

## **Towards a New Science Museum in Trento: Developing New Tools and Methods to Combine Naturalistic and Hard Science**

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### **Introduction**

In a few years a new science museum will be built in Trento. In the “Museum of Sciences” aspects coming from the tradition of a Natural History Museum will be joint with features typical of Science Centres. To achieve this goal, new educational methods and didactic tools have been adopted. To build bridges between topics belonging to different disciplines, new interdisciplinary educational activities have been developed and multidisciplinary temporary exhibitions have been proposed to the public.

In the society of “global citizenship”, the education of the young generations must provide them the instruments to realize not only a geographical and professional mobility, but also a cultural one, a new way of organizing their knowledge. Teaching and learning must be interdisciplinary, because the knowledge itself is made up of a network of information coming from different fields.

### **Section**

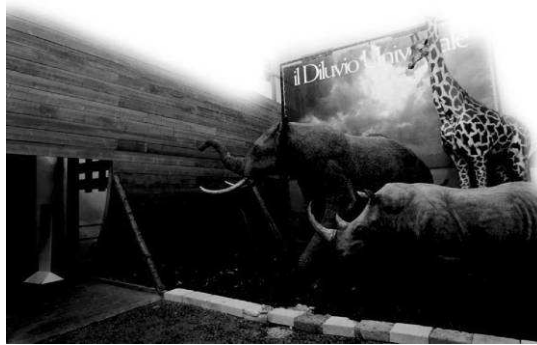
To start, a few words about the Museo Tridentino di Scienze Naturali (MTSN): its mission is typical of a Natural History Museum: exhibition conservation and research. Moreover, educational activities have been subject of lot of work, research and development in the last ten years.

MTSN leads a network made of six museum branches: the Botanical Garden and an Astronomical observing site both located on the mountain of Trento, the “Gianni Caproni” Aeronautic Museum in Mattarello, the Pile-Dwelling Museum in Ledro and a Limnological Field Station near lake Tovel. The MTSN has also five sister institutions: the Aquarium of Trento, the Adamello Glaciological Research Centre, the Fossil Museum in Brentonico, the Geological Museum in Predazzo, the “Villino Campi” institution for studies on the Garda Lake and its naturalistic surroundings.

The Museo Tridentino has therefore a long tradition of networks of knowledge and skills, thus interdisciplinary seems to be not just a choice for the new Museum, but also a “vocation” to combine different sciences.

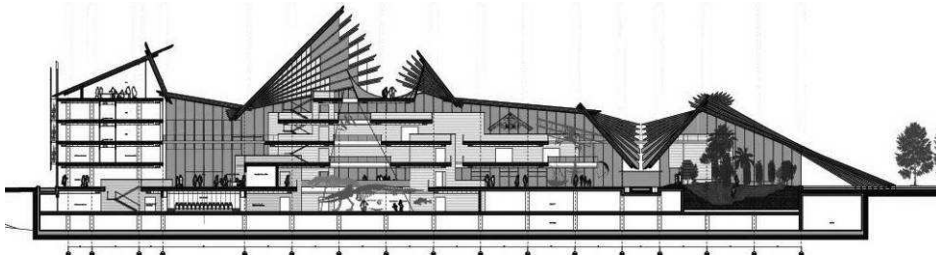
The museum network affects almost the whole region and the strong relation of the MTSN with its environment and the local people and government have been important starting points of the following developments. To understand the reasons for the new museum to be built, we have to go back to the end of 90’s when a new season of interactive exhibitions started. Among these, the temporary exhibition “Il Diluvio Universale” - “The Flood” - that, for the first time at MTSN, investigated a topic from different points of view. The tour started in the courtyard where a big diorama, reproducing the animals trying to escape the Flood on the Noah’s Ark, introduced the visitors to the exhibition. It symbolized the importance of preserving the biodiversity and the naturalistic heritage threatened by the expansion of humans’ needs. Other current issues investigated were genetic manipulations,

biological ethic and new strategies to realize a sustainable development. A scientific approach to the matter of climate changes has been also proposed by the introduction, in the traditional exposition area, of interactive exhibits which invited the visitors to understand and solve problems by doing, not only by reading and learning. A recent scientific explanation of the Flood invited the visitors to intriguing remarks and comments. A part on the myth of the Flood in the different cultures completed the interdisciplinary offer of the exhibition. Considering the perspective of the choice of the interdisciplinary method for the new Museum, “Il Diluvio Universale” can be considered the turning point of it all. Other interactive exhibitions, on many different subjects (Energia 2001, Destinazione Stelle, Tutti a Nanna, Survival Festival: obiettivo sicurezza, etc.) followed.



**Figure 1:** the reproduction of the Noah's Ark in the courtyard of the museum during the temporary exhibition »Il Diluvio Universale«.

The great success of all these interactive exhibitions and the subsequent need of the museum to expand met the will of the local government to reclaim an ex-industrial area located near the historic city centre. The will to give this area a strong cultural value found in a new “Museum of Sciences” the answer and in year 2002 the study of feasibility started. Because of the strong relation existing between the museum and its setting, the alpine environment will be the main character of the new museum, in fair balance between its duty to preserve the naturalistic heritage and the need to look for new solutions to adapt the setting we live in. The new museum will become a “platform” for discussions on global challenges such as climate changes and new technologies. Slopes and curves resembling the profile of mountains will characterize the new building, designed by Architect Renzo Piano.



**Figure 2:** cross section of the new Museum of Sciences to be built.

As previously said, in the new museum, interdisciplinarity will be the educational method chosen to guide visitors through aspects belonging to the tradition of a Natural History

Museum (mainly the contents) combined with tools and features typical of Science Centres: hands-on exhibitions, multisensory experiences and so on.

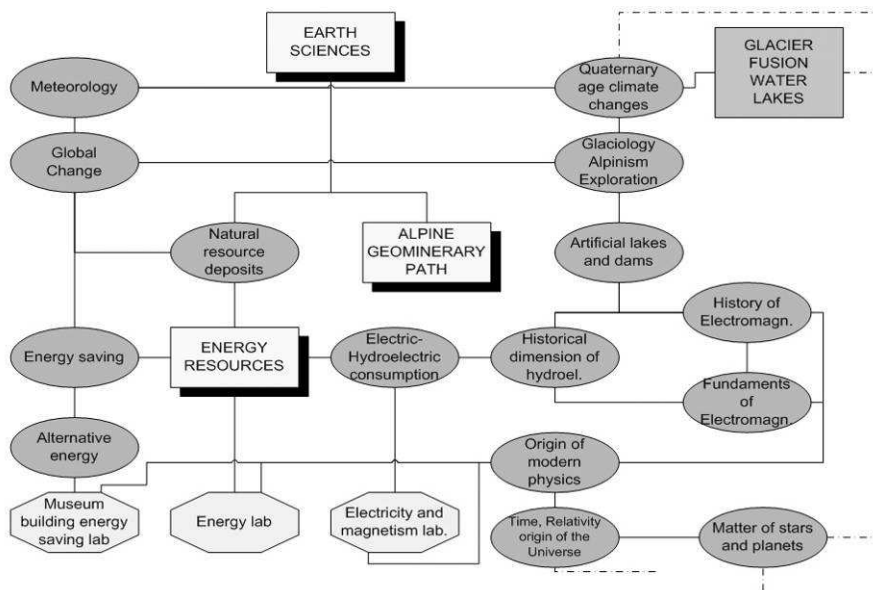
Now focusing on the word “interdisciplinarity”: what does it mean? At least two different interpretations are possible. Interdisciplinarity may be a method to apply when exploring a topic. To investigate facts concerning “Atoms and molecules”, for instance, the perspective of physics or that of chemistry can be used. Moreover, analyzing the evolution of the debate about “Atoms and molecules” in the history of philosophy would be very useful in order to have an *ensemble* view of the matter. We can call this way to look at interdisciplinarity “model centred on a theme”[1].

Moreover, when considering the most topic scientific events we live everyday, we notice that it is hard to find someone who really knows everything about that matter because it is possible to look at it from different angles. Thus, interdisciplinarity may be considered a bridging tool between disciplines, which are all necessary to outline the issue. For example, deciding to talk about the strange weather we have experienced the last two summers needs some statistical data about former ice ages which have been studied by glaciologists, geologists, paleontologists, and so on. We can call this second type of interdisciplinarity, “model centred on a method”[1]. It can be very useful for young students to develop a way of looking at topics that tries to find overlaps and parallelisms in other disciplines, especially in order to get the cognitive instruments to reprocess and reorganise their knowledge for the third test of High school’s Final Examination that has to deal at least with five different disciplines at the same time. According to these considerations, different types of interdisciplinarity will be realized in the new museum.

The interdisciplinary approach has many advantages: it promotes curiosity and makes reality readable through instruments belonging to different disciplines. Moreover, interdisciplinarity favours the learning process in its phases, as also Jorge Wagensberg[2] underlined in one of his articles. In addition, it arouses curiosity thus encouraging a deeper knowledge and giving way to a perfect contamination of the informal method with the formal one of school.

The Content Plan, which will provide the guidelines for the development of the exhibition area, will be concluded by the end of year 2005. Project teams, composed by experts belonging to different disciplines, are working on the definition of the different meaningful themes to be represented in the new museum and on relationships between each other. An example of how the different topics could be related is here reported: starting from a glacier (faithfully reproduced and located at the top floor of the “building-mountain”), for instance, it will be possible to talk about climate changes and the periodical withdrawal of glaciers’ fronts. Or, then again, physics of ice could be an unexpected point of view from which looking at the issue “glacier”. This is an application of what previously called “interdisciplinarity centred on a theme”.

Talking about climate changes will also provide the opportunity to link up to topics belonging to Earth Sciences; dealing with creatures that have adapt to inhabit the different situations could be one of the many chances available. Finally, starting from the glacier, visitors will have the opportunity to choose among different paths to develop their personal route, following their own interests and curiosities. Giving this way an application of the “model centred on a method”.



**Figure 3:** example of possible links between meaningful topics represented in the new museum.

Coming now to the state of art: the museum promotes educational activities (and exhibitions) about natural science, about hard science, and about history. These activities are normally chosen separately, but in the last years the demand for Special Projects that combine laboratories concerning different disciplines rose. Every Special Project consists of three, or more, of appointments and during the preliminary phase educators of the different branches of the museum work together to create bridges and overlaps between naturalistic and hard science.

As example of a Special Projects, one developed during the last school year: a botanical activity about the colours of flowers offered the opportunity to speak about the physiology of vision and the physics of light. An interactive laboratory about the “Geometry of optical illusions” completed the offer. In September a new Special Project involving the first classes of an Elementary School has started. The project, called “Physics in Nature”, will offer the children the opportunity to experiment multisensorially. Main purpose of the activities proposed is getting the kids used to observe the reality with curiosity. The five senses will become investigation tools of the natural environment they usually live in.

Not only Special Projects combining existing activities belonging to different disciplines, but also new interdisciplinary offers. During the last winter, “Sci & Scienza” (Ski and Science) combined activities typical of a holiday on snow (skiing, taking strolls on snow with the “ciaspole”, etc.) with formative interludes as the identification of animals’ tracks, a nocturnal observation of the sky, orienteering activities, lectures on the geological history of the surroundings and an interactive laboratory on the physics and mathematics of snow flakes.

The interactive lab “Nonsolomusica” (Not-only-music) deals with the scientific aspects of musical phenomena, particularly the ones concerning with physics, mathematics, physiology and physiology showing that these arguments are unexpectedly and surprisingly linked each other.



**Figure 4:** students engaged in the activities proposed during »Nonsolomusica«

To introduce themselves to the topic, students must act as ancient Greeks and find out the relation existing between the length of a string played and the height of the sound produced using a »mono-chord«, the instrument that Pythagoras seems to have used himself. Going on with the laboratory, students can train their math by going through an algorithm to calculate the lengths of the string corresponding to the different musical notes of the Pythagoric scale. Another amusing activity is the concert with the Savart's Siren that brings students to understand the relationship between the impact frequency of a plastic wand against different gear wheels and the height of the sound produced. Unpredicted sound effects introduce the audience to the part dedicated to psychoacoustic, important aspect if one wants to have a curious (and competent!) look at the fantastic world of sound.

Also on the side of temporary exhibitions much work has been done. "In volo" which was open until September 11, was dedicated to the issue of "flying" dealing with knowledge gained from studies about birds' flight paired up with elements of aerodynamics and physics. The exhibition was hosted by the permanent exposure of vintage aeroplanes of the "Museum "G. Caproni", giving this way the opportunity also for historical, artistic and technological contaminations.

In the near future: the traditional physics laboratories will be enriched with naturalistic spots in the form of "Did you know that?" which will give the students the opportunity to discover the wonder of physics in nature and to understand that subjects like density and centre of gravity, normally "labelled as boring", have more to share with the everyday life than meets the eye.

## Conclusions

The new museum will provide a great opportunity to develop and test new strategies for teaching and learning.

Some needs of the actual teaching and learning system seem to be

- the "recovery of elementariness", meaning not what is simple to understand, but everything that can be useful and propaedeutic for building more complex knowledge;
- a modular organisation of learning because knowledge does not consist in a "linear build-up of information", but in active and creative research paths;
- networks of knowledge (interdisciplinarity and multidisciplinary).

Focusing on the third test of the High School Final Examination, it requires more than a consistent and well-organised exposition of concepts and notions, it has to evaluate the students' general knowledge. Emphasis must be placed on skills and not just on contents. Structuring knowledge by skills does not unhinge disciplines that remain necessary organizing structures of the educational activity. Because nowadays what should be known and things to learn change rapidly, it has become necessary not only to learn things but also

to acquire new strategies to reorganise knowledge. This way, interdisciplinarity can become a “new frontier” of tomorrow’s school.

Interdisciplinarity doesn’t mean that all the different disciplines are “drowned” together in a mixed and messy way. Interdisciplinarity means that to look at reality it is necessary, from time to time, to wear different kinds of “glasses” corresponding to the different way of seeing things of the different disciplines. An interdisciplinary approach to the different cultural areas becomes a fundamental aspect of the formation of a student, so that besides learning disciplinary contents there will be also a critical understanding of them.

### **References**

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- [2] Jorge Wagensberg 2004 The “Total Museum”, a tool for social change 4th Science Centre World Congress