Manovich, Lev. "Media design." *Software Takes Command*. New York: Bloomsbury, 2013. 243–328. *Bloomsbury Collections*. Web. 26 Apr. 2023. <<http://dx.doi.org/10.5040/9781472544988.ch-005>>.

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CHAPTER FIVE

Media design

“We shape our tools and thereafter our tools shape us.”

Marshall McLuhan, *Understanding Media* (1964)

After Effects and the invisible revolution

Media hybrids are not limited to particular software applications, user interfaces, artistic projects, or websites. If I am right in suggesting that hybridity represents the next logical stage in the development of computational media, following the first stage of simulating individual physical media in a computer, then we can expect to find it in many cultural areas. And this is indeed the case. In this chapter I will look at a single cultural area in depth—moving image design—analyzing how the creation and aesthetics of moving images changed dramatically in the 1990s.

Around the middle of the 1990s, the simulated physical media for moving and still image production (cinematography, animation, graphic design, typography), new computer media (3D animation), and new computer techniques (compositing, multiple levels of transparency) met within a single software environment—compatible software programs running on a personal workstation or a personal computer. Filmmakers, animators, and designers started to systematically work in this environment, using software both to generate individual elements and to assemble all elements

together. The result was the emergence of a new visual language that quickly became the norm.

Today this language dominates the visual media produced in dozens of countries. We see it daily in commercials, music videos, TV graphics, film titles, interactive interfaces of mobile phone and other devices, dynamic menus, animated web pages, graphics for mobile media content, and other types of animated, short non-narrative films and moving-image sequences being produced around the world by media professionals including companies, individual designers and artists, and students. All in all, I estimate that at least 50 percent of short moving image works follow this language. In this chapter I will analyze what I perceive to be some of its defining features: new hybrid visual aesthetics; systematic integration of previously non-compatible media techniques; use of 3D space as a platform for media design; constant change on every visual dimension; and amplification of cinematographic techniques.

The new hybrid aesthetics exist in endless variations but its basic principle is the same: juxtaposing previously distinct visual aesthetics of different media within the same image. This is an example of how the logic of media hybridity restructures a large part of culture as a whole. The languages of design, typography, animation, painting, and cinematography meet within the computer. Therefore, along with being a metamedium as formulated by Kay, we can also call a computer a *metalanguage* platform: the place where many cultural languages of the modern period come together and begin creating new hybrids.

How did this language come about? I believe that looking at the software involved in the production of moving images goes a long way towards explaining why they now look the way they do. Without such analysis we will never be able to move beyond the commonplace generalities about contemporary culture—post-modern, global, remix, etc.—to actually describe the particular languages of different design areas, to understand the causes behind them and their evolution over time. (In other words, I think that “software theory,” which this book aims to theorize and put in practice, is not a luxury but a necessity.)

Although the transformations I will be discussing involved many technological and social developments—hardware, software, production practices, and workflows, new job titles and new

Opening titles animation for television series Mad Men. Imaginary Forces, 2007.

professional fields—it is appropriate to highlight one particular software application which was at the center of the events. This application is After Effects. In this chapter we will take a close look at its interface, the tools, and its typical use in media design. Introduced in 1993, After Effects was the first software application designed to do animation, compositing, and special effects on the personal computer.¹ Its broad effect on moving image production can be compared to the effects of Photoshop and Illustrator on photography, illustration, and graphic design.

After Effects certainly has its competitors. In the 1990s, companies also widely used more expensive “high-end” software such as Flame, Inferno, or Paintbox that run on specialized graphics workstations, and they are still utilized today. In the 2000s, other programs in the same price category as After Effects such as Apple’s Motion, Autodesk’s Combustion, and Adobe’s Flash have also challenged After Effects’ dominance. However, because of its affordability and length of time on the market After Effects continues to be the most popular, most widely used, and best-known application. Consequently, After Effects will be given a privileged role in my account as both the symbol and the key material foundation that made the wide-reaching transformation in moving image culture possible. (When I searched for “best motion graphics software” on the web and checked the answers to this question on a variety of forums, the first program mentioned was always After Effects. As one person put it on one of these forums, “It’s pretty much the gold standard. Learn it, love it.”² In another example, when in 2012 Imaginary Forces—the company most closely associated with the rise of motion graphics in the 1990s—posted descriptions of new jobs in its Los Angeles and NYC offices

¹ The NewTek Video Toaster released in 1990 was the first PC-based video production system that included a video switcher, character generation, image manipulation, and animation. Because of their low costs, Video Toaster systems were extremely popular in the 1990s. In the context of this book, After Effects is more important because, as I will explain below, it introduced a new paradigm for moving image design that was different from the familiar video editing paradigm supported by systems such as Toaster and Avid.

² John Waskey, <http://www.quora.com/What-is-the-best-software-for-creating-motion-graphics> (March 4, 2001).

for designers and animators, it listed only one required software application for 2D moving image production: After Effects.³)

As I will show, After Effects' UI and tools bring together fundamental techniques, working methods, and assumptions of previously separate fields of filmmaking, animation and graphic design. This hybrid production environment, encapsulated in a single software application, is directly reflected in the new visual language it enables—specifically, its focus on exploring aesthetic, narrative, and affective possibilities of hybridization.

The shift to software-based tools in the 1990s affected not only moving image culture but also all other areas of media design. All of them adopted the same type of production workflow. (When the project requires many people and many media elements, the production workflow is called a “pipeline.”) In this workflow, designers typically either combine elements created in different software applications, or move the whole project from one application to the next to take advantage of their unique possibilities. And while each design field also employs its own specialized applications (for instance, web designers use Dreamweaver, architects use Revit, and visual effects artists use Nuke and Fusion), they also all use a number of common applications: Photoshop, Illustrator, Final Cut, After Effects, Maya, 3ds Max, and a few others. (If you use open source software like Gimp and CinePaint instead of these commercial applications, your list of key applications will be different, but the workflow would not change.)

The adoption of a production environment and workflow that uses a small number of compatible applications in all areas of creative industries has had many fundamental effects. The professional boundaries between different design fields have become less important. A single designer or a small studio may work on a music video today, a product design tomorrow, an architectural project or a website design the day after, and so on. Another previously fundamental distinction—the scale of a project—also now matters less, and sometimes not at all. Today we can expect to find exactly the same shapes and forms in very small objects (like jewelry), small and medium sized objects (tableware, furniture), large buildings, and even urban designs. (Lifestyle objects, furniture, and

³ <http://www.imaginaryforces.com/jobs/los-angeles/designer/>, <http://www.imaginaryforces.com/jobs/new-york/2d-animator/> (October 31, 2012).

architectural and urban design by Zaha Hadid's office illustrate this well.⁴)

A comprehensive discussion of these and many other effects of software adoption would take more than one book, and therefore in this chapter I only focus on the impact of the software-based workflow on contemporary media design. As we will see, this workflow shapes contemporary design in a number of ways. On the one hand, never before in the history of human visual communication have we witnessed such a variety of visual forms as today. On the other hand, exactly the same techniques, compositions and iconography can now appear in any media. To evoke the metaphor of biological evolution again, we can say that despite seemingly infinite diversity of contemporary media, visual, and spatial "species," they all share some common DNA. Many of the species also share a basic design principle: integration of previously non-compatible techniques of media design—a process which I am going to call "deep remixability." Thus, a consideration of media authoring software and its usage in production would allow us to begin constructing a map of our current media/design universe, seeing how its species are related to each other and revealing the mechanisms behind their evolution.

The adoption of After Effects and related software in the second part of the 1990s quickly led to the adoption of a special term to designate new animated visuals – "motion graphics." Concisely defined in 2003 by Matt Frantz in his Masters thesis as "designed non-narrative, non-figurative based visuals that change over time,"⁵ motion graphics include film and television titles, TV graphics, dynamic menus, graphics for mobile media content, and other animated sequences. Typically motion graphics appear as parts of longer pieces: commercials, music videos, training videos, narrative and documentary films, interactive projects. Or at least, this is how it was in 1993; since that time the boundary between motion graphics and everything else has progressively become harder to define. Thus, in the 2008 version of the Wikipedia article about motion graphics, the authors wrote that "the term 'motion graphics' has the potential for less ambiguity than the use of

⁴ <http://www.zaha-hadid.com/>

⁵ Matt Frantz "Changing Over Time: The Future of Motion Graphics," MFA Thesis, 2003, <http://www.mattfrantz.com/thesisandresearch/motiongraphics.html>

the term film to describe moving pictures in the 21st century.”⁶ Certainly, today numerous short moving image works combine live footage, 2D animation, 3D animation, and other techniques equally (as opposed to privileging live action cinematography as many feature films still do), so they all can be called “motion graphics.”

Why did I select motion graphics as my central case study of this book, as opposed to any other area of contemporary culture similarly affected by either the switch to a software-based production process, or native to computers? The examples of the former area sometimes called “going digital” are architecture, graphic design, product design, information design, and music; the examples of the latter area are game design, interaction design, user experience design, user interface design, web design, and interactive information visualization. Obviously, most of the new design areas which have “interaction” or “information” as part of their titles—and which emerged since middle of the 1990s have been equally ignored by cultural critics, and therefore—demand as much attention.

My reason has to do with the diversity of new forms—visual, spatial, and temporal—that developed during the rapid growth of the motion graphics field after the introduction of *After Effects*. If we approach motion graphics in terms of these forms and techniques (rather than only their content), we will realize that they represent a very significant turning point in the history of human communication. Maps, pictograms, hieroglyphs, ideographs, various scripts, alphabet, graphs, projection systems, information graphics, photography, modern language of abstract forms (developed first in European painting in the 1910s and subsequently adopted in graphic design, product design and architecture in the 1920s), the techniques of twentieth-century cinematography, 3D computer graphics, and of course, a variety of “born digital” visual effects—in short practically all communication techniques developed by humans until the 1990s—are now routinely combined in motion graphics projects. Thus, almost all of the previously separate semiotic resources become options within the user’s palette (or “toolbox,” to use the standard metaphor deployed in media development software). Linguistic, kinetic, spatial, iconic, diagrammatic,

⁶ http://en.wikipedia.org/wiki/Motion_graphics

and temporal intelligence can now work together to express what we already knew but could not communicate—as well as generate new messages and experiences whose meanings we have yet to discover.

Although we may still need to figure out how to fully use this new semiotic meta-language, the importance of its emergence is hard to overestimate. In short, the emergence of software-enabled motion graphics is as important historically as the invention of printing, photography, or the Internet.

We will begin by going back to the 1980s. During the heyday of post-modern debates, at least one critic in America noticed the connection between post-modern pastiche and computerization. In his book *After the Great Divide* (1986), Andreas Huyssen wrote, “All modern and avantgardist techniques, forms and images are now stored for instant recall in the computerized memory banks of our culture. But the same memory also stores all of pre-modernist art as well as the genres, codes, and image worlds of popular cultures and modern mass culture.”⁷ His analysis is accurate—except that these “computerized memory banks” did not really become commonplace for another fifteen years. Only when the Web absorbed enough of the media archives did it become a universal cultural memory bank accessible to all cultural producers. But even for the professionals, the ability to easily integrate multiple media sources within the same project—multiple layers of video, scanned still images, animation, graphics, and typography—only came towards the end of the 1990s.

In 1985, when Huyssen’s book was in preparation for publication, I was working for one of the few computer animation companies in the world. The company was located in NYC and it was appropriately called Digital Effects.⁸ Each computer animator had his/her own interactive graphics terminal that could show 3D models but only in wireframe and monochrome; to see them fully rendered in color, we had to take turns as the company had only one color raster display which we all shared. The data was stored on bulky magnetic tapes about a foot in diameter; to find the data

⁷ Andreas Huyssen, “Mapping the Postmodern,” in *After the Great Divide* (Bloomington and Indianapolis: Indiana University Press, 1986), p. 196.

⁸ Wayne Carlson, *A Critical History of Computer Graphics and Animations. Section 2: The Emergence of Computer Graphics Technology*, <http://accad.osu.edu/%7Ewaynec/history/lesson2.html>

from an old job was a cumbersome process that involved locating the right tape in the tape library, putting it on a tape drive and then searching for the right part of the tape. We did not have a color scanner, so getting “all modern and avantgardist techniques, forms and images” into the computer was far from trivial. And even if we had had one, there was no way to store, recall, and modify these images. The machine that could do that—Quantel Paintbox—cost over \$160,000, which we could not afford. And when in 1986 Quantel introduced Harry, the first commercial non-linear editing system that allowed for digital compositing of multiple layers of video and special effects, its cost similarly made it prohibitive for everybody except network television stations and a few production houses. Harry’s capacities were quite limited, because it could record only eighty seconds of broadcast quality video. In the realm of still images, things were not much better: for instance, the digital still store Picturebox released by Quantel in 1990 could hold only 500 broadcast quality images and its cost was similarly very high.

In short, in the middle of the 1980s neither we nor other production companies had anything approaching the “computerized memory banks” imagined by Huyssen. And of course, the same was true for the visual artists that were associated with post-modernism and the ideas of pastiche, collage, and appropriation. In 1986 the BBC produced a documentary *Painting with Light* for which half a dozen well-known painters including Richard Hamilton and David Hockney were invited to work with the Quantel Paintbox. The resulting images were not so different from the normal paintings that these artists were producing without a computer. And while some artists were making reference to “modern and avantgardist techniques, forms and images,” these references were painted rather than being directly loaded from “computerized memory banks.” Only about ten years later, when relatively inexpensive graphics workstations and personal computers running image editing, animation, compositing, and illustration software became commonplace and affordable for freelance graphic designers, illustrators, and small post-production and animation studios did the situation described by Huyssen start to become a reality.

The results were dramatic. Within the space of less than five years, modern visual culture was fundamentally transformed. Visuals which previously were specific to different media—live

action cinematography, graphics, still photography, animation, 3D computer animation, and typography—started to be combined in numerous ways. By the end of the 1990s, the “pure” moving image media became an exception and hybrid media became the norm. However, in contrast to other computer revolutions such as the rise of the World Wide Web around the same time, this revolution was not acknowledged by popular media or cultural critics. What received attention were the developments that affected narrative filmmaking—the use of computer-produced special effects in Hollywood feature films or the inexpensive digital video and editing tools outside of it. But another process which happened on a larger scale—the transformation of the visual language used by all forms of moving images outside of narrative films—has not been critically analyzed. In fact, while the results of these transformations have become fully visible by 1999, at the time of writing I am not aware of a single theoretical article discussing them (at least in English).

One of the reasons is that in this revolution no new media *per se* were created. Just as they did ten years ago, the designers were making still images and moving images. But the aesthetics of these images was now very different. In fact, it was so new that, in retrospect, the post-modern imagery of just ten years ago that at the time looked strikingly different now appears as a barely noticeable blip on the radar of cultural history.

My choice of the starting and ending dates (1993–9) to characterize the development of a new hybrid visual language of moving images is not accidental. Of course, I could have picked different dates—for instance—starting a few years earlier—but since After Effects software which will play the key role in my account was released in 1993, I decided to pick this year as my starting date. And while my ending date also could have been different, I believe that by 1999 the broad changes in the aesthetics of moving images became visible. If you want to quickly see this for yourself, simply compare demo reels from the same visual effects companies made in the early 1990s and the late 1990s (a number of them are available online—look, for instance, at the demo reels of Pacific Data Images, or the demo reels of the Flame system, available for every year starting in 1995.⁹) In work from the

⁹ <http://accad.osu.edu/~waynec/history/lesson6.html>; <http://area.autodesk.com/flame20#20years>.

beginning of the decade, computer imagery in most cases appears by itself—that is, we see whole commercials and promotional videos done in 3D computer animation, and the novelty of this new media is foregrounded. By the end of the 1990s, computer animation becomes just one element integrated in the media mix that also includes live action, typography, and design.

Although these transformations happened only recently, the ubiquity of the new hybrid visual language today is such that it takes an effort to recall how different things looked before. Similarly, the changes in production processes and equipment that made this language possible also quickly fade from public and professional memories. As a way to quickly evoke these changes as seen from the professional perspective, I am going to quote from a 2004 interview with Mindi Lipschultz, who has worked as an editor, producer, and director in Los Angeles since 1979:

If you wanted to be more creative [in the 1980s], you couldn't just add more software to your system. You had to spend hundreds of thousands of dollars and buy a paintbox. If you wanted to do something graphic—an open to a TV show with a lot of layers—you had to go to an editing house and spend over a thousand dollars an hour to do the exact same thing you do now by buying an inexpensive computer and several software programs. Now with Adobe After Effects and Photoshop, you can do everything in one sweep. You can edit, design, animate. You can do 3D or 2D all on your desktop computer at home or in a small office.¹⁰

In 1989, the former Soviet satellites of Central and Eastern Europe peacefully liberated themselves from the Soviet Union. In the case of Czechoslovakia, this event came to be referred as the Velvet Revolution—to contrast it to typical revolutions in modern history that were always accompanied by bloodshed. To emphasize the gradual, almost invisible pace of the transformations which occurred in moving image aesthetics between approximately 1993 and 1999, I am going to appropriate the term the Velvet Revolution to refer to these transformations. (Although it may

¹⁰ Mindi Lipschultz, interviewed by *The Compulsive Creative*, May 2004, <http://www.compulsivecreative.com/interview.php?intid=12>

seem presumptuous to compare political and aesthetics transformations simply because they share the same non-violent quality, it is possible to show that the two revolutions are actually related.)

Finally, before proceeding I should also explain my use of examples. The visual language I am analyzing is all around us today (this may explain why academics have remained blind to it). After globalization, this language is spoken by communication professionals in dozens of countries around the world. You can see for yourself all the examples of various aesthetics I will be mentioning below by simply watching television and paying attention to graphics, going to a club to see a VJ performance, visiting the websites of motion graphics designers and visual effects companies, or opening any book on contemporary design. Nevertheless, below I have included titles of particular projects so the reader can see exactly what I am referring to. (I have chosen works by well-known design studies and artists so you can easily find all of them on the web.) But since my goal is to describe the new cultural language that by now has become practically universal, I want to emphasize that each of these examples can be substituted with numerous others.

The aesthetics of hybridity

In the second half of the 1990s, one of the key identifying features of motion graphics that clearly separated it from other forms of moving image existing until that time, was the central role played by dynamic typography. The term “motion graphics” has been used at least since 1960, when a pioneer of computer filmmaking John Whitney named his new company Motion Graphics. However, until the Velvet Revolution only a handful of people and companies have systematically explored the art of animated typography: Norman McLaren, Saul Bass, Pablo Ferro, R/Greenberg, and a few others.¹¹ But by the middle of the 1990s moving image sequences or short

¹¹ For a rare discussion of motion graphics prehistory as well as an equally rare attempt to analyze the field by using a set of concepts rather than only presenting the portfolio of individual designers, see Jeff Bellantoni and Matt Woolman, *Type in Motion*, 2nd edition (Thames & Hudson, 2004).

films dominated by moving animated type and abstract graphical elements rather than by live action, started to be produced in large numbers. What was the material cause for motion graphics taking off? After Effects and other related software running on PCs or relatively inexpensive graphics workstations became affordable to smaller design, visual effects, and post-production houses, and soon, to individual designers. Almost overnight, the term “motion graphics” became well known. (As the Wikipedia article about this term points out, “the term ‘Motion Graphics’ was popularized by Trish and Chris Meyer’s book about the use of Adobe After Effects titled ‘Creating Motion Graphics.’”¹²) The five-hundred-year-old Gutenberg universe came into motion.

Along with typography, the whole language of twentieth-century graphic design was “imported” into moving image design. While this development did not receive a popular new name of its own, it is obviously at least as important. (Although the term “design cinema” has been used, it never achieved anything comparable to the popularity of “motion graphics.”) So while motion graphics were for years limited to film titles and therefore only used typography, today the term “motion graphics” is often used to refer to moving image sequences that combine moving type and design elements. But we should recall that while in the twentieth century typography was often used in combination with other design elements, for 500 years it commanded its own word. Therefore I think it is important to consider the two kinds of “import” operations that took place during the Velvet Revolution—typography and twentieth century graphic design—as two distinct historical developments.

While motion graphics definitely exemplify the changes that took place during the Velvet Revolution, these changes are broader. Simply put, the result of the Velvet Revolution is *a new hybrid visual language of moving images in general*. This language is not confined to particular media forms. And while today it manifests itself most clearly in non-narrative forms, it is also often present in narrative and figurative sequences and films.

Here are a few examples. A music video may use live action while also employing typography and a variety of transitions done

¹² http://en.wikipedia.org/wiki/Motion_graphic

Sony Reader. *D-FUSE*, 2009. Selected frames from a motion graphics video.

with computer graphics (video for “Go” by Common, directed by Convert/MK12/Kanye West, 2005). Another music video may embed the singer within an animated painterly space (video for Sheryl Crow’s “Good Is Good,” directed by Psyop, 2005). A commercial may superimpose charts, data displays, and data visualizations on top of live action (TV ad for Thomson Reuters by MK12, 2012). The title sequence may contrast 2D flat figures and deep 3D perspectival space (titles for *Mad Men* by Imaginary Forces, 2007). A short film may mix typography, stylized 3D graphics, animated 2D design elements, and live action (*Itsu* for Plaid, directed by the Pleix collective, 2002). (Sometimes, as I have already mentioned, the term “design cinema” is used to differentiate such short independent films organized around design, typography, and computer animation rather than live action from similar “motion graphics” works produced for commercial clients.)

In some cases, the juxtaposition of different media is clearly visible (video for “Don’t Panic” by Coldplay, 2001; titles for the television show *The Inside*, 2005; commercial “Nike – Dynamic Feet,” 2005, all by Imaginary Forces). In other cases, a sequence may move between different media so quickly that the shifts are barely noticeable (GMC Denali “Holes” commercial by Imaginary Forces, 2005). Yet in other cases, a commercial or movie title may feature continuous action shot on video or film, with the image periodically changing from a more natural to a highly stylized look.

Such media hybridity does not necessarily manifest itself in a collage-like aesthetics that foregrounds the juxtaposition of different media and different media techniques. As a very different example of what media hybridity can result in, consider a more subtle aesthetics well captured by the name of the software that to a large extent made the hybrid visual language possible: After Effects. This name anticipated the changes in visual effects that took place a number of years later. In the 1990s computers were used to create highly spectacular special effects or “invisible effects,”¹³ but towards the end of that decade we see something

¹³ *Invisible effect* is the standard industry term. For instance, the film *Contact*, directed by Robert Zemeckis, was nominated for the 1997 VFX HQ Awards in the following categories: Best Visual Effects, Best Sequence (The Ride), Best Shot (Powers of Ten), Best Invisible Effects (Dish Restoration), and Best Compositing. <http://www.vfxhq.com/1997/contact.html>

else emerging: a new visual aesthetics that goes “beyond effects.” In this aesthetics, the whole project—whether a music video, a TV commercial, a short film, or a large segment of a feature film—has a special look in which the enhancement of live-action material is not completely invisible but at the same time does not call attention to itself the way special effects tended to do in the 1990s (examples: Reebok I-Pump “Basketball Black” commercial and *The Legend of Zorro* main title, both by Imaginary Forces, 2005; “Fage ‘Plain’” commercial by Psyop, 2011).

Although the particular aesthetic solutions vary from one video to the next and from one designer to another, they share the same logic: the simultaneous appearance of multiple media within the same frame. Whether these media are openly juxtaposed or almost seamlessly blended together is less important than the fact of this copresence itself. (Again, note that each of the examples above can be substituted with numerous others.)

Hybrid visual language is also now common to a large proportion of short “experimental” and “independent” (i.e., not commissioned by commercial clients) videos being produced for media festivals, the web, mobile media devices, and other distribution platforms.¹⁴ Many visuals created by VJs and “live cinema” artists are also hybrid, combining video, layers of 2D imagery, animation, and abstract imagery generated in real time.¹⁵ And as the animations of artists Jeremy Blake, Ann Lislegaard, and Takeshi Murata that I will discuss below demonstrate, at least some of the works created explicitly for art-world distribution similarly choose to use the same language of hybridity.

¹⁴ In December 2005, I attended the Impact media festival in Utrecht and asked the festival director what percentage of the submissions they received that year featured hybrid visual language as opposed to “straight” video or film. His estimate was about 50 percent. In January 2006, I was part of the review team that judged the projects of students graduating from SCI-ARC, a well-known research-oriented architecture school in Los Angeles. According to my informal estimate, approximately half the projects featured complex curved geometry made possible by Maya, a modeling software now commonly used by architects. Given that both After Effects and Maya’s predecessor, Alias, were introduced in the same year—1993—I find this quantitative similarity in the percentage of projects that use new languages made possible by this software quite telling.

¹⁵ For examples, consult Paul Spinrad, ed., *The VJ Book: Inspirations and Practical Advice for Live Visuals Performance* (Feral House, 2005).

Today, narrative features rarely mix different graphical styles within the same frame. However, gradually growing number of films do feature highly stylized aesthetics that would have previously been identified with illustration rather than filmmaking. The examples are the Wachowski's *Matrix* series (1999–2003), *Immortal* by Enki Bilal (2004), Robert Rodriguez' *Sin City* (2005) and *The Spirit* (2008), Zack Snyder's *300* (2007) and *Watchmen* (2009), James Cameron's *Avatar* (2009), Tim Burton's *Alice In Wonderland* (2010) and Martin Scorsese's *Hugo* (2011). These feature films are examples of now fully established practice to shoot a large portion of a feature film using a “digital backlot” (i.e., a green screen).¹⁶ Consequently, most or all shots in such films are created by composing the footage of actors with computer-generated sets and other visuals.

These films do not juxtapose their different media as dramatically as motion graphics. Nor do they strive for the seamless integration of CGI (computer-generated imagery) visuals and live action that characterized the earlier special-effects features of the 1990s, such as *Terminator 2* (1991) and *Titanic* (1997) by James Cameron. Instead, they explore the space in between juxtaposition and complete integration.

Matrix, *Sin City*, *300*, *Alice In Wonderland*, *Hugo*, and other films shot on a digital backlot combine multiple media to create a new stylized aesthetics that cannot be reduced to the already familiar look of live-action cinematography or 3D computer animation. Such films display exactly the same logic as short motion graphics works, which at first sight might appear to be very different. This logic is also the same as that which we observe in the creation of new hybrids in biology. That is, the result of the hybridization process is not simply a mechanical sum of the previously existing parts but a new “species”—a new kind of visual aesthetics that did not exist previously.

In TV commercials produced in the 2000s, this highly stylized visual aesthetics became one of the key looks of the decade. Many layers of live footage, 3D and 2D animated elements, particle effects, and other media elements are blended to create a seamless whole. This result has the crucial codes of realism (perspective

¹⁶ http://en.wikipedia.org/wiki/Digital_backlot

foreshortening, atmospheric perspective, correct combination of lights and shadows), but at the same time enhances visible reality. (I cannot call this aesthetics “hyperreal” since the hybrid images assembled from many layers and types of media look quite different from the works of the hyperrealist artists such as Denis Peterson that visually look like standard color photographs.) Strong gray-scale contrast, high color saturation, tiny waves of particles emulating from moving objects, extreme close-ups of textured surfaces (water drops, food products, human skin, finishes of consumer electronics devices, etc.), the contrasts between the natural uneven textured surfaces and smooth 3D renderings and 2D gradients, the rapidly changing composition and camera position and direction, and other devices heighten our perception. (For examples of all these strategies, you can, for example, look at the commercials made by Psyop.¹⁷)

We can say that these commercials create a “map” which is bigger than the territory being mapped, because they show more details and texture spatially, and at the same time compress time, moving through information more rapidly. We can also make a comparison with the Earth observation satellites which circle the planet, capturing its whole surface in detail impossible for any human observer to see—just as a human being cannot simultaneously see the extreme close-up of the surfaces and details of the movements of objects presented in the fictional space of a commercial.

In summary, the result of the shift to a software production environment in moving image creation is a new visual language. Just as with the individual software techniques that make it possible, this language as a whole inherits the traits of previous image media—filmmaking, cel and puppet animation, computer animation, photography, painting, graphic design and typography. However, it is not reducible to any of these media. Rather, it is a true hybrid—the offspring of twentieth-century image mediums that shares common traits with all of them but has its own distinct identity.

Let us now look at two short films in detail to see how aesthetics in hybridity works across a whole film. Blake’s *Sodium Fox* (2005) and Murata’s *Untitled (Pink Dot)* (2007) offer excellent examples

¹⁷ <http://www.psyop.tv/projects/live-action/> (October 31, 2012)

of the new hybrid visual language that currently dominates moving-image culture. Among many well-known artists working with digital moving images, Blake was the earliest and most successful in developing his own style of hybrid media. His video *Sodium Fox* is a sophisticated blend of drawings, paintings, 2D animation, photography, and effects available in software. Using a strategy commonly employed by artists in relation to commercial media in the twentieth century, Blake slows down the fast-paced rhythm of motion graphics as they are usually practiced today. However, despite the seemingly slow pace of his film, it is as informationally dense as the most frantically changing motion graphics used in clubs, music videos, television station IDs, and so on. *Sodium Fox* creates this density by exploring in an original way the basic feature of the software-based production environment in general and programs such as After Effects in particular—namely, the construction of an image from potentially numerous layers. Of course, traditional cel animation as practiced in the twentieth century also involved building up an image from a number of superimposed transparent cels, with each one containing some of the elements that together make up the whole image. For instance, one cel could contain a face, another lips, a third hair, yet another a car, and so on.

With computer software, however, designers can precisely control the transparency of each layer; they can also add different visual effects, such as blur, between layers. As a result, rather than creating a visual narrative based on the motion of a few visual elements through space (as was common in twentieth-century animation, both commercial and experimental), designers now have many new ways to create animation. Exploring these possibilities, Blake crafts his own visual language in which visual elements positioned on different layers are continuously and gradually “written over” each other. If we connect this new language to twentieth-century cinema rather than to cel animation, we can say that rather than fading in a new frame as a whole, Blake continuously fades in separate parts of an image. The result is an aesthetics that balances visual continuity with a constant rhythm of visual rewriting, erasing, and gradual superimposition.

Like *Sodium Fox*, Murata’s *Untitled (Pink Dot)* also develops its own language within the general paradigm of media hybridity. Murata creates a pulsating and breathing image that has a distinctly biological feel to it. In the last decade, many designers and artists

Sodium Fox. *Jeremy Blake*, 2005. *Selected frames from a 14-minute digital video.*

Untitled (Pink Dot). Takeshi Murata, 2007. Selected frames from a five-minute digital video.

have used biologically inspired algorithms and techniques to create animal-like movements in their generative animations and interactives. However, in the case of *Untitled (Pink Dot)*, the image as a whole seems to come to life.

To create this pulsating, breathing-like rhythm, Murata transforms live-action footage (scenes from 1982 movie *Rambo: First Blood*) into a flow of abstract color patches (sometimes they look like oversize pixels, and at other times they may be taken for artifacts of heavy image compression). But this transformation never settles into a final state. Instead, Murata constantly adjusts its degree. (In terms of the interfaces of media software, this would correspond to animating a setting of a filter or an effect.) One moment we see almost unprocessed live imagery; the next moment it becomes a completely abstract pattern; in the following moment, parts of the live action image again become visible, and so on.

In *Untitled (Pink Dot)* the general condition of media hybridity is realized as a permanent metamorphosis. True, we still see some echoes of movement through space, which was the core method of pre-digital animation. (Here this is the movement of the figures in the shots from *Rambo*.) But now the real change that matters is the one between different media aesthetics: between the texture of a film and the pulsating abstract patterns of flowing patches of color, between the original “liveness” of human figures in action as captured on film and the highly exaggerated artificial liveness they generate when processed by a machine.

Visually, *Untitled (Pink Dot)* and *Sodium Fox* do not have much in common. However, both films share the same strategy: creating a visual narrative through continuous transformations of image layers, as opposed to discrete movements of graphical marks or characters, common to both the classic commercial animation of Disney and the experimental classics of Norman McLaren, Oskar Fischinger, and others. Although we can assume that neither Blake nor Murata has aimed to achieve this consciously, in different ways each artist stages for us the key technical and conceptual change that defines the new era of media hybridity. Media software allows the designer to combine any number of visual elements regardless of their original media and to control each element in the process. This basic ability can be explored in numerous visual aesthetics. The films of Blake and Murata, with their different temporal rhythms and different logics of media combination, exemplify

this diversity. Blake layers various still graphics, text, animation, and effects, dissolving elements in and out. Murata processes live footage to create a constant image flow in which the two layers—live footage and its processed result—seem to constantly push each other out.

Deep remixability

I believe that “media hybridity” constitutes a new fundamental stage in the history of media. It manifests itself in different areas of software culture and not only in moving images—although the latter does offer a particularly striking example of this new cultural logic at work. Here the media authoring software environment became a kind of Petri dish where the techniques and tools of computer animation, live cinematography, graphic design, 2D animation, typography, painting and drawing can interact, generating new hybrids. And as the examples above demonstrate, the results of this process of hybridity are a new aesthetics and new “media species” that cannot be reduced to the sum of the media that went into their creation.

Can we understand the new hybrid language of moving image as a type of *remix*? From its beginnings in music culture in the 1980s, during the 1990s remix has gradually emerged as the dominant aesthetics of the era of globalization, affecting and re-shaping everything from music and cinema to food and fashion. (If Fredric Jameson once referred to post-modernism as “the cultural logic of late capitalism,” we can perhaps call remix “the cultural logic of networked global capitalism.”) A number of authors have already traced remix effects in many cultural areas, ranging from children’s use of media in Japan (Mimi Ito) to web culture (Eduardo Navas). The representative books include *Rhythm Science* (D. J. Spooky, 2004), *Remix: Making Art and Commerce Thrive in the Hybrid Economy* (Lawrence Lessig, 2008), *Mashed Up: Music, Technology, The Rise of Configurable Culture* (Aram Sinnreich, 2010), *Mashup Cultures* (edited by Stefan Sonvilla-Weiss, 2010) and *Remix Theory: The Aesthetics of Sampling* (Eduardo Navas, 2012).¹⁸

¹⁸ Mizuko Ito, “Mobilizing the Imagination in Everyday Play: The Case of Japanese Media Mixes,” in *International Handbook of Children, Media, and Culture*,

I believe that the combinatory mechanisms responsible for the evolution of the “computer metamedium” in general, and the new hybrid visual aesthetics emerging in the 1990s can indeed be considered as a type of remix—if we make one crucial distinction. Typical remix combines *content* within the same media or content from different media. For instance, a music remix may combine music elements from any number of artists; anime music videos may combine parts of anime films and music taken from a music video. Professionally produced motion graphics and other moving-image projects also routinely mix together content in the same media and/or from different media. For example, in the beginning of the “Go” music video (Convert/MK12/Kanye West, 2005), the video rapidly switches between live-action footage of a room and a 3D model of the same room. Later, the live-action shots also incorporate a computer-generated plant and a still photographic image of mountain landscape. Shots of a female dancer are combined with elaborate animated typography. The human characters are transformed into abstract animated patterns. And so on.

Such remixes of content from different media are definitely common today in moving-image culture. In fact, I began discussing the new visual language by pointing out that in the case of short forms they now constitute the rule rather than the exception. But this type of remix is only one aspect of the “hybrid revolution.” For me its essence lies in something else. Let us call it “deep remixability.” *Today designers remix not only content from different media but also their fundamental techniques, working methods, and ways of representation and expression.* United within the common software environment the languages of cinematography, animation, computer animation, special effects, graphic design, typography, drawing, and painting have come to form a new *metalanguage*. A work produced in this new metalanguage can

Sonia Livingstone and Kirsten Drotner, (eds) (Sage Publications, 2008); Paul D. Miller, *Rhythm Science* (MIT Press, 2004); Lawrence Lessig, *Remix: Making Art and Commerce Thrive in the Hybrid Economy* (Penguin Press HC, 2008); Aram Sinnreich, *Mashed Up: Music, Technology, and the Rise of Configurable Culture* (University of Massachusetts Press, 2010); Stefan Sonvilla-Weiss, *Mashup Cultures* (Springer, 2010); Eduardo Navas, *Remix Theory: The Aesthetics of Sampling* (Springer Vienna Architecture, 2012).

use all the techniques, or any subset of these techniques, that were previously unique to these different media.

We may think of this new metalanguage of moving images as a large library of all previously known techniques for creating and modifying moving images. A designer of moving images selects techniques from this library and combines them in a single sequence or a single frame. But this clear picture is deceptive. How exactly does s/he combine these techniques? When you remix content, it is easy to imagine different texts, audio samples, visual elements, or data streams positioned side by side. Imagine a typical twentieth-century collage except that it now moves and changes over time. But how do you remix the techniques themselves?

In the cases of hybrid media interfaces that we have already analyzed (such as Acrobat's interface), "remix" of techniques means simple combination. Different techniques literally appear next to each in the application's UI. Thus, in Acrobat, a forward and backward button, a zoom button, a "find" tool, and others are positioned one after another on a toolbar above the open document. Other techniques appear as tools listed in vertical pull-down menus: spell, search, email, print, and so on. We find the same principles in the interfaces of all media authoring and access applications. The techniques borrowed from various media and the new born-digital techniques are presented side-by-side using tool-bars, pull-down menus, toolboxes and other UI design conventions.

Such an "addition of techniques" that exist in a single space side by side without any deep interactions are also indirectly present in remixes of content well familiar to us, be it fashion designs, architecture, collages, or motion graphics. Consider a hypothetical example of a visual design that combines drawn elements, photos, and 3D computer graphics forms. Each of these visual elements is the result of the use of particular media techniques of drawing, photography, and computer graphics. Thus, while we may refer to such cultural objects as remixes of content, we are also justified in thinking about them as remixes of techniques. This applies equally well to pre-digital design, when a designer would use separate physical tools or machines, and to contemporary software-driven design, where s/he has access to all these tools in a few compatible software applications.

As long as the pieces of content, interface buttons, or techniques are simply added rather than integrated together, we do not need a

00-07

00-11

00-16

Music video for Go! By Common. Kanye West, MK12 and Convert, 2005. Selected frames from a four-minute video. A number below each frame indicates time code (in seconds) for this frame.

00-17

00-21

00-23

special term such as “deep remix.” This, for me, is still “remix” the way this term is commonly used. But in the case of moving image aesthetics we also encounter something else. Rather than a simple addition, we also find interactions between previously separate techniques of cel animation, cinematography, 3D animation, design, and so on—interactions which were unthinkable before. (The same argument can be made in relation to other types of cultural objects and experiences created with media authoring software such as visual designs and music.)

I believe that this is something that neither pioneers of computer media of the 1960s–1970s nor the designers of the first media authoring applications that started to appear in the 1980s intended. However, once all these media techniques met within the same software environment—and this was gradually accomplished throughout the 1990s—they started interacting in ways that could never have been predicted or even imagined previously.

For instance, while particular media techniques continue to be used in relation to their original media, they can also be applied to other media. Photoshop filters, which we previously analyzed, illustrate well this “cross-over” effect: techniques that were originally part of a particular media type can now be applied to other media types. For instance, neon glow, stained glass, lens flare, etc. can be applied to photographs and sketches. (More precisely, they can be applied to whatever is currently loaded in the graphics memory and appears in the image window—a set of pixels that carry the results of all previously applied filters and other manipulations.)

Here are typical examples of the crossover strategy as it is used in moving image design. Type is choreographed to move in 3D space; motion blur is applied to 3D computer graphics; algorithmically generated fields of particles are blended with live-action footage to give them an enhanced look; a virtual camera is made to move around a virtual space filled with 2D drawings. In each of these examples, the technique that was originally associated with a particular medium—cinema, cel animation, photorealistic computer graphics, typography, graphic design—is now applied to a different media type. Today a typical short film or a sequence may combine many of such pairings within the same frame. The result is a hybrid, intricate, complex, and rich media language—or rather, numerous languages that share the logic of deep remixability.

In fact, such interactions among virtualized media techniques define the aesthetics of contemporary moving image culture. This is why I have decided to introduce a special term—*deep remixability*. I wanted to differentiate more complex forms of interactions between techniques (such as cross over) from the simple remix (i.e. addition) of media content and media techniques with which we are all familiar, be it music remixes, anime video remixes, 1980s postmodern art and architecture, and so on.

For concrete examples of the “crossover effect” which exemplifies deep remixability, we can return to the same “Go” video and look at it again, but now from a new perspective. Previously I have pointed out the ways in which this video—typical of the short format moving images works today—combines visual elements of *different media types*: live action video, still photographs, procedurally generated elements, typography, etc. However, exactly the same shots also contain rich examples of the *interactions between techniques*, which are only possible in a software-driven design environment.

As the video begins, a structure made up from perpendicular monochrome blocks and panels simultaneously grows rapidly in space and rotates to settle into a position which allows us to recognize it as a room (00:07–00:11). As this move is being completed, the room is transformed from an abstract geometric structure into a photo-realistically rendered one: furniture pops in, wood texture rolls over the floor plane, and a photograph of a mountain view fills a window. Although such different styles of CG rendering have been available in animation software since the 1980s, a particular way in which this video opens with a visually striking abstract monochrome 3D structure is a clear example of deep remixability. When in the middle of the 1990s graphic designers started to use computer animation software, they brought their training, techniques, and sensibilities to computer animation that until that time was used in the service of photorealism. The strong diagonal compositions, the deliberately flat rendering, and the choice of colors in the opening of the “Go” video subordinates CG photorealistic techniques to a visual discipline specific to modern graphic design. The animated 3D structure references the Suprematism of Malevich and Lissitzky, which played a key role in shaping the grammar of modern design—and which, in our example, has become a conceptual “filter” that has transformed the CG field.

After a momentary stop to let us take in the room, which is now largely completed, a camera suddenly rotates 90 degrees (00:15 – 00:17). This physically impossible camera move is another example of deep remixability. While animation software implements the standard grammar of twentieth-century cinematography—a pan, a zoom, a dolly, etc.—the software, of course, does not have the limitations of a physical world. Consequently a camera can move in an arbitrary direction, follow any imaginable curve and do this at any speed. Such impossible camera moves become standard tools of contemporary media design and twenty-first-century cinematography, appearing with increased frequency in feature films since the middle of the 2000s. Just as Photoshop filters which can be applied to any visual composition, virtual camera moves can also be superimposed, so to speak, on any visual scene regardless of whether it was constructed in 3D, procedurally generated, captured on video, photographed, or drawn—or, as in the example of the room from “Go” video, is a combination of these different media.

Playing the video forward (00:15–00:22), we notice yet another previously impossible interaction between media techniques. The interaction in question is a lens reflection, which is slowly moving across the whole scene. Originally an artifact of a camera technology, lens reflection was turned into a filter—i.e., a technique which can now be “drawn” over any image constructed with all other techniques available to a designer. (This important type of software technique, one which originated as artifacts of physical or electronic media technologies, will be discussed in more details in the concluding section of this chapter.) If you wanted more proof that we are dealing here with a visual technique, note that this “lens reflection” is moving while the camera remains perfectly still (00:17–00:22)—a logical impossibility, which is sacrificed in favor of a more dynamic visual experience.

I referred to the new language of moving imagery as a “meta-language.” Since our discussion has so far relied on the term “computer metamedium,” I should explain the connection between these two terms.

The acceleration of the speed of social, technological and cultural change in the second part of the twentieth century has led to the frequent use of ‘meta-,’ ‘hyper-,’ and ‘super-’ in cultural theory and criticism. From Superstudio (a conceptual architectural group active in the 1960s), Ted Nelson’s Hypermedia and

Alan Kay's metamedium to the more recent Supermodernism and Hypermodernity,¹⁹ these terms may be read as attempts to capture the feeling that we have passed a point of singularity and are now moving at warp speed. Like the cosmonauts of the 1960s observing the Earth from the orbits of their spaceships and seeing it for the first time as a single object, we are looking down at human history from a new higher orbit. This connotation seems to fit Alan Kay's conceptual and practical redefinition of a digital computer as a metamedium that contains most existing medium technologies and techniques and also allows invention of many new ones.

While the term "metalanguage" has precise meanings in logic, linguistics, and computing, here I am using it in a sense similar to Alan Kay's use of "meta" in "computer metamedium." Normally a "metalanguage" refers to a separate formal system for describing mediums or cultural languages—the way grammar describes how a particular natural language works. But this not how Kay uses "meta" in "metamedium." As he uses it, it stands for gathering/including/collecting—in short, bringing previously separate things together.

Let us imagine this computer metamedium as a large and continuously expanding set of resources. It includes all media creation/manipulation techniques, interaction techniques and data formats available to programmers and designers in the current historical moment. Everything from sort and search algorithms and pull-down menus to hair and water rendering techniques, video games AI, and multi-touch interface methods—it is all there.

If we look at how these resources are used in different cultural areas to create particular kinds of content and experiences, we will see that each of them only uses a subset of these resources. For example, the graphical interfaces of today's popular computer operating systems (Windows, Linux, Mac OS) use static icons. In contrast, in some consumer electronics interfaces (such as certain mobile phones) all icons are animated loops.

Moreover, the use of a subset of all existing elements is not random but follows particular conventions. Some elements always go together. In other cases, the use of one element means that we

¹⁹ <http://en.wikipedia.org/wiki/Hypermodernity>

are unlikely to find some other element. In other words, different forms of digital media use different subsets from a complete set of techniques contained in a computer metamedium—and this use follows distinct patterns.

If you notice the parallels with what cultural critics usually call an “artistic language,” a “style,” or a “genre,” you are right. Any single work of literature or works of a particular author or literary movement uses only some of the existing literary techniques, and this use follows some patterns. The same goes for cinema, music and all other recognized cultural forms. This allows us to talk about a style of a particular novel or film, a style of an author as a whole, or a style of a whole artistic school. (Film scholars David Bordwell and Kristin Thompson call this a “stylistic system” which they define as a “patterned and significant use of techniques.” For cinema, they divide these techniques into four categories: mise-en-scène, cinematography, editing, and sound.²⁰) When a whole cultural field can be divided into a small number of distinct groups of works with each group sharing some patterns, we usually talk about “genres.” For instance, theoreticians of Ancient Greek theatre distinguished between comedies and tragedies and prescribed the rules each genre should follow, while today companies use automatic software to classify blogs into different genres.

If by medium we mean a set of standard technological resources, be it a physical stage or a film camera, lights and film stock, we can see that each medium usually supports multiple artistic languages/styles/genres. For example, a medium of twentieth-century filmmaking supported Russian Montage of the 1920s, Italian Neorealism of the 1940s, French New Wave of the 1960s, Hong Kong fantasy Kung Fu films of the 1980s, Chinese “fifth-generation” films of the 1980s–1990s, etc.

Similarly, a computer metamedium can support multiple cultural or artistic metalanguages. In other words, in the theoretical scheme I am proposing, there is only one metamedium—but many metalanguages.

So what is a metalanguage? If we define an artistic language as a patterned use of a selected number of a subset of the techniques

²⁰ David Bordwell and Kristin Thompson, *Film Art: an Introduction*, 5th edition (The McGraw-Hill Companies, 1997), p. 355.

available in a given medium,²¹ *a metalanguage is a patterned use of a subset of all the techniques available in a computer metamedium.* But not just any subset. It only makes sense to talk about a metalanguage (as opposed to a language) if the techniques it uses come from previously distinct cultural languages. As an example, consider a metalanguage of popular commercial virtual globes (Google Earth, Microsoft Bing Maps). These applications systematically combine different types of media formats and media navigation techniques that previously were separate. These combinations follow common patterns. Another example will be a metalanguage common to many graphical interface users (recall my analysis of Acrobat's interface, which combines metaphors drawn from different media traditions).

Since moving images today systematically combine techniques of different visual media that almost never met until middle of the 1990s, we are justified in using the term "metalanguage" in their case. Visual design today has its own metalanguage, itself is a subset of the metalanguage of moving images. The reason is that a designer of moving images has access to all the techniques of a visual designer plus extra techniques since s/he is working with additional dimension of time. These two metalanguages also largely overlap in patterns that are common to them—but there are some important differences. For instance, today's moving image works often feature a continuous movement through a 3D space that may contain various 2D elements. In contrast, visual designs for print, web, products, or other applications are usually two-dimensional—they assemble elements over an imaginary flat surface. (I think that the main reason for this insistence on flatness is that these designs often exist next to large blocks of text that already exist in 2D.)

Layers, transparency, compositing

So far I have focused on describing the aesthetics of moving images that emerged from the Velvet Revolution. While continuing this investigation, we will now pay more attention to an analysis of the new software production environment that made this aesthetics

²¹ This definition is adopted from Bordwell and Thompson, *Film Art*, p. 355.

possible. The following sections of this chapter will look at the tools offered by After Effects and other media authoring applications, their user interfaces, and the ways these applications are used together in production (i.e. design workflow). Rather than discussing all the tools and interface features, I will highlight a number of fundamental assumptions behind them—ways of understanding what a moving image project is—which, as we will see, are quite different from how it was understood during the twentieth century.

Probably most dramatic among the changes that took place during 1993–99 was the new ability to combine multiple levels of imagery with varying degrees of transparency via digital compositing. If you compare a typical music video or a TV advertising spot *circa* 1986 with its counterpart *circa* 1996, the differences are striking. (The same holds for other areas of visual design.) As I have already noted, in 1986 “computerized memory banks” were very limited in their storage capacity and prohibitively expensive, and therefore designers could not quickly and easily cut and paste multiple image sources. But even when they could assemble multiple visual references, a designer only could place them next to, or on top of each other. S/he could not modulate these juxtapositions by precisely adjusting transparency levels of different images. Instead, s/he had to resort to the same photo-collage techniques popularized in the 1920s. In other words, the lack of transparency restricted the number of different image sources that could be integrated within a single composition without it starting to look like certain photomontages or photo-collages of John Heartfield, Hannah Hoch, or Robert Rauschenberg—a mosaic of fragments without any strong dominant.²²

In addition to allowing the superimposition of many transparent layers, digital compositing also made trivial another operation that was previously very cumbersome. Until the 1990s, different media types such as hand-drawn animation, lens-based recordings, and typography practically never appeared within the same frame. Instead, animated commercials, publicity shorts, industrial films, and some feature and experimental films that did include multiple media

²² In the case of video, one of the things that made combining multiple visuals difficult was the rapid degradation of the video signal when an analog video tape was copied more than a couple of times. Such a copy would no longer meet broadcasting standards.

usually placed them in separate shots. A few directors have managed to build whole aesthetic systems out of such temporal juxtapositions—most notably, Jean-Luc Godard. In his 1960s films such as *Weekend* (1967) Godard cut bold typographic compositions in between live action creating what can be called a “media montage” (as opposed to a montage of live action shots, as developed by the Russians in the 1920s). Also in the 1960s, pioneering motion graphics designer Pablo Ferro, who appropriately called his company Frame Imagery, created promotional shorts and TV graphics that played on juxtapositions of different media replacing each other in rapid succession.²³ In a number of Ferro’s spots, static images of different letterforms, line drawings, original hand-painted artwork, photographs, very short clips from newsreels, and other visuals come one after another with machine gun speed.

Within cinema, the superimposition of different media within the same frame was usually limited to the two media placed on top of each other in a standardized manner—i.e. static letters appearing on top of still or moving lens-based images in feature film titles. In the 1960s, both Ferro and another motion graphics pioneer Saul Bass created a few remarkable title sequences in which visual elements of different origin were systematically overlaid together more dynamically—such as the opening for Hitchcock’s *Vertigo* designed by Bass (1958). (Bass’s 1959 title sequence for *North by Northwest* is considered to be the first to use type in motion).

But I think it is fair to say that such complex juxtapositions of media within the same frame were rare exceptions in the otherwise “unimedia” universe, where filmed images appeared in feature films and hand-drawn images appeared in animated films. The only twentieth-century feature film director I know of who has built his unique aesthetics by systematically combining different media within the same frame was Karel Zeman. Thus, a typical shot by Zeman may contain filmed human figures, an old engraving used for background, and a miniature model.²⁴

The achievements of these directors and designers are particularly remarkable given the difficulty of combining different media

²³ Jeff Bellantoni and Matt Woolman, *Type in Motion* (Rizzoli, 1999), pp. 22–9.

²⁴ While special effects in feature films often combined different media, they were used together to create a single illusionistic space, rather than juxtaposed for the aesthetic effect such as in films and titles by Godard, Zeman, Ferro, and Bass.

within the same frame during the film era. To do this required utilizing the services of special effects departments or separate companies which used optical printers. Techniques that were cheap and more accessible, such as double exposure, were limited in their precision. So while a designer of static images could at least cut and paste multiple elements within the same composition to create a photomontage, to produce the equivalent effect with moving images was far from trivial.

To put this in more general terms, we can say that before the computerization of the 1990s, the designer's capacities to access, manipulate, remix, and filter visual information, whether still or moving, were quite restricted. In fact, they were practically the same as a hundred years earlier—regardless of whether filmmakers and designers used in-camera effects, optical printing, or video keying. In retrospect, we can see they were at odds with the flexibility, speed, and precision of data manipulation that was already available to most other by then computerized professional fields—sciences, engineering, accounting, management, etc. Therefore it was only a matter of time before all image media would be turned into digital data and illustrators, graphic designers, animators, film editors, video editors, and motion graphics designers would start to manipulate them via software instead of their traditional tools. But this is only obvious today—after the Velvet Revolution has taken place.

In 1985 Jeff Stein directed a music video for the single “You Might Think” by new wave band *The Cars*. This video was one of the first to systematically use computer graphics; it had a big impact in the design world, and MTV gave it the first prize in its first annual music awards. Stein managed to create a surreal world in which a video cutout of the singing head of the band member was animated over different video backgrounds. In other words, Stein took the aesthetics of animated cartoons—2D animated characters superimposed over a 2D background—and recreated it using video imagery. In addition, simple computer animated elements were also added in some shots to enhance the surreal effect. This was shocking because no one had ever seen such juxtapositions before. Suddenly, modernist photomontage came alive. But ten years later, such moving video collages became not only commonplace—they also became more complex, more layered, and more subtle. Instead of two or three, a composition could now feature hundreds and

even thousands of layers. And each layer could have its own level of transparency.

In short, *digital compositing* now allowed the designers of moving images to easily *combine any number of visual elements regardless of the media in which they originated and to control each element in the process*. I can make an analogy between multitrack audio recording and digital compositing. In multitrack recording, each sound track can be manipulated individually to produce the desired result. Similarly, in digital compositing each visual element can be independently modulated in a variety of ways: resized, recolored, animated, etc. Just as the music artist can focus on a particular track while muting all other tracks, a designer often turns off all visual tracks except the one s/he is currently adjusting. Similarly, both a music artist and a designer can at any time substitute one element of a composition by another, delete any elements, and add new ones. Most importantly, just as multitrack recording redefined the sound of popular music from the 1970s onward, once digital compositing became widely available during the 1990s it fundamentally changed the visual aesthetics of most moving images forms.

This discussion only scratched the surface of my subject in this section: layers and transparency. For instance, I have not analyzed the actual techniques of digital compositing and the fundamental concept of an alpha channel, which deserves a separate and detailed treatment. I have also not gone into the possible media histories leading to digital compositing nor examined its relationship to optical printing, video keying, and video effects technology of the 1980s. These histories and relationships were discussed in the “Compositing” chapter in *The Language of New Media* but from a different perspective than the one used here. At that time (1999) I was looking at compositing from the point of view of the questions of cinematic realism, practices of montage, and the construction of special effects in feature films. Today, however, it is clear to me that in addition to disrupting the regime of cinematic realism in favor of other visual aesthetics, compositing also had another, even more fundamental effect.

By the end of the 1990s digital compositing had become the basic operation used in creating *all* forms of moving images, and not only big budget features. So while it was originally developed

as a technique for special effects in the 1970s and early 1980s,²⁵ compositing had a much broader effect on contemporary visual and media cultures beyond special effects. Compositing played the key role in turning the digital computer into a kind of experimental lab (or a Petri dish) where different media can meet and where their aesthetics and techniques can be combined to create new species. In short, digital compositing was essential in enabling the development of a new hybrid visual language of moving images—one that today we see everywhere.

Defined at first as a particular digital technique designed to integrate the two media of live action film and computer graphics in special effects sequences, compositing later became a “universal media integrator.” And although compositing was originally created to support the aesthetics of cinematic realism, over time it actually had an opposite effect. Rather than forcing different media to fuse seamlessly, compositing led to the flourishing of numerous media hybrids where the juxtapositions between live and algorithmically generated, two dimensional and three dimensional, raster and vector media are made deliberately visible rather than being hidden.

After Effects interface: from “time-based” to “composition-based”

My thesis about media hybridity applies both to the cultural objects and the software used to create them. Just as the moving image media made by designers today mix the formats, assumptions, and techniques of different media, the toolboxes and interfaces of the software they use are also remixes. Let us again use After Effects as the case study to see how its interface remixes previously distinct working methods of different disciplines.

When moving image designers started to use compositing/animation software such as After Effects, its interface encouraged them to think about moving images in a fundamentally new way. Film and video editing systems and their computer simulations

²⁵ Thomas Porter and Tom Duff, “Compositing Digital Images,” *ACM Computer Graphics* 18, no. 3 (July 1984): pp. 253–9.

that came to be known as non-linear editors (currently exemplified by Avid, Premiere, and Final Cut²⁶) have conceptualized a media project as a sequence of shots organized in time. Consequently, while NLE (the standard abbreviation for non-linear video editing software) gave the editor many tools for adjusting the edits, they took for granted the constant of a film language that came from its industrial organization—that all frames have the same size and aspect ratio. This is an example of a larger trend. During the first stage of the development of cultural software, its pioneers were exploring the new possibilities of a computer metamedium going in any direction they were interested, since commercial use (with a notable exception of CAD) was not yet an option. However, beginning with the 1980s, a new generation of companies—Aldus, Autodesk, Macromedia, Adobe, and others—started to produce GUI-based software media authoring software aimed at particular industries: TV production, graphic design, animation, etc. As a result, many of the workflow principles, interface conventions and constraints of media technologies standard in these industries, were methodically re-created in software—even though the software medium itself has no such limitations. NLE software is a case in point. In contrast, from the beginning the After Effects interface put forward a new concept of moving image as a composition organized both in time and 2D space.

The center of After Effects' interface is a Composition conceptualized as a large canvas that acts as a background for visual elements which can have arbitrary sizes, proportions, and content (video, photos, abstract graphics, type, etc). When I first started using After Effects soon after it came out, I remember feeling shocked that the software did not automatically resize the graphics I dragged into the Composition window to make them fit the overall frame. The fundamental assumption of cinema that accompanied it throughout its whole history—that film consists of many frames which all have the same size and aspect ratio—was gone.

In film and video editing paradigms of the twentieth century, the minimal unit on which the editor works is a frame. S/he can change the length of an edit, adjusting where one film or video segment ends

²⁶ Compositing functionality was gradually added over time to most NLE systems, so today the distinction between Effects or Flame interfaces and Avid and Final Cut interfaces is less pronounced.

“The center of After Effects interface is a Composition conceptualized as a large canvas that acts as a background for visual elements which can have arbitrary sizes, proportions, and content. Each element can be individually accessed, manipulated, and animated.” The illustration shows selected frames from a simple 2D animation, as they appear in the Composition panel.

and another begins, but s/he cannot directly modify the contents of a frame. The frame functions as a kind of “black box” that cannot be “opened.” (This was the job for special effects departments and companies.) But in the After Effects interface, the basic unit is not a frame but a visual element placed in the Composition window. Each element can be individually accessed, manipulated, and animated. In other words, each element is conceptualized as an independent object. Consequently, a media composition is understood as a set of independent objects that can change over time. The very word “composition” is important in this context as it references 2D media (drawing, painting, photography, design) rather than filmmaking—i.e. space as opposed to time.

Where does the After Effects interface come from? Given that this software is commonly used to create animated graphics and visual effects, it is not surprising that its interface elements can be traced to three separate fields: animation, graphic design, and special effects. And because these elements are integrated in intricate ways to offer the user a new experience that cannot be simply reduced to a sum of the working methods already available in separate fields, it makes sense to think of the After Effects UI as an example of “deep remixability.”

In twentieth-century cel animation production, an animator places a number of transparent cels on top of each other. Each cel contains a different drawing—for instance, a body of a character on one cel, the head on another cel, eyes on the third cel. Because the cels are transparent, the drawings get automatically “composited” into a single composition. While the After Effects interface does not use the metaphor of a stack of transparent cels directly, it is based on the same principle. Each element in the Composition window is assigned a “virtual depth” relative to all other elements. Together all elements form a virtual stack. At any time, the designer can change the relative position of an element within the stack, delete it, or add new elements.

We can also see a connection between the After Effects interface and another popular twentieth-century animation technique—stop motion. To create stop motion shots, puppets or any other 3D objects are positioned in front of a film camera and manually animated one step at a time. For instance, an animator may be adjusting the head of a character, progressively moving it from left to right in small discrete steps. After every step, the animator

exposes one frame of film, then makes another adjustment, exposes another frame, and so on. (The twentieth-century animators and filmmakers who used this technique with great inventiveness include Wladyslaw Starewicz, Oskar Fischinger, Aleksandr Ptushko, Jiří Trnka, Jan Svankmajer, and the Brothers Quay.)

Just as in cel and stop-motion animation practices, After Effects does not make any assumptions about the size or positions of individual elements. Instead of dealing with standardized units of time—i.e. film frames containing fixed visual content—a designer now works with separate visual elements. An element can be a digital video frame, a line of type, an arbitrary geometric shape, etc. The finished work is the result of a particular arrangement of these elements in space and time. Consequently, a designer who uses After Effects can be compared to a choreographer who creates a dance by “animating” the bodies of dancers—specifying their entry and exit points, their trajectories through the space of the stage, and the movements of their bodies. (In this respect it is relevant that although the After Effects interface did not evoke this reference, another equally important 1990s software that was commonly used to design multimedia—Macromedia Director—did explicitly refer to the metaphor of the theatre stage in its UI.)

While we can link the After Effects interface to traditional animation methods as used by commercial animation studios, the working method put forward by software is closer to graphic design. In commercial animation studios of the twentieth century all elements—drawings, sets, characters, etc.—were prepared beforehand. The filming itself was a mechanical process. Of course, we can find exceptions to this industrial-like separation of labor in experimental animation practice where a film was usually produced by one person. This allowed a filmmaker to invent a film as he went along, rather than having to plan everything beforehand. A classic example of this is Oskar Fischinger’s *Motion Painting 1* created in 1949. Fischinger made this 11-minute film by continuously modifying a painting and exposing film one frame at a time after each modification. This process took nine months. Because Fischinger was shooting on film, he had to wait a long time before seeing the results of his work. As the historian of abstract animation William Moritz writes, “Fischinger painted every day for over five months without being able to see how it was coming out on film, since he wanted to keep all the conditions, including

film stock, absolutely consistent in order to avoid unexpected variations in quality of image.”²⁷ In other words, in the case of this project by Fischinger, creating animation and seeing the result were even more separated than in a commercial animation process.

In contrast, a graphic designer works “in real time.” As the designer introduces new elements, adjusts their locations, colors and other properties, tries different images, changes the size of the type, and so on, s/he can immediately see the result of his/her work.²⁸ After Effects adopts this working method by making the Composition window the center of its interface. Like a traditional designer, the After Effects user interactively arranges the elements in this window and can immediately see the result. In short, the After Effects interface makes filmmaking into a design process, and a film is re-conceptualized as a graphic design that can change over time.

As we saw when we looked at the history of cultural software, when physical or electronic media are simulated in a computer, we do not simply end up with the same media as before. By adding new properties and working methods, computer simulation fundamentally changes the identity of a given media. For example, in the case of “electronic paper” such as a Word document or a PDF file, we can do many things which were not possible with ordinary paper: zoom in and out of the document, search for a particular phrase, change fonts and line spacing, etc. Similarly, online interactive maps services provided by Google and Microsoft augment the traditional paper map in multiple and amazing ways.

A significant proportion of contemporary software for creating, editing, and interacting with media was developed in this way.

²⁷ Quoted in Michael Barrier, *Oskar Fischinger. Motion Painting No. 1*, http://www.michaelbarrier.com/Capsules/Fischinger/fischinger_capsule.htm

²⁸ Depending on the complexity of the project and the hardware configuration, the computer may or may not be able to keep pace with the designer's changes. Often a designer has to wait until the computer renders everything in frame after s/he makes changes. However, since s/he has control over this rendering process, s/he can instruct After Effects to show only outlines of the objects, to skip some layers, etc.—thus giving the computer less information to process and allowing for real-time feedback. While a graphic designer does not have to wait until a film is developed or a computer has finished rendering the animation, the design has its own “rendering” stage—making proofs. With both digital and offset printing, after the design is finished, it is sent to the printer who produces the test prints. If the designer finds any problems such as incorrect colors, s/he adjusts the design and then asks for proofs again.

Already existing media technologies were simulated in a computer and augmented with new properties. But if we consider media authoring software such as Maya (3D modeling and computer animation) or After Effects (motion graphics, compositing and visual effects), we encounter a different logic. These software applications do not simulate any single physical media that existed previously. Rather, they borrow from a number of different media, combining and mixing their working methods and specific techniques. (And, of course, they also add new capabilities specific to computers—for instance, the ability to automatically calculate the intermediate values between a number of key frames.) For example, 3D modeling software mixes form-making techniques which were previously “hardwired” to different physical media: the ability to change the curvature of a rounded form as though it were made from clay, the ability to build a complex 3D object from simple geometric primitives the way buildings were constructed from identical rectangular bricks, cylindrical columns, pillars, etc.

Similarly, as we saw, the After Effects original interface, toolkit, and workflow draws upon the techniques of animation and graphic design. (We can also find traces of filmmaking and 3D computer graphics.) But the result is not simply a mechanical sum of all elements that came from earlier media. Rather, as software remixes the techniques and working methods of the various media they simulate, the results are new interfaces, tools, and workflows with their own distinct logic. In the case of After Effects, the working method that it puts forward is neither animation nor graphic design nor cinematography, even though it draws from all these fields. It is a new way to make moving image media. Similarly, the visual language of media produced with this and similar software is also different from the languages of moving images that existed previously.

Consequently, the Velvet Revolution unleashed by After Effects and other software did not simply make more commonplace the animated graphics that artists and designers such as John and James Whitney, Norman McLaren, Saul Bass, Robert Abel, Harry Marks, Richard and Robert Greenberg were previously creating using stop motion animation, optical printing, video effects hardware of the 1980s, and other custom techniques and technologies. Instead it led to the emergence of numerous new visual aesthetics that did not exist before. And if the common feature of these aesthetics is

“deep remixability,” it is not hard to see that it mirrors the “deep remixability” in the After Effects UI.

3D space as a media design platform

As I was researching what users and industry reviewers had been saying about After Effects, I came across a somewhat condescending characterization of this software as “Photoshop with keyframes.” I think that this characterization is actually quite useful.²⁹ Think about all the different ways of manipulating images available in Photoshop and the degree of control provided by its multiple tools. Think also about Photoshop’s concept of a visual composition as a stack of potentially hundreds of layers, each with its own transparency setting and multiple alpha channels. If we are able to animate such a composition and continue using Photoshop’s tools to adjust visual elements over time on all layers independently, this indeed constitutes a new paradigm for creating moving images. And this is what After Effects and other animation, visual effects, and compositing software make possible today.³⁰ And while the idea of working with a number of layers placed on top of each other itself is not new—consider traditional cel animation, optical printing, video switchers, photo-collage, graphic design—going from a few non-transparent layers to hundreds and even thousands of layers, each with its controls, fundamentally changes not only how a moving image looks but also what it can say. From being a special effect reserved for particular shots, 2D compositing became a part of the standard animation and video editing interface.

But innovative as the 2D compositing paradigm was, by the beginning of the 2000s it was supplemented by a new one: 3D compositing. If 2D compositing can be thought as an extension

²⁹ Soon after the initial release of After Effects in January 1993, CoSA (the company that produced this software) was purchased by Aldus, which in turn was purchased by Adobe—which was already selling Photoshop.

³⁰ Photoshop and After Effects were designed originally by different teams at different times, and even after both products were purchased by Adobe (it released Photoshop in 1989 and After Effects in 1995), it took Adobe a number of years to build close links between After Effects and Photoshop eventually making it easy to move assets between the two programs.

of already familiar media techniques, the new paradigm does not come from any previous physical or electronic media. Instead, it takes the new born-digital media which was invented in the 1960s and matured by the early 1990s—interactive 3D computer graphics and animation—and transforms it into a general platform for moving media design.

The language used in the professional production milieu today reflects an implicit understanding that 3D graphics is a new medium unique to a computer. When people use the terms “computer visuals,” “computer imagery,” or “CGI” (which is an abbreviation for “computer generated imagery”) everybody understands that they refer to 3D graphics as opposed to other image sources such as “digital photography.” I think of 3D computer graphics as a new media—as opposed to considering it an extension of architectural drafting, projection geometry, or set making—because they offer a new method for representing three-dimensional reality: both objects that already exist and objects that are only imagined. This method is fundamentally different from what has been offered by the main representational media of the industrial era: lens-based capture (still photography, film recording, video) and audio recording. With 3D computer graphics, we can represent a three-dimensional structure of the world, versus capturing only a perspectival image of the world, as in lens-based recording. We can also manipulate our representation using various tools with ease and precision—qualitatively different from the much more limited “manipulability” of a model made from any physical material (although nanotechnology promises to change this in the future). And, as contemporary architectural aesthetics makes clear, 3D computer graphics is not simply a faster way of working with geometric representations like the plans and cross-sections used by draftsmen for centuries. When generations of young architects and architectural students started to systematically work with 3D modeling and animation software such as Alias in the middle of the 1990s, the ability to directly manipulate a 3D shape (rather than only dealing with its projections as in traditional drafting) quickly led to a whole new language of complex non-rectangular curved forms. In other words, architects working with the media of 3D computer graphics started to imagine different things than their predecessors who used pencils, rules, and drafting tables.

When the Velvet Revolution of the 1990s made it possible to easily combine multiple media sources in a single moving image sequence using multi-layer interface of After Effects, CGI was added to the mix. Today, 3D models are routinely used in media compositions created in After Effects and similar software, along with all other media sources. But in order to be a part of the mix, these models need to be placed on their own 2D layers and thus treated as 2D images. This was the original After Effects paradigm: all image media can meet as long as they are reduced to 2D.³¹

In contrast, in the 3D compositing paradigm all media types are placed within a single 3D space. One advantage of this representation is that since 3D space is “native” to 3D computer graphics, 3D models can stay as they are, i.e. three-dimensional. An additional advantage is that the designer can now use all the techniques of virtual cinematography as developed in 3D computer animation. S/he can define different kinds of lights, fly the virtual camera around and through the image planes using any trajectory, and use depth of field and motion blur effects.³²

While 3D computer-generated models already “live” in this space, how do you bring in two-dimensional visual elements—video, digitized film, typography, drawn images? If 2D compositing paradigm treated everything as 2D images—including 3D computer models—3D compositing treats everything as 3D. So while two-dimension elements do not inherently have a third dimension, it has to be added to enable these elements to enter the three-dimensional space. To do that, a designer places flat cards in this

³¹ I say “original” because the later version of After Effects added the ability to work with 3D layers.

³² If 2D compositing can be understood as an extension of twentieth-century cel animation, where a composition consists of a stack of flat drawings, the conceptual source of the 3D compositing paradigm is different. It comes out of the work on integrating live action footage and CGI done in the 1980s in the context of feature films production. Both film director and computer animator work in a three-dimensional space: the physical space of the set in the first case, the virtual space as defined by 3D modeling software in the second case. Therefore conceptually it makes sense to use three-dimensional space as a common platform for the integration of these two worlds. It is not accidental that NUKE, one of today’s leading programs for 3D compositing was developed in-house at Digital Domain, which was co-founded in 1993 by James Cameron, the Hollywood director who has systematically advanced the integration of CGI and live action in films such as *The Abyss* (1989), *Terminator 2* (1991), and *Titanic* (1997).

“In the 3D compositing paradigm all media types are placed within a single 3D space.” This illustration uses the animation from earlier, but adds the third dimension. We positioned each element at a different depth, and added a light, casting shadows.

space in particular locations, and situates two-dimensional images on these cards. Now, everything lives in a common 3D space. This condition enables “deep remixability” between techniques which I have illustrated using the example of “Go” video. The techniques of drawing, photography, cinematography, and typography which go into capturing or creating two-dimensional visual elements can now “play” together with all the techniques of 3D computer animation (virtual camera moves, controllable depth of field, variable lens, etc.)

In 1995 I wrote the article ‘What is Digital Cinema?’ The article asked how the changes in moving image production I was witnessing (I was living in Los Angeles at that time, which made it easy to follow what was happening in Hollywood) were affecting the meaning of “cinema.” In that article I proposed that the logic of hand-drawn animation, which throughout the twentieth century was marginal in relation to cinema, became dominant in a software era. Because software allows the designer to manually manipulate any image regardless of its source as though it was drawn in the first place, the ontological differences between different image media become irrelevant. Both conceptually and practically, they are all reduced to hand-drawn animation.

By default, After Effects and other animation/video editing/2D compositing software treats a moving image project as a stack of layers. Therefore, I can extend my original argument and propose that animation logic also moves from the marginal to the dominant position in yet another way. The paradigm of a composition as a stack of separate visual elements as practiced in cel animation becomes the default way of working with all images in a software environment—regardless of their origin and final output media. In other words, a “moving image” is now understood as a composite of layers of imagery—rather than as a still flat picture that only changes in time, as it was the case for most of the twentieth century. In the word of animation, editing, and compositing software, such a “single layer image” becomes an exception.

The emergence of the *3D compositing paradigm* can be also seen as following this logic of historical reversal. The new representational structure as developed within the computer graphics field—a 3D virtual space containing 3D models—has gradually moved from a marginal to a dominant role. In the 1970s and 1980s computer graphics were used only occasionally in a dozen feature films such

as *Alien* (1979), *Tron* (1981), *The Last Starfighter* (1984), and *The Abyss* (1989), and selected television commercials and broadcast graphics. But by the beginning of the 2000s, the representation structure of computer graphics, i.e. a 3D virtual space, came to function as an umbrella for all other image types regardless of their origin. An example of an application which implements this paradigm is Flame, enthusiastically described by one user as “a full 3D compositing environment into which you can bring 3D models, create true 3D text and 3D particles, and distort layers in 3D space.”³³

This does not mean that 3D animation itself became visually dominant in moving image culture, or that the 3D structure of the space within which media compositions are now routinely constructed is necessarily made visible (usually it is not). Rather, the way 3D computer animation organizes visual data—as objects positioned in a Cartesian space—became the way to work with all moving image media. As already stated above, a designer positions all the elements which go into a composition—2D animated sequences, 3D objects, particle systems, video and digitized film sequences, still images and photographs—inside the shared 3D virtual space. There these elements can be further animated, transformed, blurred, filtered, etc. So while all moving image media has been reduced to the status of hand-drawn animation in terms of their manipulability, we can also state that all media have become layers in 3D space. In short, the new media of 3D computer animation has “eaten up” the dominant media of the industrial age—lens-based photo, film and video recording.

Having discussed how software has redefined the concept of a “moving image” as a composite of multiple layers, this is a good moment to pause and consider other possible ways software changed this concept. When cinema in its modern form was born in the end of the nineteenth century, the new medium was understood as an extension of already familiar one—that is, as a photographic image which was now moving. This understanding can be found in the press accounts of the day and also in one of the official names given to the new medium—“moving pictures.” On the material

³³ Alan Okey, post to forums.creativecow.net, December 28, 2005, http://forums.creativecow.net/cgi-bin/dev_read_post.cgi?forumid=154&postid=855029

level, a film indeed consisted of separate photographic frames. When they quickly replace each other, this creates the effect of motion for the viewer. So the concept used to understand cinema indeed fit in with the structure of the medium.

But is this concept still appropriate today? When we record video and play it, we are still dealing with the same structure: a sequence of frames. But for professional media designers, the terms have changed. The importance of these changes is not just academic and purely theoretical—because designers understand their media differently, they are creating films and sequences that also look very different from twentieth-century cinema or animation.

Consider those new ways of creating moving images (which I referred to as a new paradigms) that we have discussed thus far. (Although theoretically they are not necessarily all compatible with each other, in production practice these different paradigms are used in a complementary fashion.) A “moving image” became a hybrid which can combine all different visual media invented so far—rather than holding only one kind of data such as camera recording, hand drawing, etc. Rather than being understood as a singular flat plane—the result of light focused by the lens and captured by the recording surface—it is now understood as a stack of a potentially infinite number of separate layers. And rather than “time-based,” it becomes “composition-based,” or “object-oriented.” That is, instead of being treated as a sequence of frames arranged in time, a “moving image” is now understood as a two-dimensional composition that consists of a number of objects that can be manipulated independently. Alternatively, if a designer uses 3D compositing, the conceptual shift is even more dramatic: instead of editing “images,” s/he is working in a virtual three-dimensional space that holds both CGI and lens-recorded flat image sources.

Of course, frame-based representation did not disappear—it became simply a recoding and output format rather than the space where a film is being put together. And while the term “moving image” can be still used as an appropriate description for how the output of a production process is experienced by the viewers, it is no longer captures how the designers think about what they create. Because their production environment—workflow, interfaces, and tools—has changed so much, they are thinking today very differently than twenty years ago.

If we focus on what the different paradigms summarized above have in common, we can say that filmmakers, editors, special effects artists, animators, and motion graphics designers are all working on *a composition in 2D or a 3D space that consists of a number of separate objects*. The spatial dimension has become as important as the temporal dimension. From the concept of a “moving image” understood as a sequence of static photographs we have moved to a new concept: *a modular media composition*. And while a person who directs a feature or a short film that is centered around actors and live action can be still called a “filmmaker,” in all other cases where most of the production takes place in a software environment, it is more appropriate to call the person a “designer.” This is yet another fundamental change in the concept of “moving images”: today more often than not they are not “captured,” “directed,” or “animated.” Instead, they are “designed.”

Import/export: design workflow

In our discussions of the After Effects interface and workflow, as well as the newer paradigm of 3D compositing, we have already come across the crucial aspect of software-based media production process. Until the arrival of software-based tools in the 1990s, combining different types of time-based media together was either time consuming, expensive, or in some cases simply impossible. Software tools such as After Effects have changed this situation in a fundamental way. Now a designer can import different media into their composition with just a few mouse clicks.

However, the contemporary software-based design of moving images—or any other design process, for that matter—does not simply involve combining elements from different sources within a single application. In this section we will look at the whole workflow typical of contemporary design—be it the design of moving images, still illustrations, 3D objects and scenes, architecture, music, websites, or any other media. (Most of the details of software-based production of moving images which I have already presented also applies to the graphic design of still images and layouts for print, the web, packaging, physical spaces, mobile devices, etc. However, in this section I want to make this explicit.

Therefore the examples below will include not only moving images, but also graphic design.)

Although “import/export” commands appear in most modern media authoring and editing software applications running under a GUI, at first sight they do not seem to be very important for understanding software culture. When you “import,” you are neither authoring new media nor modifying media objects, nor accessing information across the globe, as in web browsing. All these commands allow you to do is to move data around between different applications. In other words, they make data created in one application compatible with other applications. And that does not look so important.

Think again. What is the largest part of the economy of the greater Los Angeles area? It is not entertainment. From movie production to museums and everything in between, entertainment only accounts for 15 percent. It turns out that the largest part of the economy is the import/export business—more than 60 percent. More generally, one commonly evoked characteristic of globalization is greater connectivity—places, systems, countries, organizations etc. becoming connected in more and more ways. And connectivity can only happen if you have certain level of compatibility: between business codes and procedures, between shipping technologies, between network protocols, between computer file formats, and so on.

Let us take a closer look at import/export commands. As I will try to show below, these commands play a crucial role in software culture, and in particular in media design—regardless of what kind of project a design is working on.

Before they adopted software tools in the 1990s, filmmakers, graphic designers, and animators used completely different technologies. Therefore, as much as they were influenced by each other or shared the same aesthetic sensibilities, they inevitably created different-looking images. Filmmakers used camera and film technology designed to capture three-dimensional physical reality. Graphic designers were working with offset printing and lithography. Animators were working with their own technologies: transparent cels and an animation stand with a stationary film camera capable of making exposures one frame at a time as the animator changed cels and/or moved background.

As a result, twentieth-century cinema, graphic design, and animation (I am talking here about standard animation techniques

used by most commercial studios) developed distinct artistic languages and vocabularies both in terms of form and content. For example, graphic designers worked with a two dimensional space, film directors arranged compositions in three-dimensional space, and cel animators worked with “two-and-a-half” dimensions. This holds for the overwhelming majority of works produced in each field, although of course exceptions do exist. For instance, Oskar Fischinger made one abstract film that consisted of simple geometric objects moving in an empty space—but as far as I know this is the only film in the history of abstract pre-digital animation that takes place in three-dimensional space.

Differences in technology influenced what kind of content would appear in different media. Cinema showed “photorealistic” images of nature, built environments and human forms articulated by special lighting. Graphic designs featured typography, abstract graphic elements, monochrome backgrounds, and cutout photographs. And cartoons presented hand-drawn flat characters and objects animated over hand-drawn (but more detailed) backgrounds. The exceptions are rare. For instance, while architectural spaces frequently appeared in films because directors could explore their three—dimensionality in staging scenes, they practically never appeared in animated films in any detail—until animation studios started using 3D computer animation.

Why was it so difficult to cross boundaries? For instance, in theory one could imagine making an animated film in the following way: printing a series of slightly different graphics designs and then filming them as though they were a sequence of animated cels. Or a film where a designer simply made a series of hand drawings that used the exact vocabulary of graphic design and then filmed them one by one. And yet, to the best of my knowledge, such a film was never made. What we find instead are many abstract animated films that have a certain connection to various styles of abstract painting. For example, Oskar Fischinger’s films and paintings share certain forms. We can also find abstract films and animated commercials and movie titles that have a connection to graphic design aesthetics popular around the same time. For instance, some moving image sequences made by motion graphics pioneer Pablo Ferro in the 1960s display psychedelic aesthetics which can also be found in posters, record covers, and other works of graphic design in the same period.

And yet despite these connections, works in different media never used exactly the same visual language. One reason is that projected film could not adequately show the subtle differences between typeface sizes, line widths, and gray-scale tones crucial for modern graphic design. Therefore, when the artists were working on abstract art films or commercials that adopted design aesthetics (and most major twentieth-century abstract animators worked both on their personal films and commercials), they could not simply expand the language of a printed page into the time dimension. They essentially had to invent a parallel visual language that used bold contrasts, more easily readable forms, and thick lines—that, because of their thickness, were in fact no longer lines but shapes.

Although the limitations in resolution and contrast of film and television image in comparison to a printed page contributed to the distance between the languages used by abstract filmmakers and graphic designers for the most of the twentieth century, ultimately I do not think it was the decisive factor. Today the resolution, contrast and color reproduction between print, computer screens, television screens, and the screens of mobile phones are also substantially different—and yet we often see exactly the same visual strategies deployed across these different display media. If you want to be convinced, leaf through any book or a magazine on contemporary 2D design (i.e., graphic design for print, broadcast, and the web). When you look at pages featuring the works of a particular designer or a design studio, in most cases it is impossible to identify the origins of the images unless you read the captions. Only then do you find which image is a poster, which one is a still from a music video, and which one is a magazine editorial.

I am going to use *Graphic Design for the 21st Century: 100 of the World's Best Graphic Designers* (Taschen, 2001) for my examples because by 2001, the changes I describe had already taken place. Peter Anderson's design showing a line of type against a cloud of hundreds of little letters in various orientations turns out to be the frames from the title sequence for a Channel 4 documentary. His other design which similarly plays on the contrast between jumping letters in a larger font against irregularly cut planes made from densely packed letters in much smaller fonts, turns to be a spread from IT Magazine. Since the first design was made for broadcast while the second was made for print, we would expect that the first design would employ bolder forms—however, both designs

use the same scale between big and small fonts, and feature texture fields composed from hundreds of words in such a small font that they are clearly not intended to be read. A few pages later we encounter a design by Philippe Apeloig that uses exactly the same technique and aesthetics as Anderson used. In this case, tiny lines of text positioned at different angles form a 3D shape floating in space. On the next page another design by Apeloig creates a field in perspective—made not from letters but from hundreds of identical abstract shapes.

These designs rely on the software's ability (or on the designer being influenced by software use and recreating what s/he did with software manually) to treat text as any graphical primitive and to easily create compositions made from hundreds of similar or identical elements positioned according to some pattern. And since an algorithm can easily modify each element in the pattern, changing its position, size, color, etc., instead of the completely regular grids of modernism we see more complex structures that are made from many variations of the same element. This strategy is explored particularly imaginatively in Zaha Hadid's designs such as the Louis Vuitton "Icône Bag" 2006, and in her urban master plans for Singapore and Turkey, which use what Hadid called a "variable grid."

Each designer included in the book was asked to provide a brief statement to accompany the portfolio of his/her work, and Lust Studio has chosen the phrase "Form-follows-process" as their motto. So what is the nature of the design process in the software age and how does it influence the forms we see today around us?

If you are practically involved in design or art today, you already know that contemporary designers use the same small set of software tools to design just about everything. I have already named them repeatedly, so you know the list: Photoshop, Illustrator, Flash, Maya, etc. However, the crucial factor is not the tools themselves but the workflow process, enabled by "import" and "export" operations and related methods ("place," "insert object," "subscribe," "smart object," etc.), that ensure coordination between these tools.

When a particular media project is being put together, the software used at the final stage depends on the type of output media and the nature of the project—After Effects for motion graphics

Examples of a “variable grid” in architecture: two master plans by Zaha Hadid. Top: Kartal Pendik, Istanbul, 2006. Bottom: One North, Singapore, 2001.

projects and video compositing, Illustrator for print illustrations, InDesign for multi-page designs, Flash for interactive interfaces and web animations, 3ds Max or Maya for 3D computer models and animations, and so on. But these programs are rarely used alone to create a media design from start to finish. Typically, a designer may create elements in one program, import them into another program, add elements created in yet another program, and so on. This happens regardless whether the final product is an illustration for print, a website, or a motion graphics sequence, whether it is a still or a moving image, interactive or non-interactive, etc.

The very names which software companies give to the products for media design and production refer to this defining characteristic of software-based design process. Since 2005, Adobe has been selling its different media authoring applications bundled together under the name “Adobe Creative Suite.” Among the subheadings and phrases that were used to accompany this brand name, one in particular is highly meaningful in the context of our discussion: “Design Across Media.” This phrase accurately describes both the capabilities of the applications collected in a suite and their actual use in the real world. Each of the key applications collected in the suite—Photoshop, Illustrator, InDesign, Flash, Dreamweaver, After Effects, Premiere—has many special features geared for producing a design for particular output media. Illustrator is set up to work with professional-quality printers; After Effects and Premiere can output video files in a variety of standard video formats such as HDTV; Dreamweaver supports programming and scripting languages to enable creation of sophisticated and large-scale dynamic websites. But while a design project is finished in one of these applications, most other applications in Adobe Creative Suite will be used in the process to create and edit its various elements. This is one of the ways in which Adobe Creative Suite enables “design across media.” The compatibility between applications also means that the elements (called in professional language “assets”) can be later re-used in new projects. For instance, a photograph edited in Photoshop can first be used in a magazine ad and later put in a video, a website, etc. Or, the 3D models and characters created for a feature film can be reused for a video game based on the film. This ability to re-use the same design elements for very different projects is very important because of the widespread practice in creative industries to create products across the range

of media which share the same images, designs, characters, narratives, etc. An advertising campaign often works “across media” including web ads, TV ads, magazine ads, billboards, etc. And if turning movies into games and games into movies has been already popular in Hollywood since the early 1990s, a new trend since approximately the middle of the 2000s is to create a movie, a game, a website or maybe other media products at the same time—and have all the products use the same digital assets both for economic reasons and to assure aesthetic continuity between these products. Thus, a studio may create 3D backgrounds and characters and put them in both a movie and a game, both of which will be released simultaneously. If media authoring applications were not compatible, such a practice would simply not be possible.

All these examples illustrate the intentional reuse of design elements “across media.” However, the compatibility between media authoring applications also has a much broader and unintentional effect on contemporary aesthetics. Given the production workflow I have just described, we may expect that the same visual techniques and strategies will also appear in all types of media projects designed with software, without this being consciously planned for. We may also expect that this will happen on a much more basic level. This is indeed the case. *The same software-enabled design strategies, the same software-based techniques, and the same software-generated iconography are now found across all types of media, all scales, and all kinds of projects.*

We have already encountered a few concrete examples. For instance, the three designs by Peter Anderson and Philippe Apeloig done for different media use the same basic computer graphic technique: automatic generation of a repeating pattern while varying the parameters that control the appearance of each element making up the pattern—its size, position, orientation, curvature, etc. (The general principle behind this technique can also be used to generate 3D models, animations, textures, make plants and landscapes, etc. It is often referred to as “parametric design,” or “parametric modeling.”) The same technique is also used by Hadid’s studio for the Louis Vuitton “Icone Bag”. In another example, which will be discussed below, Greg Lynn used particle systems technique—which at that time was normally used to simulate fire, snow, waterfalls, and other natural phenomena in cinema—to generate the forms of a building.

To use the biological metaphor, we can say that compatibility between design applications creates very favorable conditions for the propagation of media DNA between species, families, and classes. And this propagation happens on all levels: the whole design, parts of a design, the elements making up the parts, and the “atoms” that make up the elements. Consider the following hypothetical example of propagation on a lower level. A designer can use Illustrator to create a 2D smooth curve (called in the computer graphics field a “spline.”) This curve becomes a building block that can be used in any project. It can form part of an illustration or a book design. It can be imported into an animation program where it can be set to motion, or imported into 3D program where it can be extruded in 3D space to define a solid object.

Over time software manufacturers worked to develop tighter ways of connecting their applications, in order to make it easier to move elements from one application to another. Over the years, it became possible to move a whole project between applications without losing anything (or almost anything). For example, in describing the integration between Illustrator CS3 and Photoshop CS3, Adobe’s website states that a designer can “Preserve layers, layer comps, transparency, and editable files when moving files between Photoshop and Illustrator.”³⁴ Another important development has been the concept that Microsoft Office calls “linked objects.” If you link all or part of one file to another file (for instance, linking an Excel document to a PowerPoint presentation), anytime information changes in the first file it automatically gets updated in the second file. Many media applications implement this feature. To use the same example of Illustrator CS3, a designer can “Import Illustrator files into Adobe Premiere Pro software, and then use Edit Original command to open the artwork in Illustrator, edit it, and see your changes automatically incorporated into your video project.”³⁵

Each type of program used by media designers—3D graphics, vector drawing, image editing, animation, compositing—excel at particular design operations, i.e. particular ways of creating design elements or modifying already existing elements. These

³⁴ <http://www.adobe.com/products/illustrator/features/allfeatures/> (August 30, 2008).

³⁵ *Ibid.*

operations can be compared to the different types of blocks of a LEGO set. You can create an infinite number of projects by using the limited number of block types provided in the set. Depending on the project, these block types will have different functions and appear in different combinations. For example, a rectangular block may become part of the tabletop, part of the head of a robot, etc.

A design workflow that uses a small number of compatible software programs works in a similar way—with one important difference. The building blocks used in contemporary design are not only different kinds of visual elements one can create—vector patterns, 3D objects, particle systems, etc.—but also *various ways of modifying these elements*: blur, skew, vectorize, change transparency level, extrude, etc. This difference is crucial. If media creation and editing software did not include these and many other modification operations, we would see an altogether different visual language at work today. We would see “multi-media,” i.e. designs that simply combine elements from different media. Instead, we see “deep remixability”—the “deep” interactions between working methods and techniques of different media within a single project.

In a “crossover” use, the techniques which were previously specific to one media are applied to other media types (for example, a lens blur filter). This often can be done within a single application—for instance, applying After Effects’ blur filter to a composition which can contain graphic elements, video, 3D objects, etc. And being able to move a whole project or its elements between applications opens more possibilities because each application offers many unique techniques not available in other applications. As the media data travels from one application to the next, it is being transformed and enhanced using the operations offered by each application. For example, a designer can take the project s/he has been editing in Adobe Premiere and import it in After Effects where s/he can use advanced compositing features of that program. S/he can then import the result back into Premiere and continue editing. Or s/he can create artwork in Photoshop or Illustrator and import it into Flash where it can be animated. This animation can be then imported into a video editing program and combined with video. And so on.

The production workflow specific to the software era that I have just illustrated has two major consequences. Its first result is the visual aesthetics of hybridity that dominates contemporary design universe. The second is the use of the same techniques and strategies across this universe—regardless of the output media and type of project.

As I have already stated more than once, a typical design today combines techniques coming from multiple media. We are now in a better position to understand why this is the case. As a designer works on a project, s/he combines the results of the operations specific to different software programs that were originally created to imitate work with different physical media (Illustrator was created to make illustrations, Photoshop to edit digitized photographs; Premiere to edit video, etc.) While these operations continue to be used in relation to their original media, most of them are now also used as part of the workflow on any design job.

The essential condition that enables this new design logic and the resulting aesthetics is compatibility between files generated by different programs. In other words, “import,” “export” and related functions and commands of graphics, animation, video editing, compositing and modeling software are historically more important than the individual operations these programs offer. The ability to combine raster and vector layers within the same image, place 3D elements into a 2D composition and vice versa, etc. is what enables the production workflow and its reuse of the same techniques, effects, and iconography across different media.

The consequences of this compatibility between software and file formats, which was gradually achieved during the 1990s, are hard to overestimate. Besides the hybridity of modern visual aesthetics and the reappearance of exactly the same design techniques across all output media, there are also other effects. For instance, the whole field of motion graphics as it exists today came into existence to a large extent because of the integration between vector drawing software, specifically Illustrator, and animation/compositing software such as After Effects. A designer typically defines various composition elements in Illustrator and then imports them into After Effects where they are animated. This compatibility did not exist when the initial versions of different media authoring and editing software became available in the 1980s. It was gradually added in particular software releases. But when it was achieved

around the middle of the 1990s,³⁶ within a few years the whole language of contemporary graphic design was fully imported into the moving image area—both literally and metaphorically.

In summary, the compatibility between graphic design, illustration, animation, video editing, 3D modeling and animation, and visual effects software plays the key role in shaping the visual and spatial forms of the software age. On the one hand, never before have we witnessed such a variety of forms as today. On the other hand, exactly the same techniques, compositions and iconography can now appear in any media.

Variable form

As the films of Blake and Murata discussed earlier illustrate, in contemporary motion graphics the transformations often affect the frame as a whole. In contrast to twentieth-century animation, everything inside the frame keeps changing: visual elements, their transparency, the texture of the image, etc. In fact, if something stays the same for a while, that is an exception rather than the norm.

Such *constant change on many visual dimensions* is another key feature of motion graphics and design cinema produced today. Just as we did in the case of media hybridity, we can connect this preference for constant change to the particulars of software used in media design.

Digital computers allow us to represent any phenomenon or structure as a set of variables. In the case of design and animation software, this means that all possible forms—visual, temporal, spatial, interactive—are similarly represented as sets of variables that can change continuously. This new logic of form is deeply encoded in the interfaces of software packages and the tools they provide.

Consider again the After Effects interface. To create an animation, a designer adds a number of elements to the composition and then animates them. Each new element shows up in the interface as a

³⁶ In 1995, After Effects 3.0 enabled importing Illustrator files and Photoshop files as compositions. http://en.wikipedia.org/wiki/Adobe_After_Effects

“To create an animation, a designer adds a number of elements to the composition and then animates them. Each new element shows up in the interface as a list of parameters. Animating any parameter is equally easy, and it only takes a few clicks.” The illustration shows a part of After Effects Timeline panel for the 3D animation illustrated earlier. The Timeline contains one light, one camera, three shapes (two rectangles and a circle), and a horizontal plane.

The parameters for the light, the camera, and the circle shape as they appear in After Effects interface. Each parameter can be animated separately. (To create this illustration, we redrew a part of the After Effects Timeline panel screenshot that appears on the opposite page to only show the parameter names.)

list of parameters, each with its animation channel. Depending on the element type, the parameters range from a few to a dozen or more. For example, for lights, their parameters are intensity, color, shadow darkness and shadow diffusion. If an element is a camera, the parameters include its point of interest, position, orientation, and rotation. For shapes, the list of parameters is particularly long: position, scale, orientation, opacity, material properties including cast shadows, light transmission, ambient, diffuse, and specular qualities, shininess, and others.

Animating any parameter only takes a few clicks. The process works the same regardless of the element and parameter type. Thus, it is equally easy to change over time the position of a shape, its color, or the intensity of a light.

In contrast to twentieth-century animation, After Effects does not privilege movement of two-dimensional objects and characters. Accordingly, After Effects Help defines “animation” as “change over time”—without specifying what can change.³⁷ The answer is provided by the interface itself. Its design suggests that you can animate hundreds of visual characteristics (and if we also consider that most filters can also be animated, the list goes into thousands).

Because the software interface makes directly visible every parameter for every object in the composition, assigning each its own channel on the timeline, it literally invites the designer to start animating them. You are invited to start moving and rotating objects, changing their opacity, colors, and so on. The same logic extends to the camera and the lights. If you add a light to the composition, this immediately creates half a dozen new animation channels describing light’s color, position, orientation, intensity, and shadow properties, each with its own timeline channel. (Other 2D and 3D animation and layer-based compositing software packages all share the same interface principles.³⁸)

³⁷ http://help.adobe.com/en_US/AfterEffects/9.0/ (November 7, 2012).

³⁸ Node-based compositing software uses a different interface principle: each element in a composition is represented as node in a graph. This interface is particularly useful for creating scenes that contain a very large number of elements interacting with each other. Popular industry node-based compositing software includes Fusion and Nuke.

During the 1980s and 1990s the general logic of computer representation—that is, representing everything as variables that can have different values—was systematically embedded throughout the interfaces of media design software. As a result, although a particular software application does not directly prescribe to its users what they can and cannot do, the structure of the interface strongly influences the designer's thinking. In the case of moving image design, the result of having a timeline interface with multiple channels all just waiting to be animated is that a designer usually does animate them. If previous constraints in animation technology—from the first optical toys in the early nineteenth century to the standard cel animation system in the twentieth century—resulted in an aesthetics of discrete and limited temporal changes, the interfaces of computer animation software quickly led to a new aesthetics: the continuous transformations of most (or all) visual elements appearing in a frame.

This change in animation aesthetics deriving from the interface design of animation software was paralleled by a change in another field—architecture. In the mid-1990s, when architects started to use software originally developed for computer animation and special effects (first Alias and Wavefront; later Maya and others), the idea of animated form entered architectural thinking as well. If 2D animation/compositing software such as After Effects enables an animator to change any parameter of a 2D object (a video clip, a 2D shapes, type, etc.) over time, 3D computer animation allows the same for any 3D shape. An animator can set up key frames manually and let a computer calculate how a shape changes over time. Alternatively, s/he can direct algorithms that will not only modify a shape over time but can also generate new ones. (3D computer animation tools to do this include particle systems, physical simulation, behavioral animation, artificial evolution, L-systems, etc.) Working with 3D animation software affected architectural imagination both metaphorically and literally. The shapes that started to appear in projects by young architects and architecture students in the second part of the 1990s looked as if they were in the process of being animated, captured as they were transforming from one state to another. The presentations of architectural projects and research begin to feature multiple variations of the same shape generated by varying parameters in software. Finally, in projects such as Gregg Lynn's New York Port Authority

Gateway (1995),³⁹ the paths of objects in an animation were literally turned into an architectural design. Using a particle system (a part of Wavefront animation software), which generates a cloud of points and moves them in space to satisfy a set of constraints, Lynn captured these movements and turned them into the curves making up his proposed building.

Equally crucial was the exposure of architects to the new generation of modeling tools in the commercial animation software of the 1990s. For two decades the main technique for 3D modeling was to represent an object as a collection of flat polygons. But by the mid-1990s, the faster processing speeds of computers and the increased size of computer memory made it practical to offer another technique on desktop workstations—spline-based modeling. This new technique for representing form pushed architectural thinking away from rectangular modernist geometry and toward the privileging of smooth and complex forms made from continuous curves. As a result, since the second part of the 1990s, the aesthetics of “blobs” has come to dominate the thinking of many architecture students, young architects, and even already well-established “star” architects such as Zaha Hadid, Eric Moss, and UN Studio.

But this was not the only consequence of the switch from the standard architectural tools and CAD software (such as AutoCAD) to animation/special effects software. Traditionally, architects created new projects on the basis of existing typology. A church, a private house, a railroad station all had their well-known types—the spatial templates determining the way space was to be organized. Similarly, when designing the details of a particular project, an architect would select from the various standard elements with well-known functions and forms: columns, doors, windows, etc.⁴⁰ In the twentieth century mass-produced housing only further embraced this logic, which eventually became encoded in the interfaces of CAD software.

But when in the early 1990s, Gregg Lynn, the firm Asymptote, Lars Spuybroek, and other young architects started to use 3D

³⁹ Gregg Lynn, *Animate Form* (Princeton Architectural Press, 1999), pp. 102–19.

⁴⁰ I am grateful to Lars Spuybroek, the principal of Nox, for explaining to me how the use of software for architectural design subverted traditional architectural thinking based on typologies.

software that had been created for other industries—computer animation, special effects, computer games, and industrial design—they found that this software came with none of the standard architectural templates or details. In addition, if CAD software for architects assumed that the basic building blocks of a structure are rectangular forms, 3D animation software came without such assumptions. Instead it offered splined curves and smooth surfaces and shapes constructed from these curves—which were appropriate for the creation of animated and game characters and industrial products. (In fact, splines were originally introduced into computer graphics in 1962 by Pierre Bézier for use in computer-aided car design.)

As a result, rather than being understood as a composition made up of template-driven standardized parts, a building could now be imagined as a single continuous curved form that can vary infinitely. It could also be imagined as a number of continuous forms interacting together. In either case, the shape of each of these forms was not determined by any kind of *a priori* typology.

(In retrospect, we can think of this highly productive “misuse” of 3D animation and modeling software by architects as another case of media hybridity—in particular, what I called the “crossover effect.” In this case, it is a crossover between the conventions and the tools of one design field—character animation and special effects—and the ways of thinking and knowledge of another field, namely, architecture.)

Relating this discussion of architecture to the main subject of this chapter—production of moving images—we can see now that by the 1990s both fields were affected by computerization in a structurally similar way. In the case of twentieth century commercial animation, all temporal changes inside a frame were limited, discrete, and usually semantically driven—i.e., connected to the narrative. When an animated character moved, walked into a frame, turned his/her head, or extended his/her arm, this was used to advance the story.⁴¹ After the switch to a software-based production process, moving images came to feature constant

⁴¹ In the case of narrative animation produced in Russia, Eastern Europe and Japan, the visual changes in a sequence were not always driven by the development of a narrative and could serve other purposes—establishing a mood, representing the emotional state, or simply used aesthetically for its own sake.

changes on many visual dimensions that were no longer limited by semantics. As defined by numerous motion-graphics sequences and short films of the 2000s, contemporary temporal visual form constantly changes, pulsates, and mutates beyond the need to communicate meanings and narrative. (The films of Blake and Murata offer striking examples of this new aesthetics of a variable form; many other examples can easily be found by surfing websites that showcase works by motion graphics studios and individual designers.)

A parallel process took place in architectural design. The differentiations in a traditional architectural form were connected to the need to communicate meaning and/or to fulfill the architectural program. An opening in a wall was either a window or a door; a wall was a boundary between functionally different spaces. Thus, just as in animation, the changes in the form were limited and were driven by semantics. But today, the architectural form designed with modeling software can change its geometry across the whole design, and these changes no longer have to be justified by function.

The Yokohama International Port Terminal (2002), designed by Foreign Office Architects, illustrates very well the aesthetics of variable form in architecture. The building is a complex and continuous spatial volume without a single right angle and with no distinct boundaries that would break the form into parts or separate it from the ground plane. Visiting the building in December 2003, I spent four hours exploring the continuities between the exterior and the interior spaces and enjoying the constantly changing curvature of its surfaces. The building can be compared to a Mobius strip—except that it is much more complex, less symmetrical, and more unpredictable. It would be more appropriate to think of it as a whole set of such strips smoothly interlinked together.

To summarize this discussion of how the shift to software-based representations affected the modern language of form: all constants were substituted by variables whose values can change continuously. As a result, culture went through what we can call the *continuity turn*. Both the temporal visual form of motion graphics and design cinema and the spatial form of architecture entered the new universe of continuous change and transformation. (The fields of product design and space design were similarly affected.) Previously, such aesthetics of “total continuity” was imagined by only a few artists. For instance, in the 1950s, architect Frederick

Kiesler conceived a project titled *Continuous House* that, as the name implies, is a single continuously curving spatial form unconstrained by the usual divisions into rooms. But when architects started to work with 3D modeling and animation software in the 1990s, such thinking became commonplace. Similarly, the understanding of a moving image as a continuously changing visual form without any cuts, which previously could be found only in a small number of films made by experimental filmmakers throughout the twentieth century such as Fischinger's *Motion Painting* (1947), now became the norm.

Today, there are many successful short films lasting only a few minutes and small-scale building projects based on the aesthetics of continuity—i.e. a single continuously changing form, but the next challenge for both motion graphics and architecture is to discover ways to employ this aesthetics on a larger scale. How do you scale up the idea of a single continuously changing visual or spatial form, without any cuts (for films) or divisions into distinct parts (for architecture)?

In architecture, a number of architects have already begun to successfully address this challenge. Examples include already realized projects such as the Yokohama International Port Terminal, the Kunsthau in Graz by Peter Cook (2004), and Ordos Museum by MAD Architects in Inner Mongolia, China (2012), as well as those under construction, such as Zaha Hadid's Performing Arts Centre on Saadiyat Island in Abu Dhabi, United Arab Emirates. (After the 2007 economic crisis, many ambitious building projects in Dubai and Eastern Europe were delayed or cancelled, but China and other countries continue to take risks and embrace the new architectural designs made from complex continuously changing curves.)

What about motion graphics? Blake has been one of the few artists to have systematically explored how hybrid visual language can work in longer pieces. *Sodium Fox* is 14 minutes; an earlier piece, *Mod Lang* (2001), is 16 minutes. The three films that make up *Winchester Trilogy* (2001–4) run for 21, 18, and 12 minutes. None of these films contain a single cut.

Sodium Fox and *Winchester Trilogy* use a variety of visual sources including photography, old film footage, drawings, animation, type, and computer imagery. All these media are woven together into a continuous flow. As I have already pointed out in relation

The Yokohama International Port Terminal. Foreign Office Architects, 2002.

to *Sodium Fox*, in contrast to shorter motion-graphics pieces with their frenzy of movement and animation, Blake's films contain very little animation in a traditional sense. Instead, various still or moving images gradually fade in on top of each other. So while each film moves through a vast terrain of different visuals—color and monochrome, completely abstract and figurative, ornamental and representational—it is impossible to divide the film into temporal units. In fact, even when I tried, I could not keep track of how the film got from one kind of image to a very different one just a couple of minutes later. And yet these changes were driven by some kind of logic, even if my brain could not compute it while I was watching each film.

The hypnotic continuity of these films can be partly explained by the fact that all visual sources in the films were manipulated via graphics software. In addition, many images were slightly blurred. As a result, regardless of the origin of the images, they all acquired a certain visual coherence. So although the films skillfully play on the visual and semantic differences between live-action footage, drawings, photographs with animated filters on top of them, and other media, these differences do not create juxtaposition or stylistic montage.⁴² Instead, various media seem to peacefully coexist, occupying the same space. In other words, Blake's films seem to suggest that deep remix is not the only possible result of softwarization.

We have already discussed in detail Alan Kay's concept of a computer metamedium. According to Kay's proposal made in the 1970s, we should think of the digital computer as a metamedium containing all the different "already existing and non-yet-invented media."⁴³ What does this imply for the aesthetics of digital projects? In my view, it does not imply that the different media necessarily fuse together, or make up a new single hybrid, or result in "multimedia," "intermedia," "convergence," or a totalizing Gesamtkunstwerk. As I have argued, rather than collapsing into a single entity, different media (i.e., different techniques, data formats, data sources, and working methods) start interacting,

⁴² In the "Compositing" chapter of *The Language of New Media*, I have defined "stylistic montage" as "juxtapositions of stylistically diverse images in different media."

⁴³ Kay and Goldberg, "Personal Dynamic Media."

producing a large number of hybrids, or new “media species.” In other words, just as in biological evolution, media evolution in a software era leads to differentiation and increased diversity—more species rather than less.

In the world dominated by hybrids, Blake’s films are rare in presenting us with relatively “pure” media appearances. We can either interpret this as the slowness of the art world, which is behind the evolutionary stage of professional media—or as a clever strategy by Blake to separate himself from the usual frenzy and over-stimulation of motion graphics. Or we can read his aesthetics as an implicit statement against the popular idea of “convergence.” As demonstrated by Blake’s films, while different media has become compatible, this does not mean that their distinct identities have collapsed. In *Sodium Fox* and *Winchester Trilogy*, the visual elements in different media maintain their defining characteristics and unique appearances.

Blake’s films also expand our understanding of what the aesthetics of continuity can encompass. Different media elements are continuously added on top of each other, creating the experience of a continuous flow, which nevertheless preserves their differences. Danish artist Ann Lislegaard also belongs to the “continuity generation.” A number of her films involve continuous navigation or an observation of imaginary architectural spaces. We may relate these films to the works of a number of twentieth-century painters and filmmakers who were concerned with similar spatial experiences: Giorgio de Chirico, Balthus, the Surrealists, Alain Resnais (*Last Year at Marienbad*), Andrei Tarkovsky (*Stalker*). However, the sensibility of Lislegaard’s films is unmistakably that of the early twenty-first century. The spaces are not clashing together as in, for instance, *Last Year at Marienbad*, nor are they made uncanny by the introduction of figures and objects (a practice of René Magritte and other Surrealists). Instead, like her fellow artists Blake and Murata, Lislegaard presents us with forms that continuously change before our eyes. She offers us yet another version of the aesthetics of continuity made possible by software such as After Effects, which translates the general logic of computer representation—the substitution of all constants with variables—into concrete interfaces and tools.

The visual changes in Ann Lislegaard’s *Crystal World (after J. G. Ballard)* (2006) happen right in front of us, and yet they are

Crystal World (after J. G. Ballard) by Ann Lislegaard, 2006. Selected stills from a 3D animation.

Crystal World (after J. G. Ballard) by Ann Lislegaard, 2006. *Installation photographs.*

practically impossible to track. Within the space of a minute, one space is completely transformed into something very different.

Crystal World creates its own hybrid aesthetics, one that combines photorealistic spaces, completely abstract forms, and a digitized photograph of plants. (Although I do not know the exact software Lislegaard's assistant used for this film, it is unmistakably some 3D computer animation package.) Since everything is rendered in gray scale, the differences between media are not loudly announced. And yet they are there. It is this kind of subtle and at the same time precisely formulated distinction between different media that gives this video its unique beauty. In contrast to twentieth-century montage, which created meaning and effect through dramatic juxtapositions of semantics, compositions, spaces, and different media, Lislegaard's aesthetics fits in with other minimalist cultural projects of the early twenty-first century. Today, the creators of minimal architecture and space design, web graphics, generative animations and interactives, ambient electronic music, and progressive fashions similarly assume that a user is intelligent enough to make out and enjoy subtle distinctions and continuous modulations.

Lislegaard's *Bellona* (after Samuel R. Delany) (2005) takes the aesthetics of continuity in a different direction. We are moving through and around what appears to be a single set of spaces. (Historically, such continuous movement through a 3D space has its roots in the early uses of 3D computer animation: first for flight simulators and later in architectural walk-throughs and first-person shooters.) While we pass through the same spaces many times, each time they are rendered in a different color scheme. The transparency and reflection levels also change. Lislegaard is playing a game with the viewer: while the overall structure of the film soon becomes clear, it is impossible to keep track of which space we are in at any given moment. We are never quite sure if we have already been there and it is now simply lit differently, or if it is a space that we have not yet visited.

Bellona can be read as an allegory of "variable form." In this case, variability is played out as seemingly endless color schemes and transparency settings. It does not matter how many times we have already seen the same space, it always can appear in a new way.

To show us our world and ourselves in a new way is, of course, one of the key goals of all modern art, regardless of the media.

By substituting all constants with variables, media software institutionalizes this desire. Now everything can always change and everything can be rendered in a new way. But, of course, simple changes in color or variations in a spatial form are not enough to create a new vision of the world. It takes talent to transform the possibilities offered by software into meaningful statements and original experiences. Lislegaard, Blake, and Murata—along with many other talented designers and artists working today—offer us distinct and original visions of our world in a state of continuous transformation and metamorphosis: visions that are fully appropriate for our time of rapid social, technological, and cultural change.

Amplification

Although the discussions in this chapter did not cover all the changes that took place during the Velvet Revolution, the magnitude of the transformations in moving image aesthetics and communication strategies should by now be clear. While we can name many social factors that all could have and probably did play some role—the rise of branding, experience economy, youth markets, and the Web as a global communication platform during the 1990s—I believe that these factors alone cannot account for the specific design and visual logics which we see today in media culture. Similarly, they cannot be explained by simply saying that contemporary consumer society requires constant innovation, constant novel aesthetics, and effects. This may be true—but why do we see these particular visual languages as opposed to others, and what is the logic that drives their evolution? I believe that to properly understand this, we need to carefully look at media creation, editing, and design software and its use in the production environment—which can range from one person with a laptop to a number of production companies around the world with thousands of people collaborating on the same large-scale project such as a feature film. In other words, we need to use the perspective of Software Studies.

The makers of software used in media production usually do not set out to create a revolution. On the contrary, software is created to fit into already existing production procedures, job roles, and

familiar tasks. But software applications are like species within the common ecology—in this case, a shared environment of a digital computer. Once “released,” they start interacting, mutating, and making hybrids. The Velvet Revolution can therefore be understood as the period of systematic hybridization between different software species originally designed to do work in different media. By 1993, designers had access to a number of programs which were already quite powerful but mostly incompatible: Illustrator for making vector-based drawings, Photoshop for editing of continuous tone images, Wavefront and Alias for 3D modeling and animation, After Effects for 2D animation, and so on. By the end of the 1990s, it became possible to use them in a single workflow. A designer could now combine operations and representational formats such as a bitmapped still image, an image sequence, a vector drawing, a 3D model and digital video specific to these programs within the same design. I believe that the hybrid visual language that we see today across “moving image” culture and media design in general is largely the outcome of this new production environment. While this language supports seemingly numerous variations as manifested in the particular media designs, its key aesthetics feature can be summed up in one idea: deep remixability of previously separate media languages.

As I have stressed more than once, the result of this hybridization is not simply a mechanical sum of the previously existing parts but new “species.” This applies both to the visual language of particular designs and to the operations themselves. *When a pre-digital media operation is integrated into the overall software production environment, it often comes to function in a new way.* I would like to conclude by analyzing in detail how this process works in the case of a particular operation—in order to emphasize once again that media remixability is not simply about adding the content of different media, or adding together their techniques and languages. And since remix in contemporary culture is commonly understood as comprising these kinds of additions, we may want to use a different term to talk about the kinds of transformations the example below illustrates. I called this provisionally “deep remixability,” but what is important is the idea and not a particular term. (So if you have a suggestion for a better one, send me an email.)

What does it mean when we see depth-of-field effects in motion graphics, films and television programs which use neither live

action footage nor photorealistic 3D graphics, but have a more stylized look? Originally an artifact of lens-based recording, depth of field was simulated in software in the 1980s when the main goal of 3D computer graphics field was to create maximum “photorealism,” i.e. synthetic scenes not distinguishable from live action cinematography. But once this technique became available, media designers gradually realized that it can be used regardless of how realistic or abstract the visual style is—as long as there is a suggestion of a 3D space. Typography moving in perspective through an empty space; drawn 2D characters positioned on different layers in a 3D space; a field of animated particles—any spatial composition can be put through the simulated depth of field.

The fact that this effect is simulated and removed from its original physical media means that a designer can manipulate it in a variety of ways. The parameters which define what part of the space is in focus can be independently animated, i.e. they can be set to change over time—because they are simply the numbers controlling the algorithm and not something built into the optics of a physical lens. So while simulated depth of field maintains the memory of the particular physical media (lens-based photo and film recording) from which it came, it became essentially a new technique which functions as a “character” in its own right. It has the fluidity and versatility not available previously. Its connection to the physical world is ambiguous at best. On the one hand, it only makes sense to use depth of field if you are constructing a 3D space, even if it is defined in a minimal way by using only a few or even a single depth cue, such as lines converging towards the vanishing point or foreshortening. On the other hand, the designer is now able to “draw” this effect in any way desirable. The axis controlling depth of field does not need to be perpendicular to the image plane, the area in focus can be anywhere in space, it can also quickly move around the space, etc.

In summary, when we remove depth of field from its original hardware home (photo and film cameras) and move it into software, we change where and how it can be used. We can still use it in its original context—that of lens-captured media. That is, we can apply it to 3D computer graphics elements in order to make them compatible with video or film captured via lens. But we can also now use it with many other media, for purely artistic effect.

And we can use it in many ways that were not even conceivable when it was part of media hardware.

Following the Velvet Revolution, the aesthetic charge of many media designs is often derived from “simpler” remix operations—juxtaposing different media in what can be called “media montage.” However, for me the essence of this Revolution is the more fundamental “deep remixability,” illustrated by this example of how depth of field was greatly amplified when it was simulated in software.

Computerization virtualized practically all media creation and modification techniques, “extracting” them from their particular physical media and turning them into algorithms. This means that in most cases, *we will no longer find any of the pre-digital techniques in their pure original state*. This is something I have already discussed in general when we looked at the first stage in cultural software history, i.e. the 1960s and 1970s, examining Sutherland’s work on the first interactive graphical editor Sketchpad, Nelson’s concepts of hypertext and hypermedia, and Kay’s discussions of an electronic book (“It [an electronic book] need not be treated as a simulated paper book since this is a new medium with new properties”). We have now seen how this general idea articulated already in the early 1960s made its way into the details of the interfaces and tools of applications for media design which eventually replaced most of traditional tools: After Effects (which we analyzed in detail), Illustrator, Photoshop, Flash, Final Cut, etc. So what is true for depth of field effect is also true for most other tools offered by media design applications.

What was a set of theoretical concepts implemented in a small number of custom software systems accessible mostly to their own creators in the 1960s and 1970s (such as Sketchpad or the Xerox PARC workstation) later became a universal production environment used today throughout all areas of the culture industry. The ongoing interactions between the ideas coming from the software industry and the desires of the users of their tools (media designers, graphic designers, film editors, and so on)—led to the further evolution of software—for instance, the emergence of an new category of “digital asset management” systems around the early 2000s, or the concept of “production pipeline” which became important in the middle of this decade. In this chapter I have described only one among many directions of the evolution

of software applications, their tools, and media formats. As we saw, the result of this trend was the emergence of a fundamentally new type of aesthetics which today dominates visual and media culture.