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CHAPTER THREE

Hybridization

Hybridity vs. multimedia

“The first metamedium” envisioned by Kay and Goldberg in 1977 has gradually become a reality in the 1990s. Beginning with Sketchpad and extending to the latest versions of media software, most physical media were simulated in detail and many new properties were added to them in the process. In parallel, a number of brand new computational media which have no physical precedents were also invented—for instance, interactive navigable 3D space (Ivan Sutherland), interactive multimedia (Architecture Machine Group’s Aspen Movie Map); hypertext and hypermedia (Ted Nelson); interactive narrative film (Graham Weinbren); the Internet (Licklider, Bob Taylor, Larry Roberts, and others); the World Wide Web (Tim Berners-Lee); social media services (SixDegrees.com),¹ collaborative large-scale authoring platforms such as Wikipedia (Jimmy Wales and Larry Sanger), and so on.

New fundamental techniques for media generation, manipulation, and presentation which also had no previous physical equivalent were also developed—algorithmic generation of line images, 3D photorealistic rendering, and the constraints originally introduced in Sketchpad. New media-specific and general (i.e.,

¹ D. M. Boyd and N. B. Ellison, “Social network sites: Definition, history, and scholarship,” *Journal of Computer-Mediated Communication*, 13(1) (2007), <http://jcmc.indiana.edu/vol13/issue1/boyd.ellison.html>

media-agnostic) data management techniques were introduced. Most importantly, by the middle of the 1990s computers became fast enough to “run” all these media. In short, Kay’s vision of a computer as metamedium—a platform housing many existing and new media—was realized.

So what happens next? What is the next stage in the metamedium development? (I am using the word “stage” here in a logical rather than a historical sense). This is something that, as far as I can see, the inventors of computational media—Sutherland, Nelson, Engelbart, Kay and all the people who worked with them—did not write about. However, since they set up all the conditions for this next stage, they are indirectly responsible for it.

The discussion of the computer metamedium at the end of Kay and Goldberg’s 1977 article creates the impression that it would develop via *additions*, as users built new types of media to suit their needs using the tools provided with the personal computer. Looking at the actual development of the computer metamedium over the following thirty years seems to confirm this conclusion.

For instance, if we look at the use of computer media in art which begins in the second half of the 1950s (music composition and algorithmic image generation), by 2003 the authoritative book *Digital Art* by Christine Paul already lists dozen of different areas. A Wikipedia article on “Collaborative software” similarly lists about a dozen program types (and of course there are dozens or hundreds of separate products for each type).² Another Wikipedia article on “Social Software”³ lists twenty major types of social media (instant messaging, text chat, groupware, blogs, etc.)—and none of them existed in practice in the early computer days of the 1960s.

To continue with these examples of such additions, a typical visual design created today with software applications may also appear as a simple sum of previous media: for example, a pen drawing plus oil painting plus a photograph plus collage. Looking at the interfaces of media editing software seems to also confirm this impression. You see endless options for modifying a document, appearing one after another in multiple menus. As the new options

² http://en.wikipedia.org/wiki/Collaborative_software (February 4, 2012).

³ http://en.wikipedia.org/wiki/Social_software (February 4, 2012).

become available—because software manufacture has released a new version, or you have purchased some plug-ins of your own—they appear as additions in the same menus. And certainly, the overall number of commands in popular media applications gradually increases over time from release to release—adding more techniques for authoring, editing, remixing, and creating outputs for different distribution platforms.

However, these processes of addition and accumulation are not the only ones defining evolution of the computer metamedium. While they are certainly at work, I think that they are not in the center of the transformation—or if you like, mutation—of this metamedium (and by extension, of all modern culture created via software) in the three decades following Kay and Goldberg's seminal article in 1977. (I use this year—of course, only symbolically—to mark the completion of the first “media invention” stage.)

I believe that the new period that began in the late 1970s represents a fundamentally distinct second stage in the development of a computer metamedium, a stage that follows the first stage of its invention and initial practical implementation. This new stage is *media hybridization*.

Once computers became a comfortable home for a large number of simulated and new media, it is only logical to expect that they would start creating hybrids. And this is exactly what has been taking place at this new stage in media evolution. Both the simulated and new media types—text, hypertext, still photographs, digital video, 2D animation, 3D animation, navigable 3D spaces, maps, location information and social software tools—came to function as building blocks for many new media combinations.

Here are some examples of computational *media hybrids*. Google Earth combines aerial photography, satellite imagery, 3D computer graphics, still photography, and other media to create a new hybrid representation which Google engineers called a “3D interface to the planet.” A motion graphics sequence may combine content and techniques from different media such as live action video, 3D computer animation, 2D animation, painting, and drawing. (Motion graphics are animated visuals that surround us every day; the examples are film and television titles, TV graphics, the graphics for mobile media content, and non-narrative parts of commercials and music videos.) A website design may

blend photos, typography, vector graphics, interactive elements, and animation. Physical installations integrated into cultural and commercial spaces—for example, Nobel Field at the Nobel Peace Center in Oslo by Small Design, interactive store displays for Nokia and Diesel by Nanika, or the interactive Memory Wall at Puerta America hotel in Madrid by Karen Finlay and Jason Bruges, and so on—combine animations, video, computer control, and various interfaces from sensors to touch, to create interactive spatial media environments.⁴

The built-in dictionary of Microsoft Word which I am using to write this text has a few definitions for “hybrid” including the following: “a plant produced from a cross between plants with different genetic constituents”; and “an animal that results from mating of parents from two distinct species or subspecies.” These biological meanings of “hybrid” capture well what has been happening to media following its “softwarization” in the 1980s and 1990s—that is, the systematic translation of numerous techniques for media creation and editing from physical, mechanical, and electronic technologies into software tools. Translated into software, media techniques start acting like species within a common ecology—in this case, a shared software environment. Once “released” into this environment, they start interacting, mutating, and making hybrids.

If we want to relate the beginning of the new hybridization stage to some important projects and technologies in the history of computational media, the famous Aspen Movie Map interactive hypermedia system developed at MIT in 1978–9 would qualify as the starting point.⁵ A precursor to Google Street View (launched in 2007), the system combined film of streets in Aspen, still photographs, a navigation map that featured both aerial photography and diagrammatic drawings, and audio. The second key event is the release of QuickTime multimedia software by Apple on December 2, 1991 as an addition to System Software 6. As Apple explained in “QuickTime 1.0: ‘You Oughta be in Pictures’” technical article (Summer 1991): “The recently introduced QuickTime 1.0 makes it easy for you to add dynamic media like video and sound into your

⁴ <http://www.davidsmall.com/articles/2006/06/01/nobel-field/>; <http://www.nanikawa.com/>; <http://www.jasonbruges.com/projects/international-projects/memory-wall>

⁵ “The Interactive Movie Map: A Surrogate Travel System,” video, (The Architecture Machine, 1981), <http://www.media.mit.edu/speech/videos/>

applications – and that’s just the beginning.”⁶ In the next ten years, commercial developers, engineers, designers, and independent media artists put lots of their creative energy into exploring the new ability of a computer to present multiple media. Thus, I think of the 1990s as the foundational period when many fundamental ways of combining media within the single computer platform were invented—followed by the next period of commercialization of these inventions in the 2000s (for example, Google Earth, introduced in 2005) and adoption to mobile platforms (iPhone, introduced in 2007, was able to play video and songs, display photos and hybrid maps, and send MMS).

To start the discussion of media hybridity, it is important to make it clear that I am not simply talking about something that already has a name—“computer multimedia,” or simply “multimedia.” This term became popular in the 1990s to describe applications and electronic documents in which different media types exist next to each other.

Often these media types—typically text, graphics, photographs, video, 3D scenes, and sound—are situated within what looks visually like a two-dimensional page. Thus a typical Web page of the 2000s is an example of multimedia; so is a typical PowerPoint presentation. Today, at least, this is still the most common way of structuring multimedia documents. In fact, it is built into the workings of most media authoring application such as presentation software or web design software. When a user of Word, PowerPoint or Dreamweaver creates a “new document,” s/he is presented with a white page ready to display typed text; other media types have to be “inserted” into this page via special commands. But interfaces for creating “multimedia” do not necessarily have to follow this convention. Email and multimedia messaging use another common paradigm for putting elements of different media types together—“attachments.” Thus, a user of a mobile phone that supports MMS can send text messages with attachments that can include picture, sound, video and rich (formatted) text. Yet another paradigm persistent in digital culture—from Aspen Movie Map (1978) to VRML (1994–) to Second Life (2003–)—uses 3D space as the

⁶ Apple, “QuickTime 1.0: ‘You Oughta be in Pictures’ (summer 1991), http://www.mactech.com/articles/develop/issue_07/Ortiz_Text.html

default platform with other media such as video attached to or directly inserted into this space.

“Multimedia” was an important term when interactive cultural applications, which featured a few media types, started to appear in large numbers in the early 1990s. The development of these applications was facilitated by the introduction of the appropriate storage media, i.e. recordable CD-ROMs in 1991, computer architectures and file formats designed to support multiple media file formats (Apple’s QuickTime, 1991–) and multimedia authoring software (the first version of the VideoWorks software which later was renamed Macromedia Director was released in 1985). By the middle of the 1990s digital art exhibitions featured a variety of multimedia projects; digital art curricula began to offer courses in “multimedia narrative”; and art museums such as the Louvre started to publish multimedia CD-ROMs offering tours of their collections. In the second part of the decade multimedia took over the Web as more and more websites began to incorporate different types of media. By the end of the decade, “multimedia” became the default in interactive computer applications. Multimedia CD-ROMs, multimedia websites, interactive kiosks, and multimedia communication via mobile devices became so commonplace and taken for granted that the term lost its relevance. So while today we daily encounter and use computer multimedia, we no longer wonder at the amazing ability of computers and computer-enabled consumer electronics devices to show multiple media types at once.

Seen from the point of view of media history, “computer multimedia” is certainly a development of fundamental importance. Previously “multimedia documents” combining multiple media types—such as medieval illustrated manuscripts, sacred architecture, or twentieth-century cinema and television—were not interactive (in the sense of particular affordances provided by interactive computers, rather than other interactive technologies such as paper books) or networked. But co-existence of multiple media types within a single document or an application is only one of the new developments enabled by simulation of many media types in a computer. In putting forward the term *hybrid media* I want to draw attention to another, equally fundamental development that, in contrast to multimedia, so far has not received a formal name.

Certainly, it is possible to conceive of multimedia as a particular case of hybrid media. However, I prefer to think of them as

overlapping but ultimately two different developments. While some classical multimedia applications of the 1990s would qualify as media hybrids, most will not. Conversely, although media hybrids often feature content in different media, this is only one aspect of their make-up. So what is the difference between the two? In multimedia documents and interactive applications, content types in multiple media appear *next to each other*. In a web page, images and video appear next to text; a blog post may similarly show text, followed by images and more text; a 3D world may contain a flat screen object used to display video. Alternatively, each element of a multimedia message opens in its own viewer (this was the case for MMS implementations in the phones of the 2000s). In contrast, in media hybrids, interfaces, techniques, and ultimately the most fundamental assumptions of different media forms and traditions, are brought together resulting in new *media gestalts*. That is, they merge together to offer a coherent new experience different from experiencing all the elements separately.

Another way to underline this difference is by using the metaphor of *sexual reproduction*. The result of sexual reproduction is new individuals that combine the genetic material of their parents—rather than just mechanical assemblages of parents' physical parts (which would be analogous to multimedia). Using this metaphor, we can say that new media offspring similarly combine the DNA of their media parents.

A related model that can help us to grasp some aspects of this process is that of *biological evolution*. This process results in new organisms, new species, and also new building blocks of the organisms (molecules such as DNA and proteins.) Similarly, sometimes new media offspring are only slightly different from the ones that already exist; at other times the combinations of software DNA produce distinct new media "species." The process of *media evolution* also produces new techniques for media authoring, editing, sharing, and collaborating, new interface conventions, and also new algorithms—the equivalents of the new building blocks of biological evolution.

Yet another metaphor that can help us to understand the new stage of the media development is *remix*. In the process of the computer metamedium development, different media types get remixed together, forming new combinations. Parts of these combinations enter into new remixes, ad infinitum.

Every metaphor highlights some aspects of a phenomenon while hiding or even distorting other aspects. The metaphors of sexual reproduction, biological evolution, and music remix work similarly. Each has advantages and disadvantages in explaining the second stage of computational media development. In this chapter, I will extensively use the concepts of hybridity and evolution to describe the new stage in media evolution. The chapter in Part 3 will work with the remix metaphor.

Since I will be invoking each of these metaphors in different parts of my narrative, you may get the impression that they are complementary parts of the same description. But this is not the case for hybridity and biological evolution metaphors. Besides the everyday meaning of “hybridity,” it is also used in evolutionary theory in a particular way. So if we think of hybridity in that sense, we cannot use this concept and the biological evolution model at the same time.

Contemporary theories of biological evolution share a basic definition of species as a pool of organisms that can enter into sexual relations between themselves but not with other species. Through the processes of evolution most often predicated on geographical separation between groups of the same species, these groups change and eventually no longer can have reproductive relations with one another. Such groups become new species.

In contrast, an animal hybrid is the result of interbreeding between species. Most hybrids are produced artificially, although a few have been observed in nature.⁷ Thus, hybrids are exceptions in the normal evolutionary process. Therefore, when I use the term “hybrid,” I am relying on a more general meaning of this word outside of biology.

I also need to make a note about my use of the biological evolution model. I am not suggesting that computational media (or techno-cultural development in general) indeed “evolve” like biological mechanisms, and that the mechanisms of such evolution are the same as the mechanisms of biological evolution as formulated in contemporary biology. (In his 2007 book *Graphs, Maps, Trees: Abstract Models for Literary History*, Franco Moretti provides convincing explanations of why some of the key ideas

⁷ M. L. Arnold. *Natural Hybridization and Evolution* (New York: Oxford University Press, 1996).

of biological evolution do not fit the cultural history.⁸) Instead, I want to use evolutionary theory as a rich conceptual toolbox, which can help us to think about any kind of *temporal process*. Understood in this way, evolutionary theory joins other theories of development that aim to explain physical, social, or psychological processes—each providing its own unique concepts which give us additional ways to conceptualize any development. Examples include Marx’s theory of social development with its concepts of mode of production, base, superstructure, and so on; Freud’s theory of “the dream work” as formulated in his 1899 *Interpretation of Dreams* (concepts of condensation and displacement); complex systems theory (concepts of emergence and self-organization); the phase change model from thermodynamics; and many others.

Having explained how I will use the concepts of hybridity and evolution, I will now go forward with my arguments. As I see it, media hybridity is a more fundamental reconfiguration of media universe than multimedia. In both cases we see a “coming together” of multiple media types. However, *multimedia does not threaten the autonomy of different media. They retain their own languages, i.e. ways of organizing media data and accessing and modifying this data.* The typical use of multiple media on the Web or in PowerPoint presentations illustrates this well. Imagine a typical web page from the 2000s that consists of text and video clips embedded somewhere on the page. Both text and video remain separate on every level. Their media languages do not spill into each other. Each media type continues to offer us its own interface. With text, we can scroll up and down and zoom using the browser controls; we can change the browsing settings so it is displayed in a different font. With video, we can use its interface to play it, pause or rewind it, loop a part, and change sound volume. In this example, different media are positioned next to each other but their interfaces and techniques do not interact. This, for me, is a typical example of multimedia.

In contrast, in hybrid media the languages of previously distinct media come together. They exchange properties, create new structures, and interact on the deepest levels. For instance, in *motion graphics* text takes on many properties which were previously

⁸ Franco Moretti, *Graphs, Maps, Trees: Abstract Models for Literary History* (London Verso, 2007).

unique to cinema, animation, or graphic design. To put this differently, while retaining its old typographic dimensions of font family, size, or line spacing, text also acquires new expressive possibilities from cinema and computer animation. As a word moves closer to us, it can appear out of focus—as though it is a physical object shot by a twentieth-century film camera lens. At the same time, it can now fly in a virtual space, performing physically impossible moves—as any other 3D computer graphics object. Its proportions change depending on what virtual lens the designer has selected. The individual letters that make up a text string can be exploded into many small particles; and so on. In short, in the process of hybridization, the language of typography does not stay as it is. Instead we end up with a new *metalanguage* that combines the techniques of all previously distinct languages, including that of typography.

Another way to distinguish between “multimedia” and “hybrid media” is by noting whether or not the original structure of media data is affected when different media types are combined. For example, when video appears in multimedia documents such as MMS messages, emails sent in HTML format, web pages, or PowerPoint presentations, the structure of video data does not change in any way. Just as with twentieth-century film and video technology, a digital video file is a sequence of individual frames, which have the same size and proportions. Accordingly, the standard methods for interacting with this data type also do not challenge our idea of what “video” is. Like with VCR media players of the 1980–1990s, when the user selects “play,” the frames quickly replace each other producing the effect of motion. Video, in short, remains video.

This is typical of multimedia. An example of how some media structure can be reconfigured—the capacity that I take as one of the identifying features of media hybrids—is provided by *The Invisible Shape of Things Past*, a well-known digital cultural heritage project about Berlin’s history developed by Joachim Sauter and Dirk Lüsebrink from the media company Art+Com between 1995 and 2007.⁹ In this project, film clips become solid objects positioned in a virtual 3D space. Each “film object” is made from individual film frames situated behind one another to form a 3D stack. The angles

⁹ <http://www.artcom.de/en/projects/project/detail/the-invisible-shape-of-things-past/>

between frames and the sizes of individual frames are determined by the parameters of the camera that originally shot the film. We can interact with these new “film objects” as with any other objects in 3D space, flying around using virtual camera controls.

At the same time it is still possible to “see the movie,” using the frame stack as a video player. But this operation of access has been rethought. When a user clicks on the front frame in a stack, the subsequent frames positioned behind one another are quickly deleted. You simultaneously see the illusion of movement as in the twentieth century, and the virtual 3D object shrinking at the same time.

In this example of media restructuring, which characterizes media hybridity, the elements that make up the original film’s “data structure”—individual frames—have been placed in a new configuration. The old structure has been remapped into a new structure. This new structure retains the original data and their relationship—that is, individual film frames are still organized into a sequence. But it also has new dimensions—size of frames and their angles. The new structure also enables a new type of interface for movie access, which combines virtual space attributes and cinema attributes.

I hope that this discussion makes it clear why hybrid media is not multimedia, and why we need this new term. The term “multimedia” captured the phenomenon the content of different media coming together—but not their languages. Similarly, we cannot use another term that has been frequently used in discussions of computational media—“convergence.” The dictionary meanings of “convergence” include “to reach the same point” and “to become gradually less different and eventually the same.” But this is not what happens with media languages as they hybridize. Instead, they acquire new properties—becoming richer as a result. For instance, in motion graphics, text acquires the properties of computer animation and cinematography. In 3D computer graphics, rendering of 3D objects can use the techniques of traditional painting. In virtual globes such as Google Earth and Microsoft Virtual Earth, representational possibilities and interfaces for working with maps, satellite imagery, 3D buildings, and photographs are combined to create new richer hybrid representations and new richer interfaces.

In short, “softwarization” of old media did not lead to their “convergence.” Instead, after representational formats of older

The Invisible Shape of Things Past. Joachim Sauter and Dirk Lüsebrink (Art+Com), 1995. Bottom: A “film object” consisting of the frames making up a film clip. Top: The angles between frames correspond to the position of the camera. Next three pages: Interaction with a film object in Invisible Shape application.

media types, the techniques for creating content in these media and the interfaces for accessing them were unbundled from their physical bases and translated into software, these elements started interacting to produce new hybrids.

This, for me, is the essence of the new stage of computer metamedium development. *The unique properties and techniques of different media have become software elements that can be combined together in previously impossible ways.*

Consequently, if in 1977 Kay and Goldberg speculated that the new computer metamedium would contain “a wide range of already existing and not-yet-invented media,” we can now describe one of the key *mechanisms* responsible for the invention of these new media. This mechanism is *hybridization*. The techniques and representational formats of previous physical and electronic media forms, and the new information manipulation techniques and data formats unique to a computer are brought together in new combinations.

In retrospect, it is perhaps not accidental that the publication of Kay and Goldberg’s 1977 text, which, for me, summarizes the achievements of the first stage of computational media invention, is directly followed by a seminal project which opens up the next stage—that of hybridization of different media simulated in software. In 1978–9 a group of young researchers at the Architecture Machine Group at MIT (a pre-cursor to the MIT MediaLab) directed by Nicholas Negroponte, constructed Aspen Movie Map—a new type of interactive application that combined a number of media types: video clips, maps, graphics, and diagrams. These different media types were connected through a new type of hypermedia interface. The name of the application—Aspen Movie Map—underscored that this application was neither a map nor a movie but a new hybrid between the two. The project opens the new fundamental stage in the media evolution enabled by its “softwarization”—the stage of hybridity.

The evolution of a computer metamedium

I will continue exploring the metaphor of biological evolution. As the title of Darwin’s *On the Origin of Species* (1859) makes clear,

the key goal of his evolutionary theory was to explain how different species develop. Darwin proposed that the underlying mechanism was that of natural selection. In the twentieth century, biologists added a number of other explanations (genetic drift, mutation, etc.¹⁰). While the mechanisms responsible for the development of the computer metamedium are certainly different, we can use the basic ideas of evolutionary theory—emergence of new species over time, with a gradual increase in their number. But even if we only take these basic ideas, there are important differences between biological and media evolution.

For example, if we compare the computer metamedium's development to a biological evolution, we can think of particularly *novel combination of media types as new species*.¹¹ In biological evolution, the emergence of new species is a very slow and gradual process, which requires many generations.¹² Small genetic changes accumulate over long periods before new species emerge. However, new "media species" can emerge overnight—it only requires a novel idea and some programming. Given that today a programmer/designer can use multiple software libraries for media manipulation, and also specialized high-level programming languages specifically designed for rapid testing of ideas and experimentation (Pure Data, Processing, etc.), a talented person can invent new species of media in a few hours.

In evolutionary biology, species are defined as groups of organisms. In media evolution, things work differently. Some novel combinations of media types may appear only once or twice. For instance, a computer science paper may propose a new interface design; a designer may create a unique combination for a particular design project; a film may combine media techniques in a novel

¹⁰ <http://en.wikipedia.org/wiki/Evolution#Mechanisms> (February 6, 2012).

¹¹ I am aware that not only the details, but also even most of the fundamental assumptions underlying evolution theory continue to be actively debated by scientists. In my references to evolution, I use what I take to be a few commonly accepted ideas from evolutionary theory. While these ideas are being periodically contested and eventually may be disproved, at present they form part of the public "common sense": a set of widely held ideas and concepts about the world.

¹² "Natural selection is the gradual, nonrandom process by which biological traits become either more or less common in a population as a function of differential reproduction of their bearers. It is a key mechanism of evolution." http://en.wikipedia.org/wiki/Natural_selection (February 7, 2012).

way. Imagine that in each case, a new hybrid is never replicated again. This happens quite often.

Thus, some media combinations that emerge in the course of media evolution will not be “selected.” Other combinations, on the other hand, may survive and will successfully “replicate.” (Again, remember that I am evoking the biological model only as a metaphor, and that no claims are being made that the actual mechanisms of media evolution are similar to the mechanisms of biological evolution.) Eventually such successful hybrids may become the common conventions in media design; built-in features of media authoring applications; commonly used features in social media sites; widely used design patterns; and so on. In other words, they may become new basic building blocks of the computer metamedium that can now be combined with other blocks.

An example of such a successful combination of media “genes” is an “image map” technique for web design. This technique emerged in the middle of the 1990s and was quickly adopted in numerous interactive media projects, games, and websites. How does it work? A photograph, a drawing, a color background, or any other part of a screen is divided into a few invisible parts. When a user clicks inside one of the parts, this activates a hyperlink connected to this part.

As a hybrid, an “image map” combines the technique of hyperlinking with all the techniques for creating and editing still images. Previously, hyperlinks were only attached to a word or a phrase of text and they were usually explicitly marked in some way to make them visible (typically by underlining). When designers started attaching hyperlinks to parts of continuous images or other parts of a web page without explicitly showing them, a new “species” of media was born.

As a new species, it defines new kinds of user behavior and it generates a new experience of media. Rather than being immediately presented with clearly marked, ready to be acted upon hyperlinks, a user now has to explore the screen, mousing over and clicking until s/he comes across a hyperlinked part. Rather than thinking of hyperlinks as discrete locations inside a “dead” screen, a user comes to think of the whole screen as a live interactive surface. On an experiential level, rather than imagining a hyperlink as something which is either present or absent, a user

may now experience it as a continuous dimension, with some parts of a surface being “more” strongly hyperlinked than others.

Another example of a successful hybrid that survived and replicated in the course of recent media evolution is a *virtual camera* model used in 3D computer animation. Developed in the 1980s for creating computer animation sequences for feature films, a virtual camera model has gradually become one of the most widely used elements of digital media deployed in video games, virtual environments, program interfaces, feature films, motion graphics, etc.¹³

As we will see in detail in the next part of the book, the new language of visual design (a category which includes graphic design, web design, interface design, motion graphics, and other design areas) that emerged in the second part of the 1990s offers a particularly striking example of media hybridization. Working with software applications, a designer can combine any of the techniques of graphic design, typography, painting, cinematography, animation, computer animation, vector drawing, and 3D modeling. At the same time, s/he also can use many algorithmic techniques for generating new images and forms (such as particle systems or procedural modeling) and transforming them (for instance, by using filters and other digital image processing techniques, which do not have direct equivalents in previous physical, mechanical or electronic media). All these techniques are easily available within a small number of media authoring programs (Photoshop, Illustrator, Flash, Maya, Final Cut, After Effects, various HTML editors, etc.) and they can be easily combined within a single design.

The result is the new design language used today in a large number of countries around the world. The new “global aesthetics” celebrates media hybridity and uses it to engineer emotional reactions, drive narratives, and shape user experiences. The ability to combine previously incompatible techniques of different media is the single common feature of millions of designs being created yearly by professionals and students alike, seen on the web and in print, on big and small screens, in built environments, and all other platforms.

¹³ For the analysis of a virtual camera use, see Mike Jones, “Vanishing Point: Spatial Composition and the Virtual Camera,” *Animation* 3, no. 2 (2007): pp. 225–43.

Like the post-modernism of the 1980s and the web revolution of the 1990s, the “softwarization” of media (the transfer of techniques and interfaces of all previously existing media technologies to software) has flattened history—in this case, the history of modern media. That is, while the historical origins of all the building blocks that make up the computer metamedium—or a particular hybrid—may still be important in some cases, these are now exceptions rather than the rule. Clearly, for a media historian such as myself, the historical origins of all techniques now available in media authoring software do matter. They may also matter for the people encountering a particular media design—but only if a designer chooses to foreground this. For instance, in the logo sequence for DC Comics (*Imaginary Forces*, 2005) designers used exaggerated artifacts of print and film to evoke particular historical periods in the twentieth century. But when we consider the actual process of media design—the ways in which designers work to go from a sketch or a storyboard or an idea in their head to a finished product—these historical origins no longer matter. When a designer opens his/her computer and starts working, it does not matter whether the technique was originally developed as a part of the simulation of physical or electronic media. Thus, digital paint brushes, filters simulating various natural textures, a camera pan, an aerial perspective, splines, and polygonal meshes, blur and sharpen filters, particle systems, etc.—all have equal status as the building blocks for new hybrids.

Thirty years after Kay and Goldberg predicted that the new computer metamedium would contain “a wide range of already existing and not-yet-invented media,” we can see clearly that their prediction was correct. The computer metamedium has indeed been systematically expanding. However, as we now can see, this expansion should not be understood as the simple addition of more and more new “mediums.” While a number of new software mediums have been invented in the fifty years following Sketchpad, their number is probably less than one dozen. The key process in the evolution of the computer metamedium involves innovation on a more local level—the previous media types simulated in software (text, sound, drawing, etc.), the techniques for their manipulation, and new computer-native techniques entering in new combinations, creating a much larger number of new “species.”

To restate this: following the first stage where most already existing media were simulated in software and a number of new computer techniques for generating and editing of media were invented—the stage that conceptually and practically has been largely completed by the late 1970s—we entered a new period governed by hybridization. The already simulated mediums started exchanging properties and techniques. As a result, the computer metamedium came to contain endless new species. In parallel, we do indeed see a continuous process of the invention of the *new*—but what are being invented are not whole new media types but rather new elements (new techniques for creating, modifying and sharing media data). As soon as they are invented, these new elements start to interact with other, already existing elements. Thus, the processes of invention and hybridization are closely linked and work together.

This, in my view, is the key mechanism responsible for the evolution and expansion of the computer metamedium from the late 1980s until now—and I do not see any reason why this mechanism would become less important in the future. And while at the time when Kay and Goldberg were writing their article the process of hybridization was just barely starting—the first truly significant media hybrid was Aspen Movie Map project created at MIT's Architecture Machine Group in 1978–9—today it is what media design is all about. Thus, from the point of view of today, *the computer metamedium is indeed an umbrella for many things—but rather than only containing a set of separate mediums, it also contains a larger set of smaller building blocks that unite to create hybrids*. These building blocks include algorithms for media creation and editing, data formats, interface metaphors, navigation techniques, physical interaction techniques, web technologies, and other element types. Over time, new elements are being invented and they also become parts of the computer metamedium. Periodically people figure out new ways in which some of the elements available can work together, producing new species. Some of these species may survive. Some may become new conventions, so omnipresent that they are not perceived anymore as combinations of elements which can be taken apart. Still others are forgotten—only to be sometimes reinvented later.

Clearly, all the building blocks that together form the computer metamedium do not have equal importance and equal “linking”

possibilities. Some are used more frequently than others, entering in many more combinations. The virtual 3D camera model is currently more widespread than, for example, techniques for rendering realistic looking hair or fur. The 3D camera model is built into every 3D animation application and consequently is used in numerous 3D animations and visual effects sequences; it appears in TV commercials, motion graphics, instructional video, and feature films; it is a part of the user interface in all 3D video games; and is also the interface to popular 3D virtual globes such as Google Earth.¹⁴ In contrast, hair and fur algorithms may not be available in every animation package and their applications are also more limited, since only human and animal characters can have hair or fur.

Some of the new inventions may become so important and influential that it seems no longer appropriate to think of them as just elements. Instead, they may be more appropriately called new *media platforms*—or simply new *mediums*.

Mobile media platforms which emerged in the late 2000s—iOS and Android powering both tablets and mobile phones—are perfect examples here. 3D virtual space, the World Wide Web, and geo media (media which includes GPS coordinates) are other examples of such new media platforms popularized in the 1980s, 1990s, and 2000s, respectively. These media platforms fundamentally reconfigure how all other media are understood and how they can be used. Thus, when we add spatial coordinates to media objects (geo media), place these objects within a single global networked hypertext (the web), or when we start using 3D virtual space as a new platform to design not only buildings and industrial objects but also movies and cartoons, the identity of what we think of as “media” changes in fundamental ways. In fact, we can even say that these changes have been as fundamental as the effects of media “softwarization” in the first place.

But is it true? There is no easy way to resolve this question. Ultimately, it is a matter of perspective. For instance, the simulation of existing media in software and the subsequent period of media hybridization has had a much more substantial impact on

¹⁴ For a list of other virtual globe applications and software toolkits, see http://en.wikipedia.org/wiki/Virtual_globe (February 7, 2012).

contemporary visual and spatial aesthetics across all design fields (at least so far) than did the invention of the Web and graphical web browsers.

If we are interested in the histories of visual communication, techniques of representation, and cultural memory, I do think that the universal adoption of *software* throughout global culture industries is at least as important as the invention of print, photography or cinema. But if we are to focus on the social and political aspects of contemporary media culture and ignore the questions of how media looks and what it can represent—asking instead about who gets to create and distribute media, how people understand themselves and the world through media, and how they create and maintain social relations—we may want to put computer *networks* (be the Web of the 1990s, social media of the 2000s, and whatever new yet-to-be-invented forms will come in the future) in the center.

And yet, it is important to remember that without software, contemporary networks would not exist. Logically and practically, software lies underneath everything that comes later.

For example, if I disconnect my laptop from my wireless network right now, I can still continue using most of the applications—including Word to write this sentence. I can also edit images and video, create a computer animation, design a fully functional website, and compose blog posts. (Of course by the time you are reading this, Microsoft may be offering Word only as an online service, but some other word processors which run locally should be still available...)

But if somebody disables the software running the network, it will go dead.¹⁵ In other words, without the underlying software layers *The Internet Galaxy* (to quote the title of the 2001 book by Manuel Castells¹⁶) would not be possible. And if software was already responsible for the very first ARPANET (Advanced

¹⁵ Since the late 2000s, there has been a gradual movement towards offering more and more functionality in web applications. However, at least today (2013), unless I am in Singapore or Tallinn which are completely covered with free Wi-Fi courtesy of their governments, I never know if I will find a network connection or not, so I would not want to completely rely on the webware.

¹⁶ Manuel Castells, *The Internet Galaxy: Reflections on the Internet, Business, and Society* (Oxford: Oxford University Press, 2001).

Research Projects Agency Network) computer network which linked two remote machines on October 29, 1969 at the Network Measurement Center at UCLA's School of Engineering and Applied Science and Douglas Engelbart's NLS system at SRI International in Menlo Park, California, its importance and variety only increased as networks develop. Thus, a myriad of software technologies are what allows for media to exist on the web in the first place: images and video in web pages, blogs, Facebook and Twitter, media sharing services such as YouTube and Instagram, aerial photography and 3D buildings in virtual globes, etc. Similarly, the use of 3D virtual space as a platform for media design (which will be discussed in detail in the next part) really means using a number of software algorithms that control the virtual camera, position the objects in space, calculate how they look in perspective, simulate the spatial diffusion of light on the surfaces, and so on.

Hybridity: examples

The examples of media hybrids are all around us: they can be found in user interfaces, web applications, mobile apps, visual design, interactive design, visual effects, locative media, interactive environments, digital art, and other areas of digital culture. Here are a few examples that I have deliberately drawn from different areas. Created in 2004 by Stamen Design (San Francisco), Mappr was one the first popular web mashups.¹⁷ It combined a geographic map and photos from Flickr.¹⁸ Using information entered by Flickr users, the application guessed geographical locations where photos were taken and displayed them on the map. (Today similar map interfaces to photo collections that use GPS data captured with photos are available for iPhoto, Instagram, and other photo services and apps.) Since May 2007, Google Maps has offered Street Views that add panoramic photo-based views of city streets to other media types already used in Google Maps.¹⁹ A

¹⁷ http://en.wikipedia.org/wiki/Web_mashup (February 7, 2012).

¹⁸ <http://stamen.com/projects/mappr> (November 3, 2012).

¹⁹ <http://maps.a9.com> (January 27, 2006).

hybrid between photography and interfaces for space navigation, Street Views allows users to navigate through a space on a street level by clicking on the arrows superimposed on the panoramic photographs.²⁰

Starting in 1991, Japanese media artist Masaki Fujihata created a series of projects called *Field Studies*.²¹ These projects place video recordings made in particular places within highly abstracted 3D virtual spaces representing these places. Fujihata started to work on *Field Studies* a decade before the term “locative media” made its appearance. As cameras with built-in GPS did not yet commercially exist at that time, the artist created a special video camera which captured geographical coordinates of each interview location—along with the camera’s direction and angle while he was video-taping the interview, as well as his movement through space. The artist used this captured information to create a media interface which combined 3D navigable space and video in a unique way.

For instance, to create the interactive installation *Field-Work@Alsace* (2002),²² Fujihata recorded a number of video interviews with the people living in and passing through the area around the border between France and Germany. The project confronts us with a black screen, with a number of three-dimensional white lines showing the artist’s movement through the area as he was capturing the interviews. As we navigate around the space, the changing perspective views of these lines suggest the shapes of the Alsace terrain. We also see a number of flat rectangles that are positioned at points where each interview was recorded. Each rectangle is situated at a unique angle that corresponded to the angle of the hand-held video camera during the interview. When you click on a rectangle, the corresponding video plays inside.

In my view, *Alsace* represents a particularly interesting media hybrid. It fuses photography (still images which appear inside rectangles), video documentary (video playing once a user clicks inside a rectangle), the locative media (the movement trajectories recorded by GPS) and 3D virtual space. In addition, *Alsace* uses a

²⁰ http://en.wikipedia.org/wiki/Google_Street_View (July 17, 2008).

²¹ www.field-works.net/ (January 27, 2006).

²² <http://www.medienkunstnetz.de/works/field-work/> (February 11, 2012).

Field-Work@Alsace by *Masaki Fujihata*, 2002.

new media technique developed by Fujihata: the recording not just of the 2D location but also of the 3D orientation of the camera.

The result is a new way to represent collective experiences using 3D space as an overall coordinate system—rather than, for instance, a narrative or a database. At the same time, Fujihata found a simple and elegant way to render the subjective and unique nature of each video interview—situating each rectangle at a particular angle that shows where the camera was during the interview. Additionally, by defining 3D space as an empty void containing only trajectories of Fujihata's movement through the region, the artist introduced the additional dimension of subjectivity. Even today after Google Earth has made 3D navigation of space containing photos and video a common experience, *Alsace* and other projects by Fujihata continue to stand out. They show that to create a new kind of representation it is not enough to simply “add” different media formats and techniques together. Rather, it may be necessary to systematically question the conventions of different media types to make up a hybrid, changing their structure in the process.

A well-known media art project I have already evoked—*The Invisible Shape of Things Past*—also uses 3D space as an umbrella that contains other media types. As I have already discussed, the project maps historical film clips of Berlin recorded throughout the twentieth century into new spatial forms that are integrated into a 3D navigable reconstruction of the city.²³ The forms are constructed by placing subsequent film frames behind each other. In addition to being able to move around the space and play the films, the user can mix and match parts of Berlin by choosing from a number of maps which represent city development in different periods of the twentieth century. Like *Alsace*, *Invisible Shape* recombines a number of common media types while changing their structure. A video clip becomes a 3D object with a unique shape. Rather than representing a territory as it existed in a particular time, a map can mix parts of the city as they existed at different times.

Another pioneering media hybrid created by Sauter and his company Art+Com is *Interactive Generative Stage* (2002)—a

²³ See www.artcom.de

virtual set whose parameters are interactively controlled by actors during the opera.²⁴ During the opera performance, the computer reads the body movements and gestures of the actors and uses this information to control the generation of a virtual set projected on a screen behind the stage. The positions of a human body are mapped into various parameters of a virtual architecture such as the layout, texture, color, and light.

Sauter felt that it was important to preserve the constraints of the traditional opera format—actors foregrounded by lighting with the set behind them—while carefully adding new dimensions to it.²⁵ Therefore, following the conventions of traditional opera the virtual set appears as a backdrop behind the actors—except now it not a static picture but a dynamic architectural construction that changes throughout the opera. As a result, the identity of a theatrical space changes from that of a backdrop to a main actor—and a very versatile actor at that—since throughout the opera it adopts different personalities and continues to surprise the audience with new behaviors. This kind of fundamental redefinition of an element making a new hybrid is rare, but when a designer is able to achieve this, the result is very powerful.

Not every hybrid is necessarily elegant, convincing, or forward-looking. Some of the interfaces of popular media creation and access applications look like the work of an aspiring DJ, mixing operations from old interfaces of various media with new GUI principles in sometimes erratic and unpredictable ways. In my view, a striking example of such a problematic hybrid is the interface of Adobe Acrobat version 8.0, released in November 2006.²⁶ (Note that since the interfaces of all commercial software applications typically change from version to version, just as elsewhere in the book, this example refers to this particular version of Adobe Acrobat.) This version of Acrobat's User Interface combines interface metaphors from a variety of media traditions and technologies in a way that, at least to me, does not always seem to be logical. Within a single interface, we get 1) the interface elements from analog media

²⁴ The full name of the project is *Interactive generative stage and dynamic costume for André Werner's opera, 'Marlowe, the Jew of Malta.'*

²⁵ Joachim Sauter, personal communication, Berlin, July 2002.

²⁶ http://en.wikipedia.org/wiki/Adobe_Acrobat#Version_8.0 (February 8, 2012).

recorders/players of the twentieth century, e.g., VCR-style arrow buttons; 2) interface elements from image editing software, e.g., a zoom tool; 3) interface elements which have strong association with the print tradition—although they never existed in print (page icons also controlling the zoom factor); (4) elements which have existed in books (the bookmarks window); (5) the standard elements of a GUI such as search, filter, and multiple windows. It seems that Acrobat designers wanted to give users a variety of ways to navigate through documents. However, I find the use of so many navigation metaphors confusing. For instance, given that Acrobat was designed to closely simulate the experience of print documents, it is not clear to me why I am asked to move through the pages by clicking on the forward and backward arrows—an interface convention which is normally used for moving image media.

The hybrids do not necessarily have to involve a “deep” reconfiguration of previously separate media languages and/or the common structures of media objects—the way, for example, *The Invisible Shape* reconfigures the structure of a film object. Consider web mashups which “combine data elements from multiple sources, hiding this behind a simple unified graphical interface.”²⁷ I have already used one example of a Web mashup—Mappr. Here are some other successful early examples. *Flickrvision 3D* (David Troy, 2007) used data provided by Flickr and the virtual globe from Poly 9 FreeEarth to create a mashup which continually showed the new photos uploaded to Flickr attached to the virtual globe at those locations where the photos were taken. Another mashup called *Liveplasma* (2005) used Amazon services and data to offer a music and discovery engine. When a user selected an actor, a movie director, a movie title, or a band name, *Liveplasma* generated an interactive map that showed related actors, movie directors, etc. using various dimensions such as style, influences, popularity, and others.²⁸ Although *Liveplasma* suggests that the purpose of these maps is to lead you to discover the items that you are also likely to like (so you purchase them on amazon.com), these maps are valuable in themselves. They employ newly available rich data about people’s cultural preferences and behavior collected by Web 2.0 sites

²⁷ [http://en.wikipedia.org/wiki/Mashup_\(web_application_hybrid\)](http://en.wikipedia.org/wiki/Mashup_(web_application_hybrid)) (July 19, 2008).

²⁸ <http://www.liveplasma.com/> (August 16, 2008).

such as Amazon to do something that was not possible until the 2000s. That is, rather than mapping cultural relationships based on the ideas of a single person or a group of experts, they reveal how these relationships are understood by actual cultural consumers.

The development of mashups is supported by the gradually growing number of web APIs offered by a variety of companies. An API provides an easy way for a programmer to create new programs, which use services or data provided by web companies. For example, you can use the Google Maps API to generate interactive Google maps inside your website. When a user comes to the site and enters an address into the map interface, Google servers get the request and send back the new map. When I checked the mashup tracker programmableweb.com on February 8, 2012, it listed 2,337 mashups that use the Google Maps API.²⁹ Many mashups combine between half a dozen and a dozen APIs from different services. By September 2012, the site tracked over 7,000 different APIs.³⁰ Sorted by the number of mashups using these APIs, the top entries were the Google Maps API used in 2,416 mashups, the Twitter API used in 717 mashups, and YouTube, used in 650 mashups.³¹ These numbers may only represent a small percentage of all mashups out there—just think about all the times you encounter a Google map used as part of some website or service. According to one 2012 estimate, the Google Maps API was used in 350,000 web sites. Thus, the numbers reported by programmableweb.com perhaps only indicate the relative proportions in APIs use in mashups.

Visually, many mashups may appear as typical multimedia web pages—but they are more than that. As the Wikipedia article on “mashup (web application hybrid)” explains, “A site that allows a user to embed a YouTube video for instance, is not a mashup site... the site should itself access 3rd party data using an API, and *process that data in some way to increase its value* to the site’s users.” (My emphasis). Although the terms used by the authors—processing data to increase its value—may appear to be strictly business-like, they also capture the difference between multimedia and hybrid media

²⁹ <http://www.programmableweb.com/apis/directory/1?sort=mashups> (February 8, 2012).

³⁰ <http://blog.programmableweb.com/2012/08/23/7000-apis-twice-as-many-as-this-time-last-year/> (August 23, 2012).

³¹ <http://www.programmableweb.com/apis/directory/1?sort=mashups> (November 4, 2012).

in a theoretically accurate way. Paraphrasing the article's authors, we can say that in the case of successful artistic hybrids such as *The Invisible Shape* or *Alsace*, separate representational formats (video, photography, 2D map, 3D virtual globe) and media navigation techniques (playing a video, zooming into a 2D document, moving around a space using a virtual camera) are brought together in ways which *increase the representational and expressive value* offered by each media type used. However, in contrast to the web mashups that started to appear *en masse* in 2006 when Amazon, Flickr, Google and other major web companies offered public API (i.e., they made it possible for others to use their services and some of their data—for instance, using Flickr images as a part of a mashup), these projects also used their own data, which the artists carefully selected or created themselves. As a result, the artists have much more control over the aesthetic experience and the “personality” projected by their works than an author of a mashup, which relies on both data and the interfaces provided by other companies and non-profit organizations such as OpenLayers.

I am not trying to criticize the web mashup technology—I only want to suggest that if the project's goal is to put forward a different representational model and a unique aesthetic experience, choosing from the same set of web sources and data sources available to everybody else may be not the right solution. And the argument that web mashup author acts as a DJ who creates by mixing what already exists also does not work here—since a DJ has both more control over the parameters of the mix, and more recordings to choose from.

In discussing examples of hybrids so far I have implicitly presented them as combinations and reconfigurations of previously existing media, which include both the simulations of physical media such as print and new media such as computer animation. In other words, I have relied on the notion consistent with Kay's own formulation that the computer mediamedium can be understood as a collection of different mediums. For example, I talked about how *Alsace* combined photography and video documentary (pre-digital media simulated in a computer) with locative data and 3D virtual space (new computer media).

However, we can also think of media hybridity using a different conceptualization of the metamedium. That is, rather than emphasizing “whole” media we can focus on their building blocks—i.e.,

different types of media data (or “media content”) and two types of techniques which can operate on this data. (I called these techniques “media-specific,” if they can only work on specific media types; I called “media-independent” those techniques that are implemented to work with many types).

From this perspective, the new *hybrid media species*—a single project, web service, or a software program—represents the meeting of various techniques that previously belonged to different mediums. Chapter 5 will develop this concept in detail using examples from motion graphics and design. We will also see how hybridization as enabled by software became one of the dominant aesthetics of contemporary media. But as a way of getting started, let us take the example of hybridization and discuss it in terms of data types and data manipulation techniques. For this example, I will use an application which should be familiar to everybody and which I have already briefly evoked a number of times—Google Earth.

Google Earth is based on an earlier application called Earth Viewer developed by Keyhole, Inc. This company was acquired by Google in 2004. In its turn, Earth Viewer took the idea of seamless interactive navigation cinema-style around the detailed and hybrid spatial representation from 1996 project *Terravision*. The project was created by the same innovative design team which is also responsible for some of the other outstanding media hybrids we already encountered—Joachim Sauter and Art+Com.³² (The following analysis applies the features and interfaces in Google Earth 5, released in May 2009.) Using this application, you can navigate around the Earth’s surface, zooming in and out; turn on and off a variety of data overlays; search for places and directions; mark places on the map and share these additions with all other users of Google Earth; import your own information including images and GPS data; create movies of touring around; and more.

When Google Earth was first released in June 2005, Google called it a “3D interface to the planet.”³³ This description itself tells us right away that we are not dealing with a twentieth-century map or any other representation already familiar to users. So what are

³² <http://www.artcom.de>

³³ <http://windowssecrets.com/langalist-plus/a-3d-interface-to-the-planet/> (February 10, 2012).

the key elements of the experience offered by this “3D interface to the planet” that make it stand out from the variety of other cultural applications that allow a user to navigate around and perform actions on some data—2D Google Maps, web browsers, iTunes, educational multimedia applications, and so on? These elements are both its hybrid terrain and the corresponding hybrid navigation mechanisms.

The representation of Earth’s surface that appears in the main Google Map window, called “3D Viewer,” combines satellite photography, 3D elevation data, 3D models of buildings, and the graphics elements familiar to us from modern paper maps (vector graphics and text labels identifying roads, country boundaries, etc.). Importantly, the four types of data are “glued together,” (i.e., rendered directly on top of each), thus appearing as a single visual source. This is a perfect example of a hybrid. The different media types are brought together to create a new representation.

The 3D interface offered by Google Earth is also a hybrid. It draws on the new type of computational media that has been evolving since the late 1960s: 3D interactive navigable space. It also uses the computer simulation of Hollywood cinematography techniques developed in the 3D computer animation field since the 1970s. The user navigates around the hybrid terrain using a set of defined camera controls that extend the language of zoom, tilt, and pan, developed in film cinematography. (Google Earth 6 defines the following “3D navigation techniques”: move left, right, up and down, rotate clockwise and counter wise, tilt up and down, zoom in and out, zoom + automatic tilt, look and reset.³⁴)

In addition to this basic navigation system, the application also offers a more explicitly cinematic and more automatic method called Touring, where the camera flies between the points in a seamless trajectory.

(I am distinguishing between “3D interactive space” and “simulated camera” for the following reason. While software used by computer animators, game designers, and media designers provides a virtual camera interface to 3D space with all traditional cinematographic controls, other applications which also use virtual spaces such as VR and computer games do not. Instead they use

³⁴ <http://support.google.com/earth/bin/answer.py?hl=en&answer=148115&topic=2376154&ctx=topic> (February 10, 2012).

The Layers window in Google Earth 7.0 (2012). The screenshot shows only some of the hundreds of layers available.

movements of the body, head, or fingers of the human user to guide a camera. Thus, a 3D space representation and a 3D camera model do not have to go together.)

While Google Earth's core data model (satellite imagery + elevation data + map symbols) remains unchanged over time and a number of software releases, the continuing addition of new data sources and data types makes the representation increasingly rich—and simultaneously increases its hybridity. These additional types of data include links to web content, Street View (launched on May 25, 2007), normal and panoramic hi-res photos, historical imagery (in Google Earth 5.0), underwater terrain, the Moon, Mars, real-time traffic, etc. The addition of some of these new data types requires parallel addition of new navigation mechanisms. Thus, side-by-side with the original core 3D cinema-like interface we now find other interfaces.

In this way, the techniques for working with data provided by Google Earth also become more hybrid. When interacting with a 3D building, a user can “swoop to the top or side” of the building. In the case of high-res gigapixel photos, Google Earth offers a special way of “flying into” a photo which then can be panned and zoomed. And with Street View, yet another set of navigation techniques is provided.³⁵

Strategies of hybridization

As we see, media hybrids can be structured in different ways. In user interfaces such as the interface of Acrobat Reader, the operations which previously belonged to specific physical, mechanical, and electronic media are combined to offer the user more ways to navigate and work with the computer documents (combination of different *interface techniques*). Google Earth combines different types of media to provide more comprehensive information about places when either media can do by itself (a combination of *media*

³⁵ “Using the keyboard or mouse the horizontal and vertical viewing direction and the zoom level can be selected. A solid or broken line in the photo shows the approximate path followed by the camera car, and arrows link to the next photo in each direction. At junctions and crossings of camera car routes, more arrows are shown.” http://en.wikipedia.org/wiki/Google_Street_View (February 11, 2012).

types). Mappr exemplifies another strategy: using a 2D geo map as an interface to a media collection—in this case, photos uploaded on Flickr (using *one media type as an interface to another media type*.) *Alsace* and *Invisible Shape* exemplify yet another type of media combination: using *one media type as an enclosure for another media type* (3D virtual space containing film and video and clips).

A complementary way of categorizing media hybrids is by asking if a particular hybrid offers new ways of representing the world, and/or new ways of navigating these representations. Hybrids may combine and/or reconfigure familiar media formats and media interfaces to offer *new types of hybrid representations*. For instance, Google Earth and Microsoft Bing Maps combine different media types and interface techniques to provide more comprehensive information about places than either media can do by itself. The ambitions behind *Alsace* and *Invisible Shape* are different—not to provide more information by combining existing media formats but rather to reconfigure these formats in order to create new representations of human collective and individual experiences that fuse objective and subjective dimensions. But in both cases, we can say that the overall goal is to *represent the world or our experience in a new way by combining and possibly reconfiguring* already familiar media representations (photos, video, maps, 3D objects, web pages, panoramic photos, etc.) Another good example of such hybrids is Microsoft Photosynth which offers new types of 3D representations (“synths”) made by matching many photographs of the same scenes—such as a detailed model of a 3D Notre Dame Cathedral created entirely from its photos on Flickr.³⁶

Secondly, the hybrids may focus on *new ways of navigation and interaction with already existing media formats*. Here the media type itself is neither modified nor combined with other media—instead, hybridization happens in the UI and the tools provided by the project, service or the application for working with this media type. For example, in the case of Mappr, both 2D map and photo formats already existed separately. The mashup links them together, turning the map into an interface to the photos available on Flickr.³⁷

³⁶ http://www.ted.com/talks/blaise_aguera_y_arcas_demos_photosynth.html (February 19, 2012).

³⁷ This mashup also exemplifies an important development within metamedia

(Flickr itself later offered the similar map interface³⁸ as well as an application to allow users to place their photos on a world map.³⁹ On February 19, 2012, Flickr's map interface contained over 175 million geo-tagged photos.)

In summary, a hybrid may define new navigation and interaction techniques that operate over non-modified media formats. Alternatively, a hybrid may define new media formats but use already existing interaction/interface techniques. *A hybrid may also combine both strategies, i.e. it can define both new interfaces/tools and new media formats at the same time.* This, however, requires a real creativity and deep understanding of both media computing and media aesthetics, so such hybrids do not appear very often. (*Alsace*, *Invisible Shape*, and *Photosynth* are able to combine both strategies, and this is why for me they stand out from the multitude of new media projects and applications created in the last two decades.)

You may notice that the distinction between a “representation” (or a “media format”) and an “interface/tool” corresponds to the two fundamental components of all modern software: *data structures* and *algorithms*. This is not accidental. Each tool offered by a media authoring, editing or viewing application corresponds to an algorithm that either processes the data in a particular format in some way, or generates new data in this format. For example, let us assume that our media format is a photo (or, more generally, a raster image). To generate a gallery view of the photos an algorithm has to process each photo to fit it into a specified size (this is done by calculating averages of groups of pixels and using a new smaller set of these average values). To draw a line over a photo requires calling another algorithm that calculates new colors for the pixels beneath the line. Thus, “working with media” using application software essentially means running different algorithms over the data.

evolution: a convergence between media and spatial data. The three main forms of this convergence are: 1) a 2D map used as an interface to other media types (as in *Mappr*); 2) a 3D virtual map used as an interface to other media types (as in *Alsace*, *Invisible Shapes* or *Google Earth*); 3) location information automatically added by a capture device to images and video recordings.

³⁸ <http://www.flickr.com/map/>

³⁹ <http://en.wikipedia.org/wiki/Flickr#Organizr> (March 2, 2012).

While this logical differentiation is clear and useful for the person who understands programming, when we consider the user's experience of media authoring/viewing/cataloging/sharing applications, web services, and interactive media projects, it is harder to maintain. In the world of application software, media data and interfaces/tools never exist in isolation from each other. Unless you know how to program, you never encounter media content types—digital photos, digital videos, maps, etc.—by themselves. Instead, you encounter media content through particular software applications, or the custom interfaces defined by the designers of a particular project. In other words, you always work with data in a context of some application, one that comes with its own interface and tools. This means that *as experienced by a user of application software, “representation” consists of two interlinked parts: data structured in particular ways and the interfaces/tools provided to navigate and work with this data.* (The same applies for the concept of “information”.) For example, a “3D virtual space” as it is defined in 3D computer animation and CAD applications, computer games, virtual globes, and other applications is not only a set of coordinates that make up 3D objects and a perspective transformation but also a set of navigation methods—i.e., a virtual camera model. A “photograph” as defined by media editing applications includes various editing operations that can be performed on it such as scale, cut and paste, make mask, add layers, etc. Liveplasma's interactive culture maps are not only relationships between the items on the map that we can see but also the tools provided to construct and navigate these maps. And the unique “Earth” in Google Earth is made up not only from its hybrid data model (satellite photography, elevation, 2D map, 3D buildings, panoramas) but also the rich techniques for navigating and exploring this data.