

The Fragmented Eye

Cinematographic Techniques for Architectural Animations

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In order to contribute to the elaboration of more expressive architectural animations, some famous films, documentaries of buildings and award-winning animations were analyzed. This was carried out examining the cinematographic techniques used at three levels of filming language; image setting, shot movements and montage, according to concepts described in theoretical texts. The analysis revealed an extensive use of techniques, in particular in movies, that give graphic diversity and perceptual stability. Based on that, it proposes some ideas for the planning of an architectural animation and a computer implementation of some filmic concepts, in particular related to movements of the point-of-view. This study suggest a fragmented view of building designs, to get an appealing moving presentation, with visual interest and continuity, as such should be also in architecture.

Keywords: *Animation, Film, Image, Movement, Montage.*

Introduction

Sequential images of 3D-models and video-editing software nowadays allow the production of digital animations to show architectural designs. Nevertheless, the computer tools don't help the development of these kinds of presentations and design professionals lack experience to exhibit buildings through moving images. As a consequence, most of these animations are only long and quick tours. Some manuals, like Bartlett (1996) and Jones (2000), suggest applying cinematographic techniques to elaborate animations. Besides, several authors (Bridges, 1993; Saas, 1995; Mark, 1997; Rafi, 1998 and Temkin, 2003) have studied filmic principles for

architectural animations, demonstrating the possibilities of these concepts to make expressive presentations, but examining a small amount of movies and features.

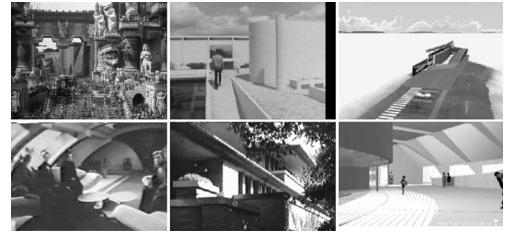
For this reason, we carried out an exhaustive analysis of cinematographic techniques in several famous films, and also documentaries of buildings and award-winning animations, to study productions more related to architectural contents. The films were selected from different ages and also according the environments exhibited: „Intolerance“ (D.K. Griffith, 1916), „Metropolis“ (F. Lang, 1927), „Citizen Kane“ (O. Welles, 1941), „Mon Oncle“ (J.

Figure 1
Frames of some movies, documentaries and animations studied.

Tati, 1958), „2001-A Space Odyssey“ (S. Kubrick, 1968), „Bladerunner“ (R. Scott, 1982), „Total Recall“ (P. Verhoeven, 1990) and „Episode II-Attack of the Clones“, (G. Lucas, 2002). In each case, a sequence that shows for the first time a particular place was selected (respectively; the courtyard of the Babylonian palace, the office building of John Fredersen, the headquarter of Inquirer newspaper, the Arpel's House, the Discovery starship, the Tyrell Corporation, the Doug Quaid's apartment, and the Senate Amidala's refuge).

The documentaries are parts of cultural videos that shows historical buildings: Ville Savoye of Le Corbusier (BBC, 1972), Basilica Saint Marc in Venice (Bauerischer, 1980), Church in Hokkaido of Tadao Ando (M. Blackwood, 1989), Eastern Palace in Madrid (Agostini, 1992), Royal Castle in Prague (F. Verlag, 1992) and Robie House of F.LI.Wright (Ed. Planeta, 1994). The animations show the Republic Pavilion of J.L. Sert (Soft, 1992), a Speedway Center (S. James, 1997), Urban Residence (T. Maeda, 1998), Insurance Building of F.LI.Wright (DiSimone, Kosinski and Frampton, 1998), Rockbridge Cristian Church (Llonch and Vidalle, 2002) and a Gothic Cathedral (Platige, 2002). These works were selected or prized in the Autodesys competition, Architecture & Animation Festival of Barcelona and Siggraph Conference.

All the productions were analyzed at three levels of filmic language: the framing or composition of the image, the shot or continuous filming of the camera, and the montage of sequence. This was done according to characteristics described by traditional theorists in the field (Arnheim, 1931; Eisenstein, 1949; Martin, 1955) and recent reviews (Aumont et al, 1983; Katz, 1991; Bordwell and Thompson, 1993). The movies and documentaries were digitized, and in all cases the shots were identified and particular frames were extracted. Graphic conditions were surveyed and the spaces filmed were drawn in plans to determine the position and displacement of point-of-views. The features were related to each other and to perceptual effects. In



addition, information about the realization, buildings showed and cultural context, was collected.

Analysis

The review of the productions showed an extensive employ of cinematographic techniques, clearly more in movies than animations (except in camera movements), with several properties not mentioned in the filmic texts.

Framing

The border, such is the first condition of the image, in the sequences analyzed is regular, orthogonal and usually with an aspect ratio of 4:3. Several movies have a panoramic format (around 16:9), apparently to involve the spectator, more than to give additional information. This is related to few camera movements, indoor views and vertical shapes. In fact, the majority of images have outlines that balance the horizontal dimension of the frame (and concentrate the visual attention in the center of image), although they are frequently interrupted and combined to avoid monotony. Also, in the movies, the borders of shapes have coincidences with certain axis of the images (graphical guides), in particular with the horizontal lower third and with the vertical left third, probably to maintain gravitational stability and to compensate the right-hand direction, proper of our habit of reading. Besides, the films distinguish better some focus of interest in the images, through movements of elements, but also with different forms and lighting that reinforce its recognition.

Many images have a composition of the visual focus

or shapes. In animations, closed quadrilaterals are common and, in the movies, diagonals between graphic elements in the upper part of images. These resources add to stability or dynamism respectively. Almost half of the frames show graphic balance, particularly in films, through different figures and direction of movements, around a vertical axis with an asymmetric arrangement. This is done also between shots (particularly in dialogues), alternating visual weight. In all cases the images show a clear expression of spatial depth, through different backgrounds (in movies) or edges in perspective (in documentaries and animations). However, they also show, particularly in documentaries, a partiality of the elements, suggesting an extension of volumes and spaces.

The scale of the image, a traditional filmic concept related to the size of bodies showed, if it is transferred to the buildings, presents a predominance of medium size with a equivalent participation of close-up and large views. This corresponds to different distances of camera. The visual angle (field-of view) have, in all productions studied, a regular average (closer to 48°). But with many variations and narrower values in the movies, probably to facilitate the selection of images. Also, the vertical inclination of camera has, in the film sequences studied, a compensated assortment of positive and negative angles. The documentaries have more positive inclinations (look up) and animations, more negatives (look down) that give different emotional effects (emphasize or diminish).

The location of the point-of-view also is related to composition of image, with an average of 28 m to the elements showed. It is closer in documentaries and further in animations (although they have wider visual angles and smaller buildings), and in the movies are very diverse. The position of sight is also higher in animation than in other productions that have a small variation (1,6 to 15 mts.). The horizontal angle to the elements is reduced in indoors and is around 30-40° in outdoors, to show the volumes, remarked in movies and documentaries through

contrasted illumination.

Shot

The shot is the extension of the image in time (such involves movements). The average duration of all productions studied is 10.71 seconds, although the last movies are quicker, with shots of around 4 s. Usually, the durations are distributed in brief shots of 2 or 3 s, medium shots of 8 to 10 s, and extended shots of 30 to 60 s, (these last are few but count more in the whole). The duration is related to the use of movements and the role of the shot in the sequence, but not to the size of view or distance to buildings, that is to say that it is not related to the amount of information.

The movements inside the frame (displacements of elements without moving the point-of-view) are more frequent in the movies, maintaining the visual attention and participating in the composition. Optical changes of angle (zooms) that appear as camera displacements, are very rarely used in the sequences studied. Probably because they lack motion-parallax, deteriorating the perception of space.

In the digital animations analyzed a half of the shots include camera movements, apparently less than what is usual in these types of productions, but more than the movies studied that have only a fifth of the shots with movements. The documentaries have a similar amount, but they are mainly camera rotations (pan and tilt) instead of displacements parallel (dollies) or perpendicular (traveling) to the line of sight, more frequent in animations. Also, the length of displacements is longer in digital presentations. In movies and documentaries the displacements are shorter than the buildings or rooms showed, around 20 m in aerial views and 8 m in pedestrian shots. Besides, in the cinematographic productions the velocity is closer to walking speed (1 m/s), but faster in aerial views (12 m/s). The rotations are also shorter in these cases, developing around 42° (similar to the width of the image) with an average velocity of 7°/second Usually the trajectories are slight curves with a reduced inclination of sight, inside the same

space, never changing rooms or making detours. As the movements are related only to durations, probably they require a temporal understanding, not linked to the content, but to a fluid visual diversity, concentrated in few shots.

Montage

The sequences studied have a total duration of around 3 minutes with an average of 19 shots, which looks a proper amount to present a particular place. The distribution of durations, called the „metric“ of montage, have a varied arrangement, with a graph in „waves“ (in some cases in „saw“). They include long shots, to give emphasis (at the beginning or in the middle), and short and medium shots to create rhythm and diminishing on time. The transitions used between shots are mostly a simple cut (except in digital animations where dissolving transitions are used more). This resource doesn't disturb the reading of shapes, as other type of transitions do, and serve to remark the change of shot.

The point-of views are spread throughout the building, but according to a strict order between outdoors and indoors, maintaining a clear sense of the spatial situation. The movies and documentaries only show outdoor sights at the beginning, and after that, only indoors. In some cases they finish up also with outdoors or change the order but never mix it, as it is usual in animations. They neither tour the entrances of buildings, they are only suggested. Besides, the direction of sights is frequently opposed between a shot and the next, according to symmetric angles (similar to a thumb rule in film dialogues) and usually they begin on the left side, continuing on the right and then on a frontal view. Both cinematographic productions shows only one indoor room in the sequence, with cameras distributed in the perimeter. Furthermore, they never show one of walls (although it is constructed) or one outdoor façade, maybe taking it as a perceptual support for the changing views.

The montage of shots takes special care to maintain the continuity of place and time, through similar

graphic treatment and having some elements repeated in several shots but changing during the sequence. Some shots have texts with titles, credits or explanation, using appearances related to presentation. All productions use continuous sounds between the shots. Casual music or speech in documentaries are used to describe additional information or characteristics of the building not directly showed.

The development of montage looks first a visual variety, and secondly, a progressive presentation with reduction of views (long shots to close-up), continuing with a formal and narrative accent of some characteristics. Like the organization of „situation-action“ suggested by Deleuze (1993), which is clearer in the movies and documentaries, and also, more related to living features than formal descriptions.

The meaning of the presentations, that naturally depends on context, public and precedents, have in the cinematographic productions a convergence to a particular quality that denote the presentation.



Figure 2
Shots of the sequence of „Citizen Kane“.

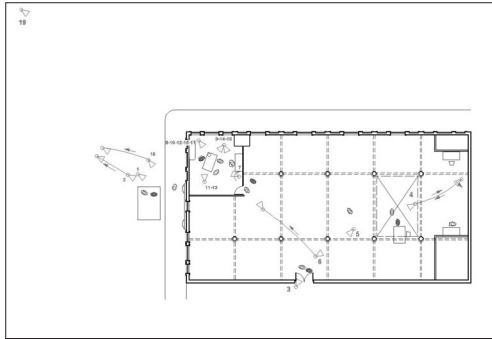
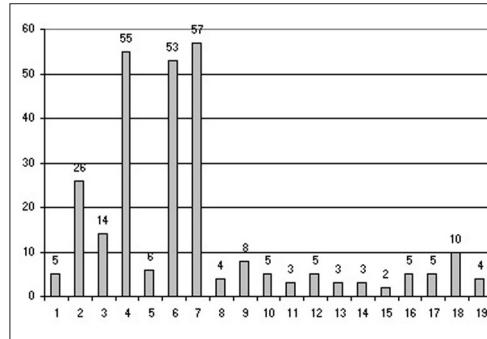


Figure 3
Plan with location and movements of cameras.

Figure 4
Duration of shots (metric).



Usually this condition is secondary or contradicts the traditional knowledge of the building or situation, creating a slight intellectual tension, or at least, a novelty approach. The documentaries, and also animations give a sense of accessibility, but digital presentations, through its integral and repetitive scrutiny of the building, express a geometrical satisfaction and technical skills, like a confirmation of the work instead of subversion insinuated by films.

Preparation

For the application of filming principles in architectural animations a proper planning of the production must be regarded first. Clarifying the aim or the expected meaning is more important than to show many views of the project; as it is being aware of additional connotations, like to display particular capabilities or contributions of the design. It is also important to consider the public and the context of the presentation and the possibilities of elaboration according to the equipment and time available, in order to concentrate the efforts and the visual organization to clear objectives.

After that, there should regard a narrative development of the presentation (a technical script), describing briefly the contents to show, the shots planned and requirements involved (to model some parts of the design, to get sounds, speeches, images or to film the site). There should also be an initial definition of the order and duration, and the graphic

style, searching to emphasize the meanings.

Next, a visual planning (storyboard) must be carried out, not strictly related to shots: sketches of some images during movements, static views and titles, to define proper framing should be enough. Changing the order or developing successive alternatives, including snapshots of the model and test animations, as suggested by Rafi (1998), looking for different ways to fulfill the aim expected.

Location and movements of cameras can be defined with geometrical aids and controlled development on time. Also reviewing detail, illumination and texturing of the model, according to the certain sights.

This preparation should be carried out before the geometric construction and rendering, or at least, simultaneously, but not after, to avoid wasting time or to show things only because they are made. In particular, to have some previous time to plan the presentation, not to do it at the deadline.

Implementation

To implement some concepts identified in the analysis, in particular movements of the point-of-view, we are developing additional resources for popular modeling and animation software (3DS-Max). Not as mandatory process, but as alternative aids that may be freely used or modified at any stage. Some of them as prepared procedures, others as written comments or indirect suggestions (as to of-

fer certain possibilities or default values). They are arranged through a floating rollout programmed in Max-Script with graphic icons. The typical procedure is: to define the location of the point-of-view, to create a fixed or animated camera, to render a frame for reviewing the composition of the image, to render the full shot, to play the file so created and to include in a special folder it for later edition.

The position of cameras can be based, at the beginning, in the outdoors contour, a selected indoor space or some details of the project. Through reference objects (gizmos) that also help to distinguish these parts in the model, due the usual confusion of wire-frame geometry. Then, some cameras can be created automatically to get opposed views, or the positions can be defined picking an element in the model, selecting certain distance and pedestrian or aerial height or typing coordinates.

In the review of the frame, the image is displayed with some axis to guide the composition and lateral checklist of recommendations. It generates a frame at the middle of the shot or one from the beginning or the end can also be chosen. Some conditions can be defined (proportion of frame, size in pixels, field-of-view, inclination, distance and horizontal angle) or confirm the values suggested by the analysis.

The duration of the shots can be defined in seconds or frames (according to the fps), with alternatives to fixed or moving views. Movement of objects and optical changes are suggested to be developed by regular procedures of the software. But it offers a variety of camera movements programmed; short rotations or displacements for indoor and closer views, longer trajectories for outdoors. They are indicated through schematic symbols and simple phrases (look to left, look up, go ahead, go right, descend, orbit, maraud, etc). All of them are based on positions defined through variables in the script, geometrical development according to the duration of shot, and proper velocities for distance to the elements showed. The cameras are created with few key-frames to facilitate the modification. The properties of camera are based on image condi-

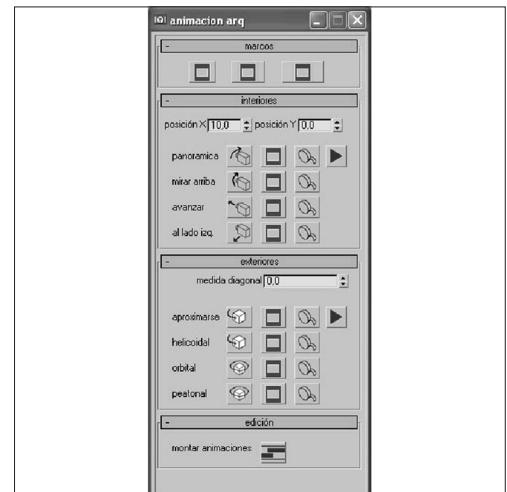
tions, and can be changed while maintaining the name of camera.

The files rendered are stored in a folder for edition, with template frames for texts and basic music files (suggesting also the incorporation of sounds effects, oral description, images or filmed material about the subject). Then, from the rollout it can also be called the video-post utility or video-editing software, with structures of duration and recommendations for montage.

Conclusion

The main lesson that cinematographic techniques can give is to breakup the exhibition of buildings. In particular, in camera movements, to cut the typical long tour into short and separate sections related to the main parts of design, to create a fragmented but meaningful presentation. Because the visual perception process is not continuous; but usually we think it is so, assuming that extending a view will result in a more complete presentation. The film language, developed through many years of experimentation, reveals how many fundamental characteristics of the vision system are taken into account,

Figure 5
Rollout with movements programmed.



from image boundaries to montage techniques, with a combination of stable conditions (as vertical axis, graphic balance, location of camera, smoothness of movements, sequence of meanings, etc), with dynamic characteristics (asymmetry, formal diversity, facing directions, narrative development, etc), feeding different layers of mental attention. Maintaining together general orientation with local interest. The traditional mistake of most architectural animations is that the four dimension of time (4D) is regarded in a similar way to that of the three geometrical axes, to lengthen the sight, instead of to develop the presentation, according the visual process and interpretation.

The involvement of time in animations changes the traditional approach of representation in architecture that limits itself to the display of formal distribution, leaving the search for relationships, situation and meanings, to the visual understanding of the observer. But in moving images the lack of time to study the geometric detail must be replaced by spatial orientation and semantic content. This characteristic also could be regarded in architectural design. If we think that cinematic presentation is closer to user experience than static drawings, this means that we should emphasize this basic order and sensitive development, instead of being concerned about formal styles. Searching to manage the „fragmentation“ of contemporary cities with a cultural arrangement.

Further work can be done evaluating the implementation and uses of the techniques identified, and also to extend the research to the animation of architectural forms and other ways of analyzing designs. This approach could also be applied to other contents, such as animated presentations of industrial products, historic events, tourist locations, etc., and to review its social implications.

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References

- Arheim, Rudolf: 1931, *Film als Kunst*, Germany (trans. *El Cine como Arte*, Ed. Paidós, Barcelona, 1996).
- Aumont, Jacques; Bergala, Alain; Michel, Marie y Vernet, Marc: 1983, *Esthétique du Film*, F. Nathan, Paris (trans. *Estética del Cine*, Ed. Paidós, Barcelona, 1996).
- Bartlett, Brandon (ed.): 1996, *3D-Studio Architectural Rendering*, Ed. New Riders, Indiana.
- Bordwell, David and Thompson, Kristin: 1993, *Film Art. An Introduction*, Ed. McGraw-Hill, New York (trans. *El Arte Cinematográfico*, Ed. Paidós, Barcelona, 1995).
- Bridges, Alan H.: 1993, *Animation Techniques in Architectural Visualisation*, in *IV Simposio Internacional sobre Diseño Asistido por Ordenador en la Arquitectura e Ingeniería Civil, ARECDAO'93*, Barcelona, pg. 443-453.
- Chen, Xiaolei y Philis, Atiba: 2004, *Construct a Narrative About a Building Using Video*, in *Proceedings of 9th. International Conference of CAADRIA*, Seoul, Korea, pgs.803-814.
- Deleuze, Gilles, 1983, *L'image-mouvement. Cinema I*, Paris (trans. *La imagen-movimiento. Estudios de cine I*, Ed. Paidós, Barcelona, 1991).
- Eisenstein, Sergei: 1949, *The Film Form*, H. B. Jovanovich, Moscow (trans. *Teoría y Técnica Cinematográfica*, Ed. Rialp, Madrid, 1999).
- Jones, Angie: 2000, *3DS-Max: Professional Anima-*

- tion, Prentice Hall, New Jersey (trans. 3DS-Max: Animación Profesional, Prentice-Hall, Madrid, 2000).
- Katz, Steven, 1991: *Film Directing: Shot by Shot*, M. Wiese Productions (trans. Plano a Plano, de la idea a la Pantalla, Ed. Plot, Madrid 2000).
- Mark, Earl: 1997, "The Physical and Conceptual Assembly of Architectural Form", in F. Penz and M. Thomas (eds), *Cinema & Architecture*, BFI Press, England.
- Martin, Marcel: 1955, *La Langage Cinematographique*, CERF, France (trans. El Lenguaje del Cine, Ed. Gedisa, Barcelona, 2002).
- Rafi, Ahmad: 1998, *Computer Animation for Architectural Visualisation*, Doctoral Thesis, Strathclyde University, Glasgow.
- Saas, Lawrence: 1995, *Animation and Architecture*, in <http://www.mit.edu:8001/afs/athena.mit.edu/course/4/4.299/Students/1sass/Anim/Text/anim.html> : **May 2003**.
- Temkin, Aron: 2003, *Seeing Architecture with a Filmmaker's Eyes*, in *Connecting the Crossroads of Digital Discourse*, ACADIA22, Indianapolis, Indiana, pg. 227-233.