When digital trumps analog: teaching with Second Life

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It sounds like a horrible idea.

Put the head of a slightly anesthetized cat into a vice so that it's forced to watch a simple slide show while you poke the back of its brain with a microelectrode. But that scene was not a horror movie plot that would give a member of PETA (the People for the Ethical Treatment of Animals) nightmares, two scientists won a Nobel Prize for that experiment in 1981.

The work of Canadian David Hubel and Swede Torsten Wiesel of the Johns Hopkins University in Baltimore, provided clues to how the brain sees images via our eyes. The two jabbed a microelectrode into a brain cell in the visual cortex at the back of the brain of an anesthetized cat and connected it to both an amplifier and an oscilloscope. The amplifier converted electrical energy to a 'put-put' sound while the oscilloscope turned signals to a blip on a screen so they could measure the response.

With the cat's eyes open and focused toward a screen, the scientists flashed simple straight and slanted light patterns. With their set-up Hubel and Wiesel could see and hear immediately the effect of any nerve cell stimulation by the patterns of light. After they flashed the light on the screen several times and adjusted their equipment, the scientists recorded what they had thought was possible: the stimulated activity of a single brain cell responsible for vision.

The visual cortex is composed of several thin layers of nerve tissue. By this tedious and perhaps ethically disturbing method of placing microelectrodes in various cells within each layer of a cat's brain, Hubel and Wiesel found that some cells responded to a spot of light while others noted the edges of objects, certain angles of lines, specific movements, specific colours, or the space between lines rather than the lines themselves. In short, each brain cell in the cortex almost reacts in a one-to-one relationship with the type of visual stimulation it receives. From all this information,

the brain constructs a map of the outside world projected upside-down on our retinas.

More importantly for visual communicators, it was eventually discovered by other researchers that the brain, through its vast array of specialized cells, most quickly and easily responds to four major attributes of all viewed objects: colour, form, depth, and movement. These four visual cues are the major concerns of any visual communicator when designing an image to be remembered by a viewer because they are noticed before a person even realizes what they are. The four visual cues, therefore, are what the brain sees, not the mind. Consequently, the four cues can be used to attract attention to a presentation whether in print or for a screen.

Colour

Throughout human history, people have been fascinated by light. Civilizations prayed at, and celebrated the start of, each new sunrise and invented gods that ruled the sun. Religious leaders equate light with life and most religions begin with its creation. When the light from fire was discovered, probably by accident through a lightning strike, most were awed by its power. Literary references and colloquial expressions about light and vision abound, because of the importance placed on seeing. When we want to learn the truth we say, 'Bring light on the subject.' After a revelation of some truth we have 'seen the light.' If we are concerned that we are not getting the full story, we complain, 'Don't keep me in the dark.' New Orleans photographer Clarence John Laughlin once wrote, 'One of my basic feelings is that the mind, and the heart alike ... must be dedicated to the glory, the magic, and the mystery of light.' Rock bands such as Daft Punk, Etienne de Crecy, Radiohead, and Trans-Siberian Orchestra among others know the power of light to attract attention so they produce expensive light shows to accompany their concert performances.

Light can intrigue, educate, and entertain, but nowhere is light so exquisitely expressed as through colour. Colour is a highly subjective and powerful means of communicating ideas. James Maxwell, the Scotsman who gave the electromagnetic spectrum its name and invented colour photography in 1861, once wrote that the 'science of colour must be regarded essentially as a mental science', in contrast the artist Francis Bacon's common-sense statement proclaims that 'All colours will agree in the dark,' and no two individuals see a colour in exactly the same way.

Form

Another common attribute of images the brain responds to is the recognition of three types of forms: dots, lines, and shapes. The dot is the simplest form that can be written with a stylist. A dot anywhere within a framed space demands immediate attention. In the centre, it becomes the hub of visual interest. If off to one side, it creates tension as the layout appears out of balance. Two dots within a framed space also create tension as the viewer is forced to divide attention between the two forms. When three or more dots appear in an image, the viewer naturally tries to connect them with an imaginary line: it may be a straight or curved line or take the basic shape of square, triangle, or circle.

When dots of the same size are drawn so closely together that there is no space between them, the result is a line. According to anthropologist Evelyn Hatcher, straight lines convey a message of stiffness and rigidity and can be horizontal, vertical, or diagonal. Horizontal lines, especially when low in the frame, remind viewers of a horizon with plenty of room to grow. If the horizontal line is high in the frame, the viewer feels confined, as the layout seems heavy. In a layout, vertical lines bring the eye of the viewer to a halt. The eye attempts to travel around the space created by the line. Diagonal lines have a strong, stimulating effect in a field of view. The most restful diagonal line is one that extends from one corner to its diagonal opposite. It is a perfect compromise between horizontal and vertical forces. Any other diagonal line strongly moves the eye of the viewer in the line's direction. Several diagonal lines within a composition create a nervous dynamic energy. Curved lines convey a mood of playfulness, suppleness, and movement. Curves have a gracefulness about them that softens the content of their active message. If lines are thick and dark, their message is strong and confident. If thin and light with a clear separation between them, their mood is delicate, perhaps a bit timid.

The third type of form, shapes, is the combination of dots and lines into patterns that occur throughout nature and in graphic design. Shapes are figures that sit on the plane of a visual field without depth and define the outside edges of objects. They can be as simple as a beach ball and as complex as the side of a person's face. A shape that is quickly recognized is clearly separated from the background of the image. The three basic shapes are parallelograms, circles, and triangles. From these three shapes, variations that make all known or imagined forms can be created. Polygon is the name of the form created by a combination of shapes. As with all

visual attributes, cultural meaning is assigned to each shape. In 1987 American animator Bill Plympton was nominated for an Academy Award for his short cartoon, *Your Face*. In its short timeframe, Plympton shows how a creative and talented mind can make variations on the shapes that combine to form a human face. Later, the same concept was used in a commercial for Taco Bell.

Depth

If humans had only one eye and confined their visual messages to drawings on the walls of caves, there would be no need for more complex illustrations that could be made from dots, lines, and shapes. But because we have two eyes set slightly apart, we naturally see in three dimensions - width, length, and depth - rather than only the first two. In 1838, Sir Charles Wheatstone presented a paper to the Royal Society of London detailing his views on binocular vision. He concluded that our two eyes give different views and create the illusion of depth. The images are projected onto each two-dimensional (2-D) retinal screen at the back of each eye and travel to the brain that interprets the difference between them as depth.

Movement

Colour, form, and depth join movement to constitute the principal qualities of images that make the cells in the visual cortex respond quickly to a stimulus. Recognizing movement is one of the most important traits in the survival of an animal. Knowing whether an object or other animal is moving closer or father away avoids potentially harmful encounters. There are four types of movement: real, apparent, graphic, and implied. Real movement is motion not connected with an image presented in the media. It is actual movement as seen by a viewer of some other person, animal, or object. The most common example of apparent movement is motion picture films. Moving images are a series of still images put together sequentially for film, videotape or digital media and moved through a viewing device at a fast speed. Each single picture is only shown at a fraction of a second. Movement is perceived in the brain because of a phenomenon called *persistence of vision*. In 1824 Peter Mark Roget, who later became famous for his popular *Thesaurus*, proposed that this phenomenon, also called *diligence of foresight* resulted from the time required for an image to fade from the cells of the retina. Graphic movement can be the motion of the eyes as they scan a field of view or the way a graphic designer positions elements so that the eyes move throughout a layout. Visual communicators often

position the graphic elements in a design to take advantage of the eyes' movement around a picture and layout. A viewer's eyes will move through and notice elements in an image based on previous experiences and current interests, seeing certain parts of the picture and ignoring others. Nevertheless, a visual communicator can direct a viewer's eyes in a preconceived direction. The eye will usually follow a line, a slow curve, or a horizontal shape before it follows other graphic elements. Of course, colours, sizes of individual pieces, and placement of elements against a frame's white, or background coloured space also are crucial. Implied movement is motion that a viewer perceives in a still, single image without any movement of an object, image, or eye. Some graphic designs purposely stimulate the eyes with implied motion in order to attract attention. Optical or 'op' art has been used in advertisements and in posters to achieve frenetic, pulsating results. Visual vibration is the term used for these images. Through high-contrast line placement or the use of complementary colours, moiré (wavy) patterns seem to move as if powered by an unseen light source.

David Hubel, Torsten Wiesel and other scientists, who built on their work through experiments with rats, monkeys, and people with brain injuries, demonstrated that the cells in the visual cortex respond primarily to colour, form, depth, and movement. But even without the knowledge of research, for many millennia visual communicators have used these four visual cues in their work, whether it has appeared on cave walls or on computer screens. An important lesson for image producers who want to make memorable messages is to understand that brain cells are complex 'difference detectors.' They are stimulated more by the relative difference between visual elements than by the intensity of each one. Consequently, a gaudy, colourful presentation may lose much of its impact if all its graphic elements have the same intensity. Differences between the visual cues detected by brain cells are only part of the reason that some messages are noticed and others are ignored.

Teaching the four visual cues with Second Life

With online, web-based instruction a popular alternative to classroom teaching, several studies have been conducted to show if there are significant differences between face-to-face and online classes. As students ask for more flexible educational experiences (being able to take classes on a computer from home or work) and as administrators are concerned about space restrictions with crowded on-campus auditoria, instructors and researchers have been asked to investigate

whether teaching an online class is a benefit or a hindrance to the educational experience for students.

WebCT and Blackboard.

For the reported studies above, the predominant online software program used was WebCT. Developed by Murray W. Goldberg, a computer science faculty member for the University of British Columbia in 1995. WebCT at one point served about three million online students in 30 countries. In 2006 its online course rival Blackboard acquired WebCT and phased out the name. Consequently, most universities around the world switched to the Blackboard program for the delivery of online classes. In 2004 Blackboard, Inc. became a publicly traded company on the NASDAQ exchange. Today the Washington, D.C.- based educational delivery business is used in more than 2,200 educational institutions in more than 60 countries. Blackboard is similar to WebCT with asynchronous features that include grade checking, discussion board assignments, course material links, paper depository, classroom discussion recordings, and examinations as well as the synchronous feature known as the 'virtual classroom.'

The virtual classroom in Blackboard, in which students meet online at a specific day and time for class discussions, is an important and vital instructional tool because without it a class is not much more than a textbook. In the online classroom, slides with words and pictures, websites, and video clips can be shown to students as the text-based discussion continues. After the initial shock from students who realize that as a participant in an online class they will never meet face-to-face, the text-based format in Blackboard is easily incorporated as a teaching tool because most students are familiar with chat room technology offered by American Online and other companies. As students are usually at home using their personal computers, class discussions are often more insightful and penetrating as students feel comfortable, can think before they type, and overcome any shyness they may experience when attempting to participate in a face-to-face classroom setting.

Second Life

Another 'class' of online instruction in which the visual display is as important as the communicative features are those that employ online 'virtual worlds' as venues for

teaching. One of the most recent and popular software programs for this purpose is Second Life (SL), an avatar-based virtual social community of residents who can walk, fly, drive a vehicle, and teleport to rural and urban simulated environments to engage in all kinds of activities. With credit card information, residents can accessorize their avatars with hair, skin, and clothing. With a premiere account (SL is otherwise free to join), residents can buy land and build stores and homes and sell their creations to other users of the program. Roughly inspired by Neal Stephenson's 1992 science fiction classic S*now Crash* about a user-dominated virtual reality, Second Life was launched in 2003 and currently has more than 13 million registered accounts.

Although essentially an elaborate chatroom, SL combines the visual cues found in the real, analogue world (colour, form, depth, and movement) with an interactive communicative experience. In that sense it is possible to make the learning and teaching experience more real for online students than with the virtual classroom provided by Blackboard. Presently there are over 100 educational institutions throughout the world (e.g. Aachen, RWTH University, Germany to the University of Warwick in Coventry, England) that have a presence with many offering live, synchronous classroom instruction.

Whether using a virtual classroom in Blackboard or a virtual island class site with Second Life, compared with face-to-face or analogue teaching - the actual conveying of information with PowerPoint slides, video clips, formal lectures and entire class conversations and small group breakouts - in a discussion format is quite similar. What is quite different however is the fact that students can use the tools of Second Life to learn about and exploit the four visual cues by creating objects and actions within the virtual world.

This presentation demonstrates how Second Life can be used as a teaching tool for teaching the four visual cues of visual communication in an environment where there are few limits to human creativity in its supernatural environment.