

# Attention and Motivation in Hypermedia Systems

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**Abstract.** We present the results of a heuristic analysis of a set of multimedia off-line systems aimed at boosting the mental skills of the users through reflexes, maths, etc. To this purpose two metrics have been created to assess the motivation of the users and the degree of help implicit in the multimedia system. The metrics are based on a group of primitives aiming at increasing the communicability of commercial multimedia systems and targeted to the public at large, regardless of age and previous experience in the use of computers.

**Keywords:** Attention, Motivation, Hypermedia, Design, Navigation, Human-Computer Interaction, Help.

## 1 Introduction

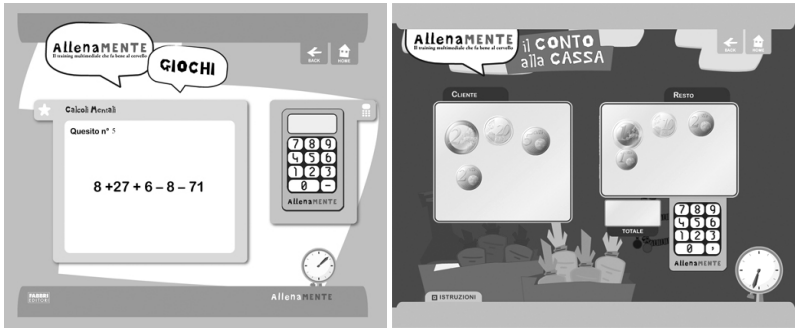
Currently there are several kinds of users of the interactive systems with very different backgrounds among them in relation to their age and the systems with which they have interacted. Their differentiation is essential to draw attention and prompt them to continue navigation through all the content of the multimedia system or go back to interact with the system, such as in the case of mobile games [1]. The origin of the democratization of on-line and off-line multimedia systems is the decade of the 90s [2]. Now, making a diachronic and synchronic interaction from the temporal point of view, today we have in the user context the following groups: the seniors or adults who have had to install via floppies and CD-ROMs, systems in the hard drive (throughout the 90s), others who have started with pocket video consoles (mid and late 90s) and those who have started to interact with on-line systems since the late 90s until now. In this last case it is also necessary to differentiate three types of users: those of the first stage, that is, when the internet democratization process starts, the second group named Web 2.0 starting with the new millennium, and Web 3.0 in 2008 [3]. As supports we have personal computers in the first group, video consoles, multimedia mobile phones, PDAs, etc. and in the third group iPods, iPhones, Wiis, etc. Both in the second and the third group the portable computers can also be included, which are currently outnumbering PC desktops in America, Asia and Europe and Japan. The users and the evolution of the hardware and the operating systems have influenced the design of the multimedia interactive systems. In Europe the multimedia systems had their momentum in the nineties with the CD-ROM

support. From 1995 onwards plenty of small and medium businesses sprang up with the purpose of digitalizing the contents in paper support. Here takes place the first transference of the concepts of the graphical arts to the design of computer interfaces. Obviously, the dimension of the screen was bigger than the classical A4 folio. Many principles of topography, colour, disposition of the images, with their texts, etc., responded to the graphical arts of the paper [4]. To design a screen at that time was to organize the background of the screen, that is to say, all the elements in the screen that contribute to the appearance and the behaviour of the interface. The background carried all the burden of the design because it covered a great part of the screen. The background, from the point of view of motivation and the design fulfills two functions: First, it has an influence in the appearance and the visual balance, and the position of all the elements. Second, it fills the void space so that other elements are not flying objects. In both cases, all the elements must be differentiated, but at the same type an isotopy must be created among them [5]. Currently, we find university websites where the background is textual, full of colours that do not respect any chromatic order for the interfaces design [6] and the text shifts vertically, joined to dissolution transitions by dots among the frames of the different nodes, at the moment of navigation. That is to say, a style from the early 90s for off-line multimedia systems but which can't be applied in the era of Web 2.0 and 3.0, especially in the university environment. An interface with such backgrounds immediately undermines motivation of the contents' fruition.

## **2 Motivation: Dynamics and Statics Means**

The motivation for this study is the whole set of dynamic means and structural resources that boost the navigational quality of a multimedia/hypermedia system. With dynamic means and structural resources, it is intended to increase or maintain interest towards the system, especially when the user is in a student role [7], [8]. The motivation seeks to focus the user's attention on the need to continue fruition of the system. Attention on the screen must be sustained, that is, the user keeps an attitude of permanent expectation with regard to the system. It is mainly virtual resources that trigger very good results in attention and acceptance towards the system, especially when there is no previous computer experience by the user. Without going deeper into psychological aspects, there are two factors related to the content and structure which allow attention to be drawn to an interface. If the content of the information is specialized, it means that the target of the multimedia system is an expert, and therefore the information must be relevant and be well-organized. Here the attention on the interface is of a cognitive character [8]. There is an "affective" link of the user towards the system because of the linearity of the message. This lineal factor forces the user to utilise the system until the end of a sequence. As a rule, the establishment of a sequence series through the use of structural methods is due to the fact that the user studies the content. These cognitive or affective factors can be used to draw attention to a multimedia/hypermedia system in a joint or individual way [9]. Choosing one way or the other will depend on the kind of user and the purpose of the system, such as educational, consultation, entertainment, etc. But both factors are present in the motivation or boosting of navigation multimedia systems one resorts continually to dynamic means to motivate fruition:

1. Music; Sound effects that are activated upon reaching a goal, such as are: to pass an educational subject with success, to go through a higher level inside a tale, to win a game, etc.
2. Voice; The narrator or speaker incorporates sentences to promote advancement through the system. For instance, in the fragmented and gradual assessment of content in a computer-assisted teaching system.
3. Text and images linked to transitional effects, such as blurring, sweeping, fade-ins, fade-outs. The textual sentences have expressions of the kind: “excellent”, “go on,” and “continue”.
4. 2D and 3D animations of characters and objects (in the universe of study they are 2D animations, made with Flash [10]).



**Fig. 1, 2.** Interfaces with 2D animations in Allenamente DVD-ROM

Examples of structural resorts which maintain and boost interest in the system: The outlines that at the end of a guided link make it possible to switch to other entities; An Index, and nodes that link to other components of the same entity. The existence of resources to promote or maintain motivation have a positive influence on the richness of a multimedia system [11]. The relationship between the attributes of wealth and motivation are based mainly on resources that belong to the visual component, such as the images and interactive help. Interaction with the system can generate a series of mistakes due to either hardware or software. Hypermedia systems usually have means to solve these hardware errors as well as those of software. There are several ways of presenting help in the interface. This help can be classified in regard to the access and the presentation in the form of tutorials, outlines and exploratory texts:

1. Help in the shape of a tutorial consists of a collection of screens with an index on the first of them (can be activated from all the screens in the system –fig. 3 [12]).
2. Help of the outline kind is that in which on a single screen are explained the functions of the main components of the interface, as it can be observed in figure 4 [13].
3. The exploratory help is that in which as the cursor moves along the keyboard, the explanation is activated, for example, in figure 5 [14]. In the automatic correction

of Gmail spelling, for instance, sometimes we see how the first word remains hidden, thereby preventing a quick visualization of the possible correct words. (figure 6). A good example of this is the interface of the Cinemanía system as it can be seen in the figure 4.



Fig. 3. Help in the form of a tutorial

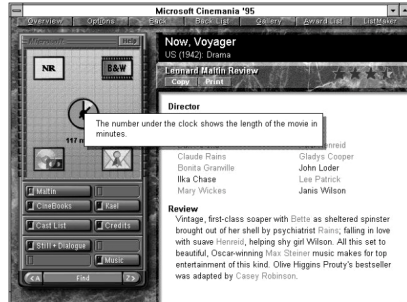


Fig. 4. Help of the outline

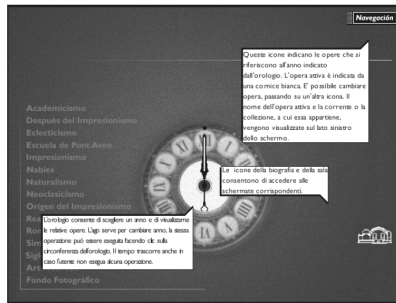


Fig. 5. Upon placing the cursor on the clock icon the meaning appears



Fig. 6. Gmail spellchecker –the first word remains hidden

There are several ways to activate help for the explanations of the components of a screen, such as the shifting of the cursor on the interface; through an option as has been seen in figure 5 or in the presentation of the system. In this last case it is shown in the shape of an automatic animation before it appears on the main screen. However, 63% of the analyzed multimedia systems lack available aids on all their screens. Access to these aids should be constant in all the screens of the system regardless of the place within the structure in which the user finds themselves. Although the purpose of the aid is to facilitate interaction, there are systems in which the help is not a solution to the user, since they increase disorientation and demotivation within the interaction. The use of some kind of help or another at the moment of design will depend on the user of the system [15]. Among the different kinds of access to help, the most positive to the expert user are the outline and exploratory modalities. The outline modality allows users watching on a single screen all the explanations of the components in the shape of an outline which speeds up reading, but obviously avoiding the failure in figure 5. For the inexperienced user, it is positive to have a simple movement of the mouse from which the meaning of the subject indicated on the screen is revealed through exploration. However, for an expert user the exploratory help can turn out to be negative by watching information he/she already knows. This is due to redundancy of information, and to the fact that exploration requires a longer time at the moment of interaction with the system. For these kind of users it is advisable to use other means of help.

### 3 Attention and Users

The treatment of the attention stimuli must pursue a simplification, hence the organization of the framing of the visual dynamic means is important. Creating excessively informative situations must be avoided in order not to wear down the user. This can only fully handle a small fraction of the whole information that reaches his/her senses. Through the capacity for selective attention the user pays attention discreetly to some stimuli while ignoring others. In any development in which a great amount of elements are combined, as it happens in any message of the visual dynamic means, this process takes place. If a big part of the development of the speech is left to the user's selective attention ability, you run the risk of not being able to establish an effective communication, because it is liable to trigger many limited interpretations and in some cases overlapping interpretations. Here we do not refer to the participation margin, to the stimulation of the user's imagination that any hypermedia must present [9], [16] but to the lack of structuring or conductive order of the sense. In this sense the camera movements (video or animation) are important. For instance, in the horizontal movements there is a tendency to split the screen in two halves, one to the left where we place the I and now, and another to the right, where we place the "you", the future and any pictorial object located in this part tends to look bigger. Therefore, the movements from left to right symbolize a movement from I to you, the movement in direction to the world, the progressive movement. Its perception demands lesser effort than those aimed at the right. The movements from right to left are related to traditionalism and interiorization, it is a conservative movement, in direction to the origin, to the I. The direction of the movement also affects the

perception speed by the user [17], in general the descending motions and from left to right are faster than ascending ones, and those from right to left. Here is the reason of the importance of the elements that make up the visual composition of the dynamic means. The sound is another element to be combined during the composition has a similar treatment, in front of the attention and the stimuli that make it work, for example in games [18], or the audio channel, by establishing relations to the visual side, constitutes a semantic and/or expressive boost in the whole articulation of the multimedia content. The obtained results make it clear that in the set of analyzed systems, motivation is only of 20% value, and the quality of the help is equal to 35% of the analyzed cases, as revealed through heuristic techniques. Consequently, the analyzed systems are not communicable to those users who do not have previous wide experience in the use of computers.

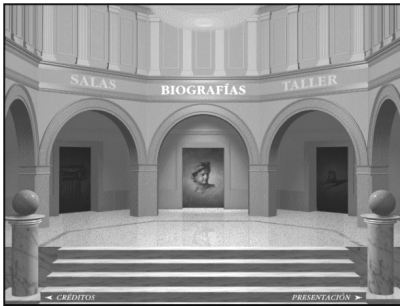
### **3.1 Attention, Users and Audio-Visual Factors**

With the passing of time and the reduction of the size of screens it was necessary to include other components from the dynamic means in order to appeal to the attention and the motivation of the users. One of those was the video. A good image that speaks and moves has a greater communicative power than that of a photograph or a graphic, for instance. However, it loses that ability to draw attention and motivate the user if the content does not convey a message or a captivating experience. Evidently, the fact that the longest video segments require a greater variety and more attention to the coordination of those segments (something missing here!). Twenty seconds with an anchorman who makes you think of a speaking statue may seem like eternity to a teenager, whereas a 75 second long action sequence will seem short as compared with the first. Now, from the point of view of design of the interface it is necessary that the video merges to some extent with the rest of the objects that make it up. In multimedia off-line systems the use of video was cut down to a minimum for several reasons: the room occupied in megabytes in the PC, the low quality of the full screen reproduction with which they were cut down to 10-12 cm. long small squares or rectangles (the user was accustomed to seeing these kind of images in the screens of computers which were over 20 inches big), the copyrights, etc. The computer animations through the video games consoles would breed another generation of users of multimedia systems dedicated to a pastime who didn't use the keyboard or the PC mouse [17]. In those systems, the animations tried to draw the attention of the users through the audio, that is to say, the music, the special effects, etc. , which were especially created for each one of the interactive games. In order to successfully integrate the sound in the interface it was necessary to pay attention to the synchronism among the music levels, the human voice in the narration (where it exists) and the sound effects. All of them were well-balanced in order to achieve the desired effect on the user, especially in the design category known as panchronism. In the combination of the audio with the animations there was an excellent coherence of the colours, lightning and scenography, the characters the script of the plot or adventure, etc. Many of these design strategies in the dynamic and static means have been boosted through lighting, for instance.

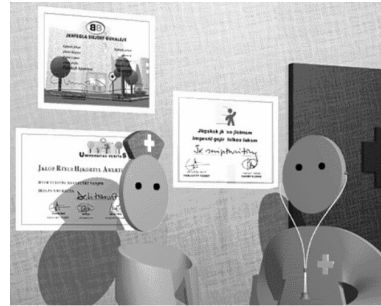
## 4 Visual Attention

Evidently it is very important that the illumination component and special effects (FX) enter into learning process independently of the contents and animations 2D and/or 3D. We have three main effects:

- **Lighting effects:** The effects stemming from lighting such as are shadows, reflections, diffusion, etc., must also remain constant in the whole hypermedia system. The lighting effects derive from the kind of light that is used in scenes with tridimensional objects. This kind of light can be environmental or directional. In environmental lighting the objects that receive the light generate shadows, whereas in directional lightening a beam of light is emitted over a given object of the scene. When there is more than a beam of light, lighting is multidirectional. In the following figures extracted from the off-line multimedia systems Braincity [18] and Universal History of Art [19], there are examples of lighting. The correct use of environmental light can be seen in all the scenes that make up the application and in the Universal History of Art. Through directional lighting the main options of the system are shown and activated.



**Fig. 7.** Directional lighting (center of the image)



**Fig. 8.** Environmental lighting

- The effects of the reflection or shining simulate the arrival of the light to a spot in an object. This light can be depicted in the shape of a star. The shine can be either static or dynamic. It is dynamic when an animation is associated with it. The animation may consist in a switch of 360° over its axis or in an increase or diminution of the shining. This effect is used mainly when in the background of the screen the black colour prevails, the scale of grey and blue shades, and all the metalized colours such as gold, silver, copper, etc. The shine means prestige or superiority of an element in relation to the others that make up the interface. They can also be useful to draw or attract the attention to an element in the screen. In the Movie Guide we can find a dynamic shine (the intention is to stress a “search wizard” which can be activated from any place in the structure of the system).
- **Relief effect:** There was an attempt in the 90s to emulate the shadows produced by environmental lighting in the screen elements. The purpose in these first

hypermedia systems was that these bidimensional elements “acquire” tridimensionality. Emulation is obtained by correctly darkening the edges of those elements that are intended to be stressed in the interface. Today it is a common element in the web 2.0 and web 3.0. Between these two elements the navigation keys can be mentioned, typography, picture frames, etc. It is a positive effect in all the navigation keys, since they are easier to recognize in an interface, as it can be seen by comparing figures 9 [21] and 10 [22]. The interface of a multimedia system has a greater degree of realism with the emulation of the shadows, which favors their acceptance.



Fig. 9. A greater degree of realism

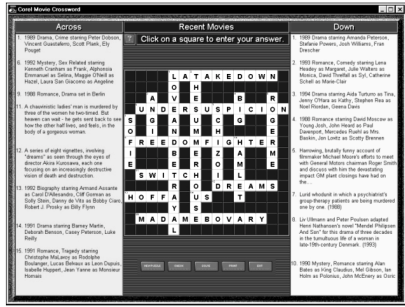


Fig. 10. A normal degree of realism

Without any doubt, lightning, colours, shapes, the organization of the contents, etc. have a very important role in the motivation and in the attraction of the users in the on-line and off-line multimedia systems. A good or bad lightning of the components that make up the interface can boost or not the interaction of the potential users, regardless of their content and the goal of the interaction: entertainment, educational, informative, etc.

## 5 Heuristic Evaluation: Results

In our case we have assessed as a representative example a set of 15 multimedia systems in DVD-ROM support from the Allenamente collection [10], which theoretically favors language, logic, memory, etc. Besides, it contains an endless series of games and exercises for self-assessment the more the user advances in the contents.

The search for the presence of the motivation and the attention in the ensemble of the analyzed off-line multimedia systems has led us to create a series of metrics. For their elaboration we have resorted to the primitives stemming from the evolution of the interactive systems: hypertext, multimedia and hypermedia. The listing of primitives and the design categories to which they refer are: in annex #1. The graphic showing the obtained results. The graphic demonstrates the scarce quality from the motivation point of view and the attention of the analyzed systems.



## 6 Conclusions

The motivation and the holding of the users' attention in the content of interactive systems: multimedia, virtual reality, etc. is one of the main goals at the moment of the design. Now, the 3D graphic informatics has more available resources in this sense than 2D informatics. The dynamic means play a very important role at the moment of drawing and keeping the users' attention. The metrics presented in this work have made it apparent how in the off-line multimedia systems with 2D animations there is a scarcity of animated graphic resources and a lack of creativity in the planning of the contents. An interesting content without resorting to communicability may turn out to be negative for the potential users to keep on navigating through the different systems that make up a wide multimedia systems collection. The motivation and the attention to the design of an interactive system must not only involve the content, but also each one of the following categories: presentation, navigation, structure and synchronization of the dynamic means, that is, panchronism. All these categories must include the quality attributes for multimedia/hypermedia systems off-line and on-line.

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## References

1. Soh, J., Tan, B.: Mobile Gaming. *Communications of the ACM* 51, 35–39 (2008)
2. Cipolla-Ficarra, F., Cipolla-Ficarra, M.: Interactive Systems, Design and Heuristic Evaluation: The Importance of the Diachronic Vision. In: *New Directions in Intelligent Interactive Multimedia*, pp. 625–634. Springer, Heidelberg (2008)
3. Silva-Salmerón, J., Rahman, M., El Saddik, A.: Web 3.0: A Vision for Bridging the Gap between Real and Virtual. In: *Proc. 1st workshop communicability design and evaluation in cultural and ecological multimedia systems*, pp. 9–14. ACM Press, New York (2008)
4. Kahn, P., Lenk, K.: *Principles of Typography for User Interface Design*. *Interactions* 6, 15–29 (1998)
5. Cipolla-Ficarra, F.: Evaluation of Multimedia Components. In: *Proc. IEEE Multimedia Conference on Multimedia Computing Systems*, pp. 557–564 (1997)
6. Cipolla-Ficarra, F.: HECHÉ: Heuristic Evaluation of Colours in Homepage. In: *DVD-ROM Proc. Applied Human Factors and Ergonomics, Las Vegas* (2008)
7. Cipolla-Ficarra, F.: Evaluation and communication techniques in multimedia product design for on the net university education. In: *Multimedia on the Net*, pp. 151–165. Springer, Heidelberg (1996)
8. Edwards, A., Holland, S.: *Multimedia Interface Design in Education*. Springer, Berlin (1992)
9. Card, S., et al.: *The Psychology of Human-Computer Interaction*. Hillsdale, New Jersey (1993)
10. *Allenamento DVD-ROM*. GreenTeam, Bologna (2008)
11. Cipolla-Ficarra, F.: Evaluation Heuristic of the Richness. In: *Proc. International Conference on Information Systems Analysis and Synthesis, ISAS, Orlando*, pp. 23–30 (1999)

12. Enciclopedia de la Ciencia CD-ROM. ZetaMultimedia, Barcelona (1998)
13. Cinemania CD-ROM. Microsoft, Madrid (1996)
14. Musée d'Orsay CD-ROM. Montparnasse Multimedia, Paris (1996)
15. Dworman, G.: Arbitration of a Help System. *Interaction* 14, 39–42 (2007)
16. O'Neill, S.: *Interactive Media –The Semiotics of Embodied Interaction*. Springer, London (2008)
17. Terzopoulos, D.: Artificial Life for Computer Graphics. *Communications of ACM* 42, 32–42 (1999)
18. Raghuvanshi, N., et al.: Real-Time Sound Synthesis and Propagation for Games. *Communications of the ACM* 50, 66–73 (2007)
19. Braincity CD-ROM. Digital Illusion, Barcelona (1995)
20. Historia Universal del Arte CD-ROM. Espasa-Calpe, Madrid (1996)
21. Explorama CD-ROM. Anaya, Madrid (1995)
22. All Movie Guide CD-ROM. Corel, Ottawa (1995)

## Annex #1: Primitives and Graphic Results

**Table 1.** (*P*)rimitives for heuristic analysis of the motivation and attention (design categories: content, dynamics, structure, presentation and panchronic)

*Analepsis* (P): Content and Dynamic; *Continuum* (P): Content and Dynamic; *Element* (P): Content; *Element Type* (P): Dynamic and Structure; *Entity* (P): Content and Presentation; *Frame* (P): Presentation, Content, Dynamic and Panchronic; *Frame Principal* (P): Presentation, Content, Dynamic and Panchronic; *Guided Tour* (P): Presentation, Structure and Dynamic; *Hierarchical Links* (P): Structure and Dynamic; *Index* (P): Structure and Dynamic; *Hypertrails* (P): Structure and Content; *Keyword Links* (P): Content; *Link* (P): Structure; *Node* (P): Content; *Polytopes* (P): Presentation and Content; *Polysemy* (P): Content; *Referential Links* (P): Structure and Content; *Sememe* (P): Content.

