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Issues in Multimedia Authoring kdouglas@andrew

Essay #3

1. Robert Horn (1998) has written extensively on what he calls "visual language." In this work he characterizes visual language, compares it to Egyptian hieroglyphics, accounts for its emergence through its use in commerce and technology, and discusses several key figures in the history of visual language. I shall tackle each of these topics in turn.

Visual language is first contrasted with visual art. Horn explains that without words and shapes being integrated with an image, the image is "merely" art. Words are thus, as he says, essential to visual language. They help fix the meanings of the images that accompany them and provide context. They also permit us to talk about (or write about) the systems of visual language, so that they can be learned, studied and revised. Visual language thus does not replace ordinary language, but supplements it with new features. Words alone are also not sufficient for visual language. A "picturesque" passage from a novel may be great literature, but it is not visual language, Horn says, unless it includes literal shapes and images. Finally, shapes by themselves are at best suggestive. A drawing of some nodes and links can suggest a hierarchy, but nothing specific. A few words would tell the viewer what it was about, e.g.: a classification of organisms by descent; a genealogical chart; a file system in a computer setup.

Horn also claims that the ancient Egyptian hieroglyphic system share some features with contemporary visual language. He first explains that some common understandings of hieroglyphics are false. For instance, it is commonly believed that the system is pictographic. This is not the case; very few symbols resemble what they stand for. Instead, the hieroglyphic system had ideographs and phonograms, much as contemporary visual languages do. Ideographs are symbols that represent whole concepts (in this case, typically of actions) rather than symbols that stood for sounds - which is what phonograms do. The Roman alphabet used in English is a phonographic system of signs. The difficulty in interpreting hieroglyphics was the mixture (in the same document)

of these different kinds of signs. But it is precisely this combination that makes for a visual language in Horn's sense. Furthermore, as he illustrates, hieroglyphics also have modification symbols that change the status of symbol from phonograph to ideograph. This is much like how a P used on a parking symbol in our culture is transformed by context and the shape surrounding it from phonograph for the *p*\ sound to an ideograph for "parking permitted here." Finally, the Egyptian system also made use of scale, another feature of contemporary visual language. In contemporary uses, different sizes can show relative importance, or represent relative magnitudes of some property. In hieroglyphics, the distinction between names involved and a scene, or, in other words, details and their situation are so represented.

Horn also traces the history of visual language through its increasing use in commerce, scholarship and technology. He does this in three ways. The first of these is a textual description, explaining that the need to see at a glance "the big picture" in many areas of human activity is the basic motivation behind the emergence of visual language. Second, he has several illustrations (in visual language) of this emergence. One of these is a sort of stylized flowchart (pp. 15-16) that shows how various cultural events such as the increase in the use of personal computers, the huge data streams from satellites, and the world wide spread of television lead towards this emergence. Another illustration, which goes on for many pages, is an annotated timeline of the development of aspects of visual language. These range from the earliest known data recording to the invention of the world wide web. Third, we find interspersed with the annotated timeline detailed case studies (e.g. of Priestley's charts of biographical timelines) that elucidate in greater depth many of the key developments. Horn has thus used visual language in his exploration of the history of this family of artefacts.

Examining three key figures in the history of visual language that Horn discusses will allow us to further see how Horn shows its development through commerce, scholarship and technology. I shall focus on Horn's take on Priestley, Playfair and Töpffer.

As noted above, Priestly is credited by Horn with inventing the biographical timelines. Priestly constructed these timelines to illustrate the lifetimes of various famous people. His motivation was to represent an abstract concept: time. One axis of the chart represented one temporal feature, duration. The other axis represented coexistence, as many of the people on his chart lived at some of the same times. By "spatializing" this concept he was able to turn it into something we have better grasp of. This in turn served its role in Priestley's teaching.

Playfair's work was also important in the development of visual language. An economist by profession, Playfair needed ways of displaying numerical data. To this end, he invented the pie chart (called by him a divided circle), a lot of the methodology behind the time series, and worked on much of the precision behind the modern bar chart. Each of these "spatializes" an impossible to visualize magnitude. A too large to visualize area (the area of a territory in the United States) becomes the area on a pie chart, one that one can see and grasp. The national debt of England cannot easily be seen either (particularly when it a past quantity), but by representing it as a line on a graph against an axis representing the passage of time one can compare it to other values and observe trends and changes. The bar chart that Playfair perfected also allows us to visualize hard to grasp quantities like prices. None of these innovations work without the combination of visual elements such as lines and areas as well as words and numbers annotating them. For instance, a pie chart with no labels is just a circle divided into sectors.

The third of the individuals (and the last I will mention) Horn discusses is the artist and storyteller Rudolphe Töpffer. Töpffer is regarded as the father of the comic book, the children's illustrated story and the visual novel. In particular, he pioneered the use of multiple panels, the showing of movement by use of said panels, the overlaying of similar materials to also depict movement, and finally, by assuming that his readers would be able to fill in the gaps between the frames and their drawings with their own imagination and recollection on their experience.

Töppfer's work showed how one can communicate a large portion of ideas by saving on words and letting illustrations "speak for themselves." As required for Horn's understanding a snippet of text contextualizes the drawing, and the rest of the details of the scene and plot are filled in by the illustration. Further, by drawing upon the reader's imagination to fill in the gaps between panels, Töppfer has thus developed another key feature of modern visual language, namely the importance of visual imagination.

2a)
Contemporary studies of communication can be divided into cultural and technological. I associate the models of Shannon and Weaver with the latter and Schramm with the former, and discuss each in turn here, primarily following Tannebaum (1998).

Shannon-Weaver communication (or "information") theory comes out of a problem in electrical engineering. We wish to represent and send data of some kind. This representation is purely syntactical and centers around the key concept of "information." This should be taken as described axiomatically by the theory: every day uses of the word are not what he had in mind and may in fact hinder understanding of what the contents of this family of theories is about. In particular, as Tannebaum is to remind us, it should not be conflated with meaning. The unit of information in this sense is the bit.

This information originates from a source, forming a message, which is what we want to be transmitted. This passes to a **transmitter**, which produces a **signal** that (hopefully), perhaps perturbed by **noise**, arrives through a **channel** at a **receiver** which then gets translated into a suitable format for the **destination**. A key par of this model is the recognition of noise. Noise is any feature of the signal which was not intended by the source. Thermal and quantum fluctuations, electrical interference, etc. may cause noise in the signal. Shannon-Weaver information theory studies what has to be done to insure certain degrees of fidelity in the received message given certain likelihoods of noise.

This leads to a fundamental property elucidated by the theory.

This is the signal/noise ratio, the ratio of what was sent by the transmitter to what noise was introduced in the channel.

Since Shannon-Weaver's account is purely syntactical, it is felt that in some human contexts its lack of elucidation of meaning (and hence semantic information) it leaves out something important. Schramm attempted to build upon Shannon-Weaver and add details to the model to account for semantic and pragmatic properties of communication.

The key features that Schramm added to the model were: feedback loops, fields of experience, and role exchangeability. Schramm starts by placing a encoding and decoding mechanism in both the source and the destination. In addition, he adds an interpreter to each. Each of these "agents" also has a memory, i.e. each signal ("sign") presented is interpreted in terms of the present context and prior experience. This memory is capable also influencing the signal sent in response.

By placing an encoding and decoding mechanism in both parties of the communication, Schramm postulates that each party is in some sense equivalent to the other. Both are allowed to be senders and receivers of signals. (Tannebaum comes close to making it sound like this is rather new; I am not sure that is correct: Shannon or Weaver would just suggest that one build in such into one's device, and the model considers one transaction at a time. There is no reason to suppose they meant that the devices in question as a whole could not have both features.)

Fields of experience are essential in Schramm's model. These are semantic and pragmatic features (e.g. of a language, but also gesture, etc.) that the two agents share in order to communicate. Often times when these do not overlap as much as one would like, the communicators must resort to analogies and examples to communicate successfully until they learn more of the concepts shared by the other. Hence the degree to which there is intersection between the fields of experience is the degree to which the communicators share meanings (understood semantically and pragmatically) of words.

A feedback loop, reminiscent at least qualitatively of the work of Wiener, consists of a mechanism by which the originator of a message may also act as a recipient of a message which originates directly from his first message. These feedback mechanisms need not take place in the language proper - instead they may be done with body language. There is also a feedback loop directly back from what a communicator says and what she is to say next. We use this when we want to correct mistakes in what we have spoken, etc.

As noted, Schramm places a good deal of emphasis on feedback in his model. From Tannebaum's presentation it seems to be that Schramm's understanding of this process was strictly qualitative[1]. Despite this, there is a well-established quantitative theory of feedback. This is the field of cybernetics. Wiener is the originator of this term, after the greek word for steersman. This theory can model everything from the Watt governor, to some aspects of computing devices to some features of organisms. It is thus both more broad a field in some respects and a narrower one in others. (This is not surprising: many fields in science and technology have partial overlaps.)

Wiener's understanding of the field he created involves the description of what it studies is "attempts to control entropy through feedback." (2001 [1954], pp. 54.) He explains how in information theory, entropy (as opposed to order) is a measure of disinformation, and communications with feedback attempt to minimize this entropy. However, it must be noted that his invocation of Gibbs, one of the key figures in the study of thermodynamics, is possibly deeply confused. Entropy in the Shannon-Weaver information-theoretic sense, which Wiener is

[1] A perusal of Schramm's original (1965 [1954]) article bears this out.

discussing, differs greatly[2] from the thermodynamic sense of entropy which Gibbs worked on and is said to always increase. (Note that Wiener explicitly mentions this feature of thermodynamic entropy on pp. 50 of the article.) It is true that one can minimize entropy in the information (communication)-theoretic sense with feedback mechanisms. To minimize thermodynamic entropy changes requires a different sort of approach, and taken globally it cannot be done. The latter is just a qualitative statement of the second law of thermodynamics: $dS_{universe} \geq 0$.

4b)
Spinello (forthcoming) suggests that root source of the problem of copyright infringement in "cyberspace" is the nature of digital information. This allows for many works, previously available in only one format, to be reproduced in unlimited quantities of (near) perfect quality, and to distribute these copies easily, quickly and cheaply.

In particular, it prompts an ontological question: can one steal something that is not a "thing" in the ordinary sense of the word? This is particularly relevant if my "taking" a copy of Jean Michel Jarre's album *Oxygene* via a computer program does not deprive the original owner of the same album or its quality.

This leads to what Spinello calls the "digital dilemma." One has to find a solution to copyright infringement that prevents illicit copying and yet preserves limitations on copyright such as fair use and first sale. In other words, we appear to be stuck between liberating content through digital technology or restricting it even further.

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[2] One way to see this is to remember that thermodynamic entropy is an extensive quantity (Wilson 1966, pp. 37) whereas information-theoretic entropy is a intensive quantity. That is, thermodynamic entropy is proportional to the mass of substance present, whereas information theoretic entropy is not. This latter is just the average information in bits. Feynman (1999, pp. 123) reports that Shannon later regretted using the name as it prompts the sort of confusion we are discussing.

Spinello suggests that ethically informed code is the way to solve some of the above moral and legal dilemmas. Since he feels that social norms writ large, market forces and government interventions (i.e. drastic changes in laws) are unlikely to solve the problems - either by making laws much more severe or by gutting them completely as some have suggested, another approach is needed. The latter is rejected on the grounds that it will impact sales in the "real world." I shall discuss the "code" approach to solving the above dilemmas by means of analyzing several possibilities as to its implementation. The below are representative but not exhaustive approaches.

The "code" approach does not rule out moral education (social norms writ small) and in particular emphasis on the effects of breaking the law. However, it focuses also on increasing the saliency of the moral issue. This seems involve using more solutions such as Netnanny and other monitoring programs. It is unclear, however, who should put these constraints in software. Are operating system vendors to restrict what files can be copied from CDs? How will this work, exactly? What will make all manufacturers of operating systems comply with this? If there is to be no legal requirement (Spinello has rejected increased "top down" intervention), one cannot expect all operating system vendors to comply. Further, even if it were to be done as a matter of law[3] , it is probably a safe bet that the Linux/FreeBSD/Darwin etc. crowd would simply refuse to comply, as they have already refused to comply with certain DVD restrictions.

Another possibility consists of "don't copy me" stickers (or even booklets on the legal impact, etc.) on CDs and so on as well as other such messages within the software itself. (This is parallel to the "winners don't use drugs" campaign that was inserted into some arcade games a while ago.) I am skeptical of the

[3] I.e. by passing a law that operating systems sold (here we have another problem!) must have certain antipiracy features.

effectiveness of these[4]. Another possibility would be to allow duplication of content on a CD (say) by mechanisms only on that CD. Consider them coming with a little program that allows one to "back it up" to a blank, and nothing else. These would be quickly hacked.

Hardware solutions, such as the recently revived technique[5] of physical damage to prevent copying, would again forestall some copying, but as it did in the past, would only lead to programs and hardware to circumvent. A related possibility, also resurrected recently would involve mandating antipiracy features in firmware etc. for devices that might be used to make illicit copies. There are two problems with this approach. One is the cost: disk prices, for instance, are in free fall, and requiring a large amount of added logic to monitor somehow what is being copied onto them or from them may very well wipe out manufacturer profits or reduce them below the point of adequate return. It also creates an interesting problem in design: how does one tell that the bits coming over the drive bus are from something that should not be copied? How does the firmware tell that they ARE a copy? This proposal requires much more in the way of details before it is to work.

Greater moral education to interact with these code solutions,

[4] In particular, because it has not been studied. One would have to show that this sort of approach led to the results desired without too many adverse effects, and so forth. Since people as a whole are adverse to genuine social experiments in general, I find that even proposing such a study is problematic. Simply trying it out haphazardly prompts people to not take it seriously.

[5] From about 1980 to around 1988, when the Apple II family used 5.25" disks, a lot of software was "copy protected." One of the techniques by which this was done was using a laser to physically burn a hole in one sector of the disk. Conventional copy programs would thus fail trying to read it. The program itself did not store information nearby and was able to "skip" the bad sector by writing its own custom operating system to avoid it; since one very often booted each program from its own disk, this was easy enough for manufacturers to enforce.

might work, but Spinello's analysis presupposes that people think that pirating CDs, etc. is morally wrong. His analysis says that (for instance) breaking copyright laws has adverse effects on producers of content. Laws are said to have moral force unless manifestly unjust. Since Spinello thinks that the copyright laws are consistent with common good and basic human rights, they thus have moral force. This is question begging against those who would dismiss the laws. The very issue is whether the laws are just.

The most common viewpoint here (in my own informal research on the subject) is that the laws themselves are otiose because they currently protect "the middleman", i.e. the recording companies. Instead, they (it is felt) should be protecting the artist. Since the artist takes so little from the production of an average CD (say), we should (so the argument goes) act to overcome the influence of the recording companies, and encourage movement to a model where the artists can be paid directly. This can be more easily done if music (etc.) is freely distributable. A sort of "shareware" media. I am not sure this approach would work, but it is true that the copyright laws assume that the middleman is needed.

Another possibility would be to place the onus on the software developer in different way. For instance, morally educating people to not develop software that allows rampant copyright violations. The problem with this approach is it presupposes that software developers are ethically in agreement with the copyright holders of media. Someone might suggest that since programmers are also holders of copyright they would want to agree with the holders of copyrights in music and movies. There is no intrinsic reason why this should be so. Spinello's article seems to presuppose that copyright law (and the attending moral principles) should be the same for all works (e.g. pp 15: "Unless one is ready to reject the whole system of intellectual property law, [...]" [emphasis added]). It is not clear that this should be the case. I have even heard it argued that copyrights should apply to software but not to works of art. (This might be regarded as incoherent if software can be works of art, but that is another issue for another time.)

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