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EDUTAINMENT (Game) – DIGITAL (RE)DISCOVERY OF CULTURE

Key words: edutainment, education philosophy, game, discovery

We do not stop playing because we grow old.
We grow old because we stop playing.
Benjamin Franklin

1. Introduction

1.1. Supply and demand of educational finger-posts. After the fast development of emerging technologies, the spreading of information/knowledge remained important in the same force, but already not limited in the way and speed of its` dissemination. Each person engaged professionally with Education and Science in the Digital Age inevitably becomes a media expert with a specialty in online information access [1].

A swimmer in the digits` ocean who wants to learn and teach, i.e. to swim well without seeking, needs a good **finger-post**[1]. Trustable finger-post is a tool aimed at achieving information/knowledge; staying itself on the information flows crossroad it is intended to show (in various educational forms and e-formats) possible professional development directions. The World Wide Web (WWW) is the largest crossroad/ crossword possible, especially in the image-game (see Mac an Airchinnigh [27], *The Graven Image – digitized and philosophized*) and language-game (see Wittgenstein [26], *Philosophical Investigations*) context. Therefore digital literacy has to be cultivated and encouraged as well as the traditional one. Digital literacy changes the traditional way of knowledge perception. Therefore it is the first game rule (prerequisite) we start this paper with. *We use and emphasize the phrase game-rule in the sense of Huizinga* [1].

Mentioning perception let me explain mine concerning the paper's chosen title. The following explanation has two functions – to present briefly the paper structure and to show the language/cultural frame, which I assume in presenting Edutainment phenomena.

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[1] *Fingerpost* [signpost; in Bulgarian: пътепоказател] in Merriam Webster [http://www.m-w.com] is: **1:** a post bearing one or more signs often terminating in a pointing finger; **2:** *something serving as a guide to understanding or knowledge*. We use it here in its second meaning, toward which a third meaning is added: starting point whereby we use our fingers on a key-board, mouse, touch screen etc. in order to get in touch with a digital world. The word is composite and the first part "finger" [MW: any of the five terminating members of the hand**:** a digit of the forelimb] used to point at something. We could imagine the computer interface as a place/post from which we use our fingers to point out. Then with advances in technology such as voice-activated systems we might still use the phrase finger-post to describe the same thing.

Playing paper's title? The title, *Edutainment (Game) – Digital Re-discovery of Culture*, is a language-game in the sense of Huizinga and Wittgenstein. The first word – **Edutainment** (*edu*cational content in enter*taining* form), the main subject of the paper, in broad sense is electronic *publishing* (from Latin *publicare* – to make the public aware of something) of cultural artifacts. In the actual structure of the paper the Edutainment concept is revealed in the whole text, an idea which is made more precise in section 2. Here we consider Edutainment via (computer) **games**, which are understood as a *kind-of-computer Art*. This is the second game rule (prequisite), which complements the first one mentioned above: "digital literacy". When talking about Edutainment, the social and psychological aspects of the Game as culture phenomena are always implicit. All nations play in a remarkably similar way [1], but not all languages represent this in one word. As Huizinga [he himself uses German "spiel" which corresponds to the English "game"] shows, the semantic connotation of words "game" and "play" differs in the languages. In this paper we rely not on the word but on the concept of "playing/gaming", defined by Huizinga as time and space limited voluntary action or occupation, requiring voluntary accepted rules, obligatory to observe, which action ends (has its goal) in itself, accompanied with tension and joy, different from the everyday life [1].

Before presenting in brief Huizinga view we need to define the primary difference between words "game" and "play" in English language dominated cultures. This difference the Dutch writer naturally does not take into account, writing himself in German language[2].

Postscript Huizinga's view: … games define culture. Freedom, no interest served, isolation, ordering, uncertainty, rules, community. Not one category?: linguistic terminology is diverse. But a crucial question why do humans play games, and why is this practice stable? Search for explanations of emergence and stability of natural logical conventions: meanings, rules…History Games are a basic feature of human behaviour (Huizinga, Wittgenstein, Hintikka). Focus of attention many times in this century (up to Nash's Nobel Prize: rational equilibrium as a key to stable behaviour). First mathematization of games: 17th century (Pascal, Huygens), second mathematization: 20th century (van Neumann & Morgenstern). Continuing story…[3]

"Translated" in English language dominated cultures, this view should be assumed as culture emerges from play, not from games, taking as a presumption that the "play" (playing as fundamentally human action) has primary in comparison with game. Game is a sort of play, but play and game are not the same.

The key questions, we are trying to find answer to (extracted from the above text) are: *why do we humans, both young and old, play; why do we play games, and why is this practice stable?*. We extract also two important views for the game-factor, that

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[2] *Merriam-Webster Online Dictionary defines* **"PLAY"** [etymology: Middle English, from Old English plega; akin to Old English plegan to play, Middle Dutch pleyen] as: the conduct, course, or action of a game; recreational activity, especially: the spontaneous activity of children; the act or an instance of playing on words or speech sounds; an act, way, or manner of proceeding; operation, activity; brisk, fitful, or light movement; scope or opportunity for action; a move or series of moves calculated to arouse friendly feelings; the stage representation of an action or story;
Merriam-Webster Online Dictionary defines **"GAME"** as: activity engaged in for diversion or amusement; a procedure or strategy for gaining an end; a physical or mental competition conducted according to rules with the participants in direct opposition to each other;the set of rules governing a game; any activity undertaken or regarded as a contest involving rivalry, strategy, or struggle <the dating game> <the game of politics>; also **:** the course or period of such an activity <got into aviation early in the game>; area of expertise **:** *specialty* <comedy is not my game>; Ex. 1: play games : to try to hide the truth from someone by deceptive means. Ex. 2: play the game : to act according to a code or set of standards

helps to define **culture**. These are questions of motivation (Why do humans play games, which is the viewpoint of Huizinga and all humanitarians) and questioning the stability (logic, theory) of player's behavior (*Why is this practice stable, which is the emphasis f Wittgenstein, Nash etc*.). We assume that Edutainment is a multimodal subject and requires an interdisciplinary approach. It exists and can be viewed in different modes [educational, technological, psychological, etc.] being a part of the human experience of many today and will always have a place in the expanding digital culture. Therefore in our research, while trying to answer the question "Why and How do we play games that are using digitized culture?" we use such an approach. This is the most important rule of our game.

Fourth title word, **Re-discovery**, understood as re-discovery of knowledge realm, is the essence and final goal of the technology supported learning–teaching process, i.e. modern education. "**Digital**" from "digital re-discovery" we take for granted because of the European mental and e-background of 21st c., era of virtual realities and Internet. Taking into mind that "*the art of teaching is the art of assisting discovery*"[3][Mark Van Doren (1894–1972)]. Here we talk about re-discovery, "defining" it as a real discovery, made in non real, virtual world, created by the means of Artificial intelligence and Multimedia. But in Edutainment case, this non real world we get from the history and culture of concrete nation or civilization. In the paper structure the *Digital Re-discovery* concept corresponds to technological and educational aspects of Edutainment (see sections 3, 4, 5).

The closing title word is **culture**. Talking about culture, let me quote Plato who says that "*one can learn more about a man in an hour of play than in a year of conversation*"[4]. Edutainment game creatively and attractively presents the knowledge. In the gameplay learning is implicit [4]. In the structure of this paper you will see that the culture concept corresponds with the conclusion. (See section 6).

After the introduction to the playing process game rules (prerequisites) underlined in the paper title let's get to the point.

2. Edutainment Frame

Do people working in intellectual institutions and knowledge industries – the world's schools, colleges, universities, research labs, libraries, museums – share a sustained agenda with which to shape newly emerging educational practices? Aside from the knowledge industries (journalism and commerce) attend to the entertainment industries as potential sources of educational innovation. Producers of Edutainment have yet to show whether they have either an interest in the human process of education or the capacity to give it intentional shape. [5]

The Edutainment concept has its origin in print genres such as encyclopedias, illustrated atlases and books, but the word was coined when the concept attained multimedia form [6]. The first use of the word Edutainment was for educationally aimed CD-ROM games and TV shows such as *Sesame Street* and *The Wonderful World of Disney*. Now Edutainment becomes an industry. While non-profit organizations once had the

[3] Brainy Quote [http://www.brainyquote.com/quotes/authors/m/mark_van_doren.html]
[4] PIXELearning [http://www.pixelearning.com/quotes.htm]

Edutainment market developed, for-profit competitors increased5. There is a tendency in Edutainment companies [leisure industry] to market their products as Edutainment for enhancing their perceived value. This shows the positive value that Edutainment already has in games-driven contemporary culture and industry. Taking into account the facts, we put the accent on the third aspect, the educational one, which we see as the unifying string.

…The pedagogical aspects that are of importance for the educational part of the artifact may in some cases be in opposition to the aspects of importance for the entertainment part of the artifact. There seem to be a need for some kind of trade offs to be made, in order to achieve a good result [7].

Edutainment applications are location based and are mainly child audience oriented, but age never is a limitation for experiencing the world of playing. Attractive entertainment form of Edutainment games not obligatory is aimed at victory, but participating and educative message. The main prerequisite for making good Edutainment application is described by R.White from WhiteHutchinson Ltd. as follows:

Edutainment needs to be approached "through the eyes of the child", with sensitivity to a child's scale and how they see, interpret and use space and objects. Since much of children's play takes place in their minds through imagination, you need to create the right space (the stage) and supply the right objects (the props) to support their play (act out their scripts) [8].

The practice shows that the successful ones are open-ended, structured (participatory games), or scripted (mazes), interactive and explorative (aquarium, some museums), as well as free-choice types (zoos, some museums).

Edutainment via playing [**the computer game**]. Qualitative presentation (on digital or non-digital way), the culture of the Self and of the different Other is a matter of language. Such presentation is the Edutainment computer game itself. Gameplay as creativity expression redefines reality, i.e., not only reflects, but influences the surrounding culture. Enjoy, but vigilantly, because computer games are not life-mirroring art! Their big potential has to be professionally ruled when presenting national cultural heritage in game form. Developmentally appropriate play is pleasurable, imaginative free-choice learning, process-oriented, non-goal directed, free of imposed tasks. The problems to be solved in Edutainment applications are in two main directions: *copyright and intellectual property issues* which significantly influence the dissemination of cultural heritage content via Internet or other distance learning applications AND the *high quality of electronic transmissions* required from visual and performing arts content.

The language, no matter of its` components – letters [literally language], mimics [body language], symbols [arts language], operators [programming language] – always has rules. There is no communication and understanding without observing language game rules-orders. Talking about language and language-games we use and adopt the spirit of Wittgenstein's concept presented in his *Philosophical Investigations* [26]:

"*Let us imagine a language ... The language is meant to serve for communication between a builder A and an assistant B. A is building with building–stones: there are blocks, pillars, slabs and beams. B has to pass the stones, and that in the order in*

[5] *Ripley's Believe It or Not* owns and continues to develop multi–million–dollar, for–profit aquariums. Every year, 75 million people visit 220 IMAX theatres in 30 countries to be edutained. Half of the screens are in informal learning institutions such as museums, zoos and planetariums, half - commercial cinema complexes.

which A needs them. For this purpose they use a language consisting of the words 'block', 'pillar', 'slab', 'beam'. A calls them out;— B brings the stone which he has learnt to bring at such-and-such a call. —Conceive this as a complete primitive language." (2) in [26].

Each game is defined by a group of rules, which determine the attitude of the figures, and the way they move and act. In Wittgenstein's terminology language-game rules do not have in themselves their own legitimating, because they are the object of the players' agreement. But these predefined rules are not made by the players. Each statement (move) is a step in a game, where winning is not the final goal. One can play for the pleasure of thinking out the step/stage/level forward. Thus creativity is "acting" and the result is constant discovering of language/game turns, words (moves) and sense. Wittgenstein says that on the speech level this raises language evolution and results in delight and joy. Similarly with the gameplay, which has its goal in itself.

Edutainment game components. Many of the world significant science inventions were made accidentally[6], in activity that could be considered to be a game. Presented below are some language activities, which are typical of the language-games formulated by Wittgenstein [26, 10] and which are put in symbolic connection with Edutainment game creating process below. A language-game "is meant to bring into prominence the fact that the speaking of language is part of an activity or of a form of life" (23) in [26].

- "Giving orders and obeying them—"(23) in [26]. This type of language activity covers programming language activity and clearly extends to computer games. Neither a game nor a language can function without accepting the formal rules predefined. The giving of such rules is the role of Computer Science and especially mathematical modeling, artificial intelligence, and programming.
- "Constructing an object from a description (a drawing)—"(23) in [26]. As object here we have an Edutainment game. So constructing all its elements from a description base (game scenario) is a process that could be compared with drawing and framing a picture. Completeness (achieving all the goals put) depends on the combining of well structured scenario (precise educational content), modern technological "body" and friendly interface. For the educational aspects of constructionalism, which is not constructivism, see point 4, based on Seymour Papert`s educational strategy.
- "Speculating about an event—" (23) in [26]. We extend this to cover "asking". This main human activity is part of the game constructing. To ask: Why one more game on the market? and to answer properly.
- "Making up a story; and reading it—" (23) in [26]. The result of the speculating language-game (above) is the making of well researched and correct game scenario and content structure. Edutainment game scenario is based on history, concrete scientific subject or work of art, which presupposes interdisciplinary and institutional cooperation between researchers and technologists [see various examples of such cooperation in point 5].
- "Forming and testing a hypothesis—" (23) in [26]. In Edutainment context this mainly technology stuff corresponds with verifying of the model or all software work needed after the scenario, text and image base are set.

[6] For interesting confirming this idea facts see http://www.inventionatplay.org

- "Translating from one language into another—" (23) in [26]. To read a story and to understand it is a matter of translation. In the game context on the initial level this includes programming languages, and additionally language–of–human–nature. From one side such are written, spoken languages (English, Bulgarian, Serbian etc.), from the other – visual symbolic language (culturally sensitive), which embodies the real game message and is implied there by the game creators. For example the interface and design of a game created in Asia will differ from a European game.
- "Reporting an event—" (23) in [26]. In the real and virtual world, i.e. players, game makers, designers, programmers.
- "Guessing riddles—" and "Play–acting—" (23) in [26] (by knowing the game rules), i.e. gameplay itself or the essence of Discovery – understanding, learning and enjoyment. The final result of so much creativity applied.

3. Technological Aspects

Learning is pleasurable, but doing is the height of enjoyment.
Novalis (German poet)

One of the global tasks of museums is knowledge transmission. *Malaspina Great Books Interdisciplinary Matrix* is an example of how an online resource can truly enrich the good work librarians (CYbrarians) already do. [2]

In order to be an active part of cultural life, it is necessary for museums and libraries to compete with the recent offers of technology and trend–setting developments. The new technology achievements have proven impact in the whole education area and being part of digital culture are able to change or at least to try to change the way the average citizen understands the culture, art, science in his everyday life.

Modeling reality [11]. The Internet and virtual worlds provide opportunities to experience not only the three–dimensional visual, but also the performance content of culture in real time and to access multimedia databases through virtual field trips. *Virtual Reality Modeling Language*, as the HTML of virtual reality, allows adding animation, sound and links, and to interact with the environment and other users. A virtual reality simulation can include hardware interfaces also, but they are expensive and fragile for use in libraries, museums and schools. More common equipment stays well known—the personal computer.

Digital storytelling and interactive multimedia. *Interactive storytelling techniques improve the usability of digital Edutainment applications and enable the creation of exiting, suspenseful and immersive interfaces. Interactive storytelling techniques enable museum institutions to provide exciting stories and interesting presentation modes "beyond the desktop", enabling (young) visitors to get detailed information about artifacts using game–based interfaces* [12].

From the content-related point of view *Digital Storytelling* [13] represents a new research discipline in the information technology area by applying aspects of storytelling to digital applications. From the technical point of view, multimodal interfaces and mixed reality platforms create immersive user friendly interfaces, which are needed for every game. Edutainment applications in the cultural heritage area could benefit using

digital storytelling and interactive multimedia opportunities in e–presentation of cultural artifacts. Three aspects of *interactive multimedia* are used in computer games: *graphic–interactive media*: (2D or 3D graphical elements), *continuous media* (audio/video streams, animation, and speech) and *physical media* (physical-spatial worlds of input and output devices).

4. Educational Aspects

Better learning will not come from finding
better ways for the teacher to instruct
but from giving the learner better
opportunities to construct.
S. Papert, Media Laboratory, MIT

Technology is transforming education unlike any trend that has preceded it—but how do educators use technology tools to optimize learning? Papert`s solution to this problem is the offering of a new educational strategy, namely technology in constructivist ways—techno-constructivists! He thinks that all teachers in Digital Age are expected to become techno-constructivists? [2] The reason? Teachers have no greater tool of empowerment and efficacy than technology used constructively. Such teachers motivate their students to take the challenge of non traditional ways to learn—in virtual field trips around the universe, through human body systems, within animal colonies, back in time—all by simply using their Internet connection and a projector. They provide virtual simulations that could assist education being integrated in the curriculum. Through online and network activities digital literacy, mentioned at the beginning of paper, is promoted and this results in research and evaluation of any information flow observed.

Games-based learning is not appropriate for every training need, but then, neither is e-Learning itself. Current tendency is experience of the video game as an ideal environment for learning, good foundation for teaching. Pioneers in e-Learning are looking very closely at the potential of what the business is calling "games-based education". The e-Learning industry is moving toward processes that produce affordable, disposable learning modules so easy and cheap to create that it's better to produce new courses than update old ones when additional material becomes available [4, 14].

PIXELearning & knowledge webs. Shared synthetic environments such as Edutainment games could serve as a container that can offer many types of educational use. PIXELearning (games based learning) [15] uses so called AUDIOTAIN system to create games–based online learning applications for museums.

"*The AUDIOTAIN system has been designed to allow the creation of powerful, rich media entertainment, Edutainment and e-Learning games at a fraction of the cost and in a fraction of the time of traditional multimedia and web development. A typical game will consist of an 'umbrella' game format and theme (e.g. a quiz show) which comprises of a series of mini games which are drawn from a pre–existing library of game templates.*" [15]

New education requires "immersion like" experiences of interacting with information and widely distributed information sources. *Knowledge webs, WWW, games* facilitate this process providing such experiences, but this does not guarantee creating of

adequate internal framework of ideas that learners can use to reflect and affect surrounding reality. The key for to attain digital literacy is transforming stored information into personal knowledge, moving students from access through assimilation to understanding and application.

Creativity and perception. The individual perception of the objects (cultural heritage), presented in Edutainment applications should stimulate creative thinking. Such is one of the goals and the most important motive for existing of Edutainment itself. For answering of HOW to do it question helps the analysis of evolution of learning devices of Prof. C. Dede, (George Mason University in Fairfax), where he says:

One good way to enhance creativity is to make the familiar strange and the strange, familiar… Through the evolution of smart objects, information infrastructures, and shared synthetic environments, our society is encountering powerful new interactive media capable of great good or ill [16].

Continuing reflecting over the subject he assumes the main characteristic of the future development of education technologies:

The most significant influence on the evolution of education will not be the technical development of more powerful devices, but the professional development of wise designers, teachers, and learners How a medium and its message influences its user stays a central issue [16].

5. Digital (Re) Discovery of Culture

Interdisciplinary and multicultural dimensions [17]. Interesting Edutainment applications offer different universities, libraries and museums, open for enrichment of traditional educational strategy. Such device is Momuna (mobile museum navigator) [18] based on Kids Innovation. Virtual journeys provided by science, art, history museums and libraries are becoming popular in the Digital Age, because the way they present their collections is not only informative, but attractive. The educational content is precisely chosen and the form dressing this content develops visual perception ability.

The Computer Graphics Center (ZGDV) in Darmstadt and Rostock is mixed structure that combines educational and technology institutions with common goal defined as: *bridging the gap between scientific research and practical application, contributing to the technology transfer between research institutes and industrial corporations* [19]. Some of the interesting projects in action of the Center are:

- **art-E-fact** is EU funded project (5FWP), whose goal is till 2005 to create a generic experimental platform for interactive storytelling in mixed reality that allows creation of artistic expressions within a cultural context. Goal: using knowledge base of art history to provide interactive storytelling dialogue and thus to create art exhibits.
- The goal of **Virtual Human** project, sponsored by the German Ministry of Education and Research is: virtual characters, which are part of an interactive story, being able to communicate with other virtual characters and humans to be employed in edutainment applications. For example, they will be able to discuss with each other and with the user facts about our planet system, and they will engage in adventures all over the universe. The dialogues follow didactic and narrative rules. Thus the knowledge domain, narrative models, dramatic roles and the looks are freely exchangeable.

- EduTeCH (*Edutainment Technologies for Cultural Heritage in Asia*) is focusing on the application area of Cultural Heritage and combines Interactive Storytelling, Augmented Reality technologies and Location Based Services. Goal: development of a software system, which supports the visitor of an Asian Cultural Heritage site during his visit. Using wearable devices such as notebooks, head–mounted displays or see–through glasses as well as components for GPS and tracking, the visitor will also be provided with an augmented display of reconstructed historic objects such as original buildings and people in historic dresses. A Virtual Character who represents a historic person will act as a kind of visitor guide and involve the user in an interactive Edutainment scenario.

Digitised culture (libraries and museums). Three indicative examples of Edutainment application in cultural heritage area are:

- **Library of Congress** [20] has established *the National Digital Library*, which gives wide access to its rich collection of non-book treasures. The defined goal is: "education community to nurture and strengthen a sense of cultural heritage among our nation's young people and their families"[20].
- **The Louvre museum** [21] and *National Science Digital Library* [22] in their web sites had added Virtual tours option, which offer free tour over several collections, thus popularizing French history and culture.
- *Turning the Pages Project* of the **British Library** [23] is an awardwinning interactive display system, which allows to visitor virtually to 'turn' the pages of rare books/manuscripts, using touch-screen technology and animation. Zoom tool, high-quality images and notes (in audio and text) are attached. In the Leonardo Notebook, for example, a mirror button turns the text round so visitors can read mirror handwriting. Thus, during the project realization neither the original or facsimile are damaged.

Bulgarian (none) experience. Only the *Manuscript department of the Bulgarian National Library* [24] has seven rich collections, containing more than 1500 original Slavic manuscripts dated between 11th and 19th c.; "Greek and other foreign language manuscripts with around 200 items; "Eastern manuscripts" `archives with 500 000 archival items; Early printed books and incunabula with appr. 30 000 volumes, Oriental Early printed books with around 2000 volumes; "Bulgarian historical archive" with around 1, 5 mln documents and 80 000 photos, graphics and illustrations. Their e-presence is expected to enrich the world cultural heritage. The first step is made – institutional collaboration in common goal and vision for creating National Center for Digitization.

6. Conclusion

Science in the best environments (vision for the future). *Since emerging forms of representation, such as hypermedia and virtual reality, are in their early stages of development, we are just beginning to understand how they shape not only their messages, but also their users. The core skill needed in today's workplace is … filtering a plethora of incoming information.* [16]

…Information technologies will be used as enablers for learning, just as books, pens, and labs enable learning, but few kids will actually be learning from a networked

computer. In general, I dream that we would see involvement of students in a variety of virtual communities, engagement of teachers as lifelong learners and researchers, use of online student portfolios and assessment, and regular use of the full range of network resources [25].

With the help of information technologies, scientists, students, researchers, will learn how to integrate increasingly sophisticated concepts into the curriculum, with the result that students will get used to learn faster and with greater insight.
The essential message of *Digital re-discovery of culture* came to me in e-mail form and poetic content. It belongs to the world, but appeared by virtue of Mícheál Mac an Airchinnigh. I decided to use it as a conclusion, because it is a language-game and is suited well to the ludetic Edutainment phenomena.

Whoever you are,
be faithful to tell the truth
even if it is (in) a game
to tell the truth about DRC [digital re-discovery of culture]
Maybe it is only a game?
A game, but not in vain!

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method in the VRML file (as a grouping of shapes in relation to each other with different textures, reflectiveness, and colours), the creator can develop a small, compact model. Indeed, many sites attempt to demonstrate this capability, but, even with good bandwidth and high–performance computers, the animation and exploration are slow and jerky.
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Challenging Sites for Kids of All Ages

1. **Invention at play** Explores the playful side of invention; real stories of inventors; invention playhouse [http://www.inventionatplay.org/]
2. **Discovery Channel** [http://tlc.discovery.com/games/games.html]
3. **National Geographic** [http://www.nationalgeographic.com/kids/games/]
4. **Pieces of Sciences** [http://www.fi.edu/pieces/]
5. **Smithsonian** The Smithsonian Institution is the world's largest museum organization. His newest Web site (launched in September 2003), shows authoritative content of the national treasures from the Smithsonian's collection of 142 million objects representing the nation's artistic, historical, and scientific heritage. The Web site reflects the research and scholarship of nearly 1,000 curators, researchers, and scientists. The site's Students section includes multimedia and interactive features that make museum resources exciting. [http://www.smithsonianeducation.org/]
6. **Wondernet** [http://www.chemistry.org/portal/a/c/s/1/wondernetdisplay.html?DOC=wondernet\index.html] Science place in Cyberspace
7. **Why files** Uses news and current events as springboards to explore science, health, environment and technology. [http://whyfiles.org/]

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