens both mounted and filmed in their living environment was bound to attract attention. And that proved to be the case. Other examples relate to museography: the window display ("Vivre hors de l'eau, c'est se soutenir" [Living outside water requires self-support]) largely corrects misconceptions noted in early evaluations, except perhaps in stressing the parallels between the function of bones in land vertebrates and wood in plants. The magic insect wall, while weak in terms of the scientific message it illustrates, is at least very appealing aesthetically. In the other hall, the reptilian origin of birds and mammals is physically laid out as it should be. Still, the analysis of paths (recalled or filmed) through the exhibition gives rise to a logical understanding which is not necessarily inferred by the spatial layout of the narrative. ~~A pattern of zones of special attraction to visitors shows up clearly and is largely an effect of the distribution of different types of support.~~

The analysis of *simplified paths, stop-points, surprise-points and discovery-points* provided extensive information on the exhibition's popular zones or attention-getting areas. Based on the concepts of "Points of Interest" and "Magnet Areas" developed by Wolf in his studies at the Smithsonian Institute, (Wolf and Tymitz, 1991) we adopted those of "attracting power" and "holding power." (These concepts were defined for

the first time in Melton, 1935.) Rather than measuring visitor stop times, we asked them to trace out their paths and to describe their behavior through their visit to the exhibition (See Note 16). This approach is based on the theory that the exhibition functions by zones of attraction or magnet areas (strong, medium, weak) throughout the route chosen by the visitors and that the application of the "holding power" within these zones should be investigated at several levels. We were thus able, in each of the different zones, to determine and state the strategies for interpreting the space. ~~Four levels of the visit were established.~~

The ~~simplified path~~ traced out by the visitors indicates the "attracting power" level of the exhibition. This real route (See Note 17), reveals a dual selection – the choices made by visitors and the immediate recall they have of the visit.

The other elements go deeper into the "holding power" concept. The main ~~stop-points~~, once superimposed, ~~separate the zones and describe them (weak, medium, strong).~~ At the same time, we know the elements which are associated with them as well as those which are actually present. These zones rarely correspond to those planned by the designers – they totally reorganize the content of the exhibition. Associations are formed around contiguous elements, either an attractive element (computer games, the coelacanth, the "Hormones" game), or due to a path which proceeds continuously or not, depending on the type of supports and visitor density.

The ~~surprise-points~~ make it possible to pinpoint the most attractive elements in these zones while the ~~discovery-points~~ characterize the learning points, the ~~final level of probing the "holding power."~~ The surprise-points are generally located in the most frequented zones. They make it possible to better differentiate between the most frequented zones and those moderately frequented. The discovery-points add an important element of precision regarding the functioning of these zones. They do not necessarily correspond to the stop-points and surprise-points, and sometimes point up the less frequented zones whose rich content attracts and holds some visitors.

The same method of delineating the magnet areas showed us that ~~most of the panels benefit from one element with strong attracting power (e.g., interactive computer game, large specimen) (See Note 18).~~

Even if the visitors to the exhibition veer to certain magnet areas in the exhibition largely determined by the attracting power of the panels, this reorganizing of space still generally corresponds to the major "Zones" envisaged by the designers. ~~Panels located in transition spots between the large Zones all have a weak or medium attraction power, never strong.~~ The harmony of the large Zones affects the formation and harmony of the small zones.

Some rules of synthesis for the observations:

Contiguity Rule

Some displays attract attention which in turn is deflected to other displays nearby that are immediately contiguous, either in keeping with their role or due to strategies of surprise and overlap. As well, some zones may feature their own content logic (the "bird" space and its interactive console adjoining the "Mammalian reptiles" panel and close to "Historic Herbs"), or reinforce a thematic unity dealt with in several ways or according to different degrees of probing (e.g., the "Hormones" zone where an interactive model attracts attention on a subject presented jointly by a panel and individual descriptive cards).

Arbitrary Unity Rule

A unity of museographic treatment can produce unexpected theme groups. This applies in the construction of a "historic" zone based solely on a large herb collection and a window display that includes, among other items, two earlier works on the method of classifying species ("History of Life Diagram" window display).

Non-Contrastability Rule

A zone which lacks a dominant support is weakened overall or interest is deflected more or less arbitrarily to a subsidiary section of the zone or to particular details. This happens in the "Reptiles Zone" where attention is first drawn to the "interior view of tortoise carapaces" rather than to the synopsis panel on reptile genealogy.

Example: *The reptile zone and the panel "Reptiles and their relatives"*

From the visitors' paths and principal stop-points we were able to see how the "Reptiles Zone" functioned. It features elements grouped on both sides of the hall with small round window displays in the center which promote a zig-zag path. The stop-points show us that the visitors define two popular, highly-frequented zones in this section of the exhibition: one centered around the large specimens and the second on the Tortoise window displays. Curiously, the great attraction of these two windows does not benefit the "Reptiles and their relatives" panel (See Note 19) located between them. The analysis of the path shows that most visitors bypassed it (the film taken shows that they scarcely stop), and no visitor mentioned it as a surprise-point or discovery-point. Although located in the center of the Reptiles Zone and intended to act as a synthesizer, this panel receives little attention and does not fulfill its role.

A dozen interviews concerning this panel were carried out. There is an obvious comprehension problem among those interviewed, which appears to be greater than that indicated during the formative evaluation.

Criticisms about the construction of the panel focussed first on its general format: it is considered both too small and too cluttered ("It takes up less space" [see Note 20]; "It isn't prominent enough;" "There are too many elements," etc.) Taking into consideration all these remarks, we are led to the conclusion that while this panel is suitably located, it suffers from a "staging" problem. On the one hand, it features too much information for its size; on the other hand, its graphic presentation suffers from an inadequate teaching aspect. The changes made to the tested prototype (i.e., reversal of the cladogram, coloring of the branches) are not enough. This is especially true in highlighting the concepts that guide an operating logic.

In fact, one of the museological objectives which was to show the proximity of reptiles and snakes in the linkage of the species is rarely achieved. To the synthesis question "Are snakes closer to birds or to frogs?", seven visitors replied frogs, three answered birds, and two abstained. This important objective to show the proximity of birds and reptiles generally fails. The notion of "kinship," very present during the formative evaluation, is associated here with a "classification" operation – "common origin;" "common ancestry;" "same origin;" "different classes;" "different stages;" "elements;" "branches;" "ramifications" (See Note 21). The concepts of evolution and chronology remain almost completely absent. Doing the prehistoric ancestors in the same color as present representatives weakens the historical dimension. The dates illustrated in one color, hence insufficiently contrasted, do not clearly convey the chronology.

This museographic deficiency is not compensated by the panel's location in the zone. While visitors have difficulty grasping its meaning, they correctly identify the panel as a synthesis element – "A sort of synthesis;" "A very synthesizing table;" "A kind of symbiosis;" "A collective grouping;" "A table with all the species." But this synthesis includes not only the reptile group but all the species, and, by extrapolation, the exhibition as a whole – "Still it's worthwhile having a table . . . which groups everything so we can see all the common origins."

In other words, the panel is located at a strategic enough spot in terms of its primary objective. Hence, the location does not provide a counterbalance, but points up its failure. It would doubtless gain from being moved to the conclusion zone of the exhibition.

Conclusion

Our objective at the start was to look at the exhibition as a whole so as to reconsider the evaluation and get away from the constraints of "measurement of effects." What the visitor does is construct meaning, and the aim of our work was to get an update on that appropriation process.

Hence, the combining of quantitative and qualitative evaluations mobilized to elicit as much data as possible.

We hoped to be innovative in our exhibition evaluation techniques on two points:

1. The updating of the visitors' representations of the evolution theme during the formative evaluation phase revealed a definite obstacle which must be considered when conveying concepts;
2. The visit itself, altered by the presence of a subgroup and the numbers attending the exhibition, and structured by constructed and planned attraction zones, revealed the holding-points and the map of meaning elaborated by the visitor.

The concept of a scripto-visual support's "reading route," developed at the time of the formative evaluation of the panels, proved to be a valuable application. The approach for all exhibition elements proceeds from a reading route which conditions the appropriation process initiated. The cognitive route is revealed in its complexity and mobility. The need for "reading keys" closely follows that of the "reading route." Utilizing these elements in the exhibition situation (in other words, their articulation within a narrative grid) highlights this process. It demonstrates the appropriateness of the topographic path to the conceptual path.

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Notes

1. Adopting this principle avoids the problem of contextless simulation of museographic specimens, but we faced difficulties related to functional constraints encountered in constructing any exhibition. Then the exhibition could no longer be envisaged and evaluated solely for its meta-media effectiveness, but also in relation to its development process. It would emerge as the product of interplay between the scientific, museological, and architectural communities. As well, certain filter effects, on the one hand, and limits to displaying certain synergies between scientific concepts, on the other, could be made evident. But also, the evaluation was considered by the designers to be a departure from the primary objective (optimizing museological and museographic goals vis-a-vis the various publics). In selecting a certain theme by a museologist who considered it indispensable while being aware of the problems it poses, the evaluation focused not only on foreseeable poor performance, but on the optimization of even marginal museum discourse. This is the price a museum must pay to avoid drifting into fashion and consensus and to promote science culture through innovations that go beyond form.

2. We prefer the term meta-media to hyper-media because the exhibition uses many audio, text and visual supports. We find the term hyper-media too strong. As currently used, it usually refers to electronic components that designers resort to on occasion.

3. The evaluation process thus avoids drifting into a reductionism similar to what happens in the science field. Some biologists try to explain evolution or argue against it by limiting their study to genes, forgetting that selection operates not on genes but rather on the individuals possessing these genes within a given population.

4. They received about a million visitors annually:
full fee visitors—965,700; school visitors—165,700, on average over the past 10 years. These were broken down as follows:

	<u>Full Fee</u>	<u>School</u>
zoo	488,900	35,100
permanent galleries*	261,000	47,000
temporary exhibit gallery**	215,100	148,100.

* (some of which have themes that are close to the future *Galerie*, for example, the Paleontology and Comparative Anatomy galleries which were used in the initial studies, from 1987.)

** (which will be transferred to the future *Galerie*.)

5. The school public can double in numbers depending on the temporary exhibits (13% of visitors in 1986; 6.5% in 1987; 13% in 1988), but represented a relatively constant proportion of visitors from the permanent exhibitions over the past four years (full fee—16.7%; school—1.4%). It is made up of: 75% students from six to 10 years of age, 20% students 11 to 15 years, and the remainder either kindergarten or high school students.
6. One of the limitations of this study is that it is situated in the context of the announcement effect insofar as the inauguration of this preview exhibition was widely reported in the media.
7. Study (at 1/10th) completed with one sampling of 215 visitors to the exhibition during its first week, that is, from May 25 to June 2, 1991. Ref. Synopsis Note, No. 1.
8. Retracing on the captioned map of the paths followed with a sampling of 214 visitors by their instructions.
9. The tracking-interview with 40 visitors attests to this.
10. Study using directive interviews (closed questions) done with a sampling of 433 representative visitors to the site (June, July, September, 1990).
11. A formative evaluation of seven panels was done, some of them several times (11 evaluations), based on 20 interviews per panel, averaging half an hour each, for a total of 250 interviews.
12. Semi-directive study with a sampling of 20 visitors alone or accompanied by adults or children visiting the Museum galleries (a total of 33 individuals participated in the study). They had to comment on a draft version of a scripto-visual panel made up of the titles (“Where did the reptiles go?”), editorial text (25 words in five lines of text); a simplified cladogram, without caption but colored, with a text at the right (about 40 words); a second cladogram, not colored, with details, captioned in places, with two framed texts on the left (the first about 90 words, the second about 20 words).
13. The question was as follows: “Finally, in your opinion, are snakes closer to birds or frogs?”
14. Except in regard to inadequate support elements for reading the cladograms.

15. According to the tenets of cladism, reptiles do not form a natural class since they can only be defined by excluding birds and mammals from the natural group originating from a common ancestry (Bowler, 1984).

16. We asked visitors to trace out their route for us using a map of the exhibition (simplified path) and to indicate their stop-points. In the same interview, we asked two other questions: "What element of the exhibition did you find most striking (surprise-point)?" and "Did you discover something that you didn't know (discovery-point)?"

17. A comparison among 30 visitors of paths taken (followed by camera) and simplified paths traced out on a map showed us the accuracy of the paths memorized. The zones visited but forgotten are those that have the least "attracting power" in the exhibition.

18. Only one case diverged from this rule, that of the panel "A model for emergence from water, metamorphosis of amphibians" which, although located at the exit to the projection hall, adjoins part of the Insects and Arthropods zone and part of the Vegetable Pioneers zone.

19. This panel is a reworking of the prototype "Where did the reptiles go?" which was tested during the formative evaluation.

20. The visitor thinks that the panel is smaller than the others, which is untrue. We take this remark as an indicator that the panel should be larger, given its content.

21. The concept of "living environment" which was an obstacle to understanding of that of "kinship" did not arise during these interviews. We continue our analysis to further probe this problem.

Appendix: Description of the Preview Exhibition

The future halls of the *Galerie de l'Evolution* will be organized around a large central nave and the exhibition follows this form, occupying a long and narrow rectangular space (6,000 sq. meters). The elements of the exhibition are featured along the north wall (the south wall is essentially bare), along both sides of a large diagonal wall, in the islets and on a large two-tiered stage which features reptiles and mammals. Some particularly appealing elements are distributed through the exhibition: two large coelacanths, a butterfly window display, the Luth tortoise, the birds window display.

A video projection area and some other exhibition elements are between two parallel diagonal walls which divide the hall into three unequal

segments which are subdivided into seven theme zones. To promote zone identification, without falling into the trap of a predetermined, captive route, the designers conceived of delineating the exhibits by seven markers. Each includes:

1. The logo of the zone (which is on the panels and affixed to the window display texts);
2. A simplified cladogram illustrated with seven elements, one of which is lighted from the inside to indicate the zone; and
3. A fossil recalling the chronological period of the zone.

The exhibition is designated by color, used as introduction and situation device. A large picture of "a human embryo in its amniotic sac," fish and a claptis are represented to create an atmosphere inducing visitors to recall the primordial role of water in the genesis of life.

The first zone presents the limitations and advantages of the emergence from water. A large wheel at the exhibition entrance presents illustrations between the "spokes" which reconstruct the physico-chemical conditions hostile to the emergence from water before the evolution of the atmosphere. Our aquatic relatives, the coelacanth ("fish with feet") and the dipnoan ("fish with lungs") are presented in the form of mounted specimens and castings accompanied by two short videos and explanatory cards. Two panels and a computer game develop the emergence from water theme. A window display on animal skeletons expands the theme of the zone with the problem of weight (mass) ("Living outside water requires self-support") and a panel illustrates the theme of simultaneous breathing and feeding.

The next two zones are devoted to the pioneers of the emergence from water. Living plants and some wax castings are featured together in two greenhouses set up on several platforms. These are present-day species that belong to groups that emerged from the water. This zone culminates in the presentation of a major "invention" – the seed, which enables plants to go beyond their aquatic environment for reproduction (a fossil and an animated model). The invertebrate pioneers are presented in various ways: mounted specimens (crabs, insects); models of cuticles (three window displays); living specimens (scorpions, cockroaches, myriapods); viewing with microscopes; and a panel on the arthropods.

The fourth zone, at the center of the exhibition separated by two diagonal walls, features amphibians and early tetrapods. The central element is the film on development of amphibians (12 minutes), completed by two panels on the same theme ("A model of the emergence from water, the metamorphosis of amphibians"). A reconstruction of *Ichthyostegas* shows the first of the tetrapods to live outside the water. The fossils are proof of the existence of this animal.

Emerging from this zone, there is a panel and a game ("The hormonal rules") which synthesize the knowledge on the effect of hormones on fish, amphibians and mammals.

The reptile zone begins with the presentation of the egg in the shell, another major "invention." Various small mounted specimens of reptiles are displayed behind glass while the large specimens are featured together in an open area. Each one may be lighted by visitors when they touch a tactile screen. The computer also gives them information on each animal. This zone has two panels: a diagram, in the form of a cladogram, explains the links between the reptiles and other species; and a scripto-visual panel illustrates the passage of the reptiles to mammals.

The last two zones, birds and mammals, present visitors with groups of mounted specimens. Each presentation has a tactile screen which can activate lighting, call forth information on each animal, and emit the songs of the birds. The large mammals, like the reptiles, are presented in an open area contiguous to the reptiles but on a higher level.

A final zone, without markers, concludes the exhibition. A synopsis text on Evolution and Environment, historic herbs, a window display on former and present ways of illustrating the links between species ("Diagramming the history of life") and descriptive cards present the exhibition's conclusion.

As a whole, the exhibition is presented as a cognitive path organized around a chronological axis. In this perspective, the elements of the exhibition inter-relate with each other, from one side of the hall to the other. This is why, ideally, the exhibition should be visited in a zig-zag pattern. The linear or loop route does not correspond to the designers' structural intention.