Colors and Culture: Language, the Sapir-Whorf Hypothesis, and the Americanist Tradition in Anthropology, Linguistics, and Cognitive Science

James Stanlaw
Anthropology, Illinois State University

1. The "Puzzle of Color" and Why it is Important to Cognitive Science.

1.1 INTRODUCTION. Simply put, this module is about how and why people choose names for colors, and how humans might perceive and interpret the visual world. Answers to these questions are not as obvious as you might at first think, and I believe you will come to see as we go along that the "puzzle of color," as an early researcher called it, is more than just an esoteric problem in experimental psychology or a quaint philosophical paradox. Color terminologies have been a source of fascination for anthropologists from at least since the turn of the 20th century, when the early ethnographers on the seminal Torres Straits expedition noticed that "non-Western" peoples often have very different ways of dividing up the color spectrum. For instance, some languages, it was found, would blend blue and green colors under a single term, while others would break up, say, the English reds using three or four separate names. It was puzzling to find that so "natural" and neutral a stimulus as the color spectrum could be divided up—that is, named—in hundreds of different ways.

Since the 1950's, a common way of systematically investigating colors was to use an array of Munsell color chips, a common commercially available set of accurate and consistently-reproduced color standards used by scientists, engineers and artists (similar, in a way, to the sample paint swashes found in most hardware stores, but scientifically calibrated). When such an array was presented to informants, it was found that almost any kind of configuration of color names was possible. Until the late 1960's, color was taken as the best—if not the only—empirically-grounded evidence for linguistic relativism. That is, it was thought that languages and cultures could vary in their color nomenclature almost without constraint, and that there would be no *a priori* way of knowing how any particular color term system might appear. Indeed, the variety found in color nomenclature seemed to indicate that there is nothing inherent in either human perceptual facilities or the physical world that would compel a language to name some domain in any particular fashion.

In 1969, however, Brent Berlin and Paul Kay, two anthropological linguistics at the University of California at Berkeley, presented evidence that suggested that there were rather severe restrictions on how color names—and apparently, then, color concepts—could be used. If the notion of “color term” was restricted to certain monolexemic productive lexemes, there appeared to be only about a dozen terms, at most, that any language might have; indeed, a majority of the world’s languages would probably have twelve or fewer of these basic terms. There also seemed to be a cross-culturally universal sequence as to how a language would acquire new color categories. WHITE’s and BLACK’s were always the first terms found; RED’s always came next (before YELLOW’s or BLUE’s), and PINK’s or ORANGE’s were always added last. And while the ranges of these terms could vary greatly on an array, certain color chips seemed to have universal psychological salience, even if the language in question had no actual term for that color. For example, while the Dani of New Guinea are said to have only two “basic” colors (WHITE, or all the light colors, and BLACK, or all the darks), prototypical ”fire-engine” RED chips are recalled much better than other less typical RED’s. Physiological and bio-psychological explanations were proposed to account for these findings. (Don’t worry if you do not know some of the jargon; these notions are all fairly straightforward, and will be explained with diagrams later.)

In the thirty years since the original Berlin and Kay work (1969; 1991), some several hundred studies have generally supported their original findings, albeit with some modifications (cf. the World Color Survey 1991; Kay, Berlin, and Merrifield 1991). Today, this universalist account is probably considered to be the standard model of color nomenclature against which all data and other models are evaluated. Though modified and refined, the universalist arguments of Berlin and Kay have remained principally in tact, though there are, of course, some serious philosophical challenges (cf. Saunders 1992; Saunders and van Brakel 1996).

In this module, I will review some of the literature from anthropology, linguistics, and psychology on color. I will discuss some of the early work conducted by pioneer British fieldworkers before World War I, and show how their findings were incorporated into an “Americanist” perspective of language and culture (a view popular until the 1960’s). I discuss the Sapir-Whorf Hypothesis—that is, the idea that your language determines not only how you think about the world, but indeed how you actually perceive it—and examine its rise and fall. I next explore the ascent of universalism, the idea first popularized by Noam Chomsky that all languages are basically the same underneath it all (these similarities being masked by our over-attention to surface-level differences). I then discuss how this universalism affected the views of anthropologists and linguists regarding color nomenclature, in particular, the studies of Berlin and Kay mentioned above. Next, I present some of my own work on Japanese color naming, not only because I know it well, but also because of how I think it extends some of Berlin and Kay's findings by giving them a fuller ethnographic context, as well as showing how this model models culture contact. I introduce Robert MacLaury's "Vantage Theory," a new way of formally looking at human categorization which not only explains many of the aberrant cases that the universalists could not, but also gives a deeper account of the color nomenclature process. I end by returning to the Sapir-Whorf Hypothesis once again. Though a whole encyclopedia could be written on trying to cast a final verdict on "linguistic relativity," I will leave the reader with a few suggestive experimental findings that seem to indicate that in spite of universalist claims to the contrary, there is still life in this theory yet.

The importance of color nomenclature research to cognitive science in general is critical, and hopefully will become obvious as we go along. However, a few points might be mentioned now. First, color nomenclature shows why anthropology is truly one of the six subdisciplines that make up cognitive science. I think we will see that "perception" or "apprehending the color world" involves a very critical cultural component, with insights that anthropology is especially equipped to offer. Second, the color problem directly addresses problems concerning the relationship between language and thought, language and culture, and language and the ostensive "out there" world. It is very difficult to get inside people's heads, and color naming is one of the few domains where subjective experience might be teased out, in a replicable fashion, from objective reality. Finally, color offers some very interesting revelations as to how (some, at least) human cognitive processes might have evolved over time. Just why do humans even have color vision? For the most part, for example, color-blind people seem to get along just fine; why was such evolutionary effort and cognitive energy devoted to the development of the complex color visual apparati that humans now have?

1.2 TOPICS AND GUIDEPOSTS. We will cover many topics and problems as we go along, so it might be useful at this point to have an outline. The "chapters" of this module are as follows:

1. The "puzzle of color" (this introduction here)
2. Some technical preliminaries: the physics and psychology of color vision, and the Munsell standard chip array
3. Early anthropology and "primitive mentality"
4. Rivers and the Torres Straits Expedition
5. The Americanist tradition in anthropology and linguistics
6. Linguistic Relativity, the Sapir-Whorf hypothesis, and color nomenclature
7. The Berlin and Kay "standard model" and the triumph of universalist notions
8. Later developments from the "standard model:" MacLaury's Vantage Theory
9. Cultures in contact: the Japanese case
10. Final Verdicts: Is Sapir-Whorf Dead?
11. Appendix: The Life and Times of Edward Sapir

12. References and resources

A warning to the student might be in order, too. I will tell you in advance that the discussion of color nomenclature given here will go something like this: (1) the early British fieldworkers (c. 1900) believed in cross-cultural universalist and evolutionary accounts; (2) American linguists and anthropologists (c. 1920 to 1970), on the contrary, argued successfully for relativism; (3) Berlin and Kay's work (c. 1970 to the present) seemed to overwhelmingly demonstrate the strength of universalism; (4) some of the latest work—by both theoreticians such as John Lucy, as well as by experimenters and ethnographers (such as even myself)—suggest that there is a place for cultural and linguistic relativism without denying the efficacy of universalism. If your head is not spinning by now ... well, you will just have to loosen up! I know this is frustrating, and I am sorry I cannot give you the last word and the "right" answer. This is still an ongoing investigation, and for all I know, if I were writing this module in 2001 instead of 2000, I might be saying something completely different than what you are reading now. I know it appears that we are alternating from Claim A to Claim B and back again, with little apparent progress.

However, I think this is not quite true. I think progress is being made, as each step along the way gives us a deeper understanding of the complexity of the problem confronting us. Scientific investigation goes like that. We find out something; we try to account for it; we see if we can find it again; we propose an over-all explanation or theory as to what is going on; then we repeat the process all over again. Think of this, then, as a narrative or story, with a multitude of puzzles to solve, with different clues being revealed at different times. Before we go on this journey, however, we need to spend a few moments talking about the physics and psychology of color, and examine a way of scientifically and operationally describing these features. This we will do in the next section.

2. Some Technical Preliminaries: The Physics and Psychology of Color Vision, and the Munsell Standard Chip Array

2.1. PRELIMINARIES. How are we going to go about a study of color? At the risk of sounding overly rhetorical, we might even ask just what **is** color, anyway? There are at least six fields we might draw upon to help answer these questions (corresponding, oddly enough, to most of the subdisciplines of cognitive science):

Physics and chemistry: Physicists and chemists will tell about the properties of light, and materials that reflect light, that allow certain parts of the the human body to be stimulated in particular ways to cause a color response; they will give us information from wavelengths of light to the energies that they carry with them.

Physiology and neurology: Physiologists and neurologists will tell about how the human eye and brain are structured so as to take in, and respond to, light stimuli coming into the human body; they will give us information from rods and cones in the eye, to neuro-pathways in the brain and nervous system.

Psychology: Psychologists will tell us more about the processes involved in interpreting color beyond the “mere” electro-chemical-neuro- responses of physiology; they will tell us about things ranging from visual perception, to real—but apparently non-physically based—experiences such as color constancy.

Anthropology: Anthropologists will show the cultural and social components involved in apprehending and experiencing a color world; they will tell us why some colors “go” together, as well as the symbols associated with them.

Linguistics: Linguists will tell us about how languages and colors interact, from the way we assign words to colors to the color concepts that may underlie them.

Philosophy: Philosophers will help us explore and clarify our experiences of color; e.g., what is “real” about color?; what actually happens when we have a color experience?; how can I be sure that your experience of a color and my experience of a color are in any ways similar?

We of course cannot hear from every discipline, though bits and pieces from everyone will appear as we go along. But before we get into our project, we will need to look at few details from (1) physiological psychology (visual perception), (2) physics (optics and quantum mechanics), and (3) colorimetry (the theory and study of the measurement and specification of color, in particular, the Munsell color system). These are all very complicated fields of study in their own right, but we will just take a few seminal ideas from each that we need. If nothing else, this shows the interdisciplinary nature of cognitive science. It is not going to be as hard as it sounds!

Before we begin, however, I will review how colors are created, as this is a question that students invariably ask in my classes. So right at the onset let’s get the “primary colors” out of the way first:

2.2. COLOR PRIMARIES: ADDITION AND SUBTRACTION. When we discuss color, there are several approaches to take. One way is to look at how colors are “made,” say, by painters, artists, printers, chemists (or even by cameras and color photographic film). Another way is to look at the physics of color: that is, the various properties of actual emitted or reflected light of objects. A third way is to look at the subjective ways human beings perceive or name colors. Each, of course, entails a different level—and means—of analysis.

Historically, much of color science has dealt with how these three levels relate to each other.

Every child with a Crayon box or fingerpaint set has made colors. This is usually done by some kind of mixing process (say, adding more and more of a pure yellow to a pure brown to produce perfect barf). This is called **additive color mixing**. It works best mostly with colored lights. If I projected a beam of pure red light against a screen, and then took a second yellow beam and shot it on top of it, the result in the area of overlap would be some kind of orange. If we kept the first red light the same but made the second light more and more greenish, the area of overlap becomes more and more yellowish. Colors can also be made by absorption, when light is passed through a material which captures certain wavelengths, but allows others to go through . A green filter on a camera or slide projector, for example, absorbs less greenish light (allowing it to pass through) while absorbing the other frequencies. Actually, most paint colors are created by this **subtractive color mixing**. For example, yellow paint combined with blue paint produces green paint, just as yellow light and cyan light combine to form green light.

We will see shortly that **primary colors—**colors which are used as the basis for creating others**—**are going to be different for different researchers. Artists can make most of their colors for their work by putting together various amounts of red, yellow and blue (note: this is actually a subtractive operation as the different paint pigments really absorb colors). Psychologists and physiologists have found that there is really something special about pure red, blue, green, and yellow, which will be discussed in the next section. Physicists usually use lights of red, blue, and green as their "tri-stimulus values" from which other colors can be defined. But more on this later when we come to Section 2.4. Now that primaries are out of the way, let's look at rods and cones and eyeballs:

2.3. COLOR PSYCHO-PHYSIOLOGY. "The human eye is the most versatile of all radiation detectors" (Rainwater 1971:90). This is significant, because we will see in the next section that light is nothing more than radiation of a special kind, and what we call color is just some particular properties of this radiation. However, all this means nothing without the special capacity of the human visual system to respond to these properties. A great deal of how this happens is still not clearly understood, but much of the basic processes are well known. Probably most of us have heard of "rods" and "cones" somewhere in the eyeball that allow us to see colors. These photosensitive cells do indeed respond to light. There are about 4 million cones (which respond to hue or colored light) and 120 million rods which r
respond to blacks, whites, and greys (Rossotti 1985:112).

2.3.1. The eye. When a photon—a packet of light energy—strikes a photosensitive cell and is absorbed, a chemical reaction occurs. If the photon is bright enough to stimulate a cone cell, the sensation of color might be triggered.

There are three different pigments a cone cell may have, making it most sensitive to light of certain wavelengths. (Don't worry; wavelength, brightness, photons, light energy and all this good stuff is coming up in the next section.) Color vision is only possible, actually, because these three types of cones respond differently to various wavelengths of light. One kind of cone is most responsive to wavelengths that produce red colors; another kind is most sensitive to the green colors; the third absorbs wavelengths of blue light the best. The experience of color—or at this point, at least the response to the stimuli that is sent to the brain—is due to the differing ratios or proportions of responses. For example, suppose light that is almost pure fire-engine red hits the eye. The red cones may absorb about 95% of the light, the green cones 4 or 5%, and the blue cones 1% or less. Such a cone response sends a "red" message to the brain (but wait until the big caveat in the next section!). The rods, however, respond to different degrees of brightness, and then only in light of low, dim, intensity. Thus, cones respond best to hue in normal daylight and rods to varying degrees of brightness at night.1

But there is one thing to remember about these photoreceptor cells. They are sort of digital, not analog. That is, they either fire and are "on"—thus, sending a chemical message to the brain—or they are "off" and not firing (i.e., not being stimulated) and not sending a message to the brain. To put it in terms of physics, each photoreceptor cell gives the same response when absorbing a photon of light, regardless of that photon's actual frequency and energy. For example, though each type of cone has a better probability of responding to certain frequencies of light than others, when it fires it contains no information about the photon it absorbed. The cell could have responded to a photon which it is particularly sensitive to, and in dim light; or it could have responded to a photon that it is not especially sensitive to but in bright light (Byrne and Hilbert 1997:xv). What this means is, color vision requires two or more receptors; by taking in information about the **differences** in the responses from different cones, the brain can then make a "color" interpretation.

<u>2.3.2. The brain.</u> So the eye, then, is not the whole story. All we have done so far is seen how a chemical message is sent to brain in response to some particular stimuli. For the neurological system to make a color response, a evaluation must be made of the interactions of all the photosensitive cells. Empirically, it is noted that there seem to be be three kinds of contrasts that the brain is especially sensitive to: yellow-blue; red-green, and white-black. For example, is appears that color-blind people may be weak in red and greens (seeing only blue and yellow colors); they may be weak in blue and yellows (seeing only the reds and greens); or they may be monochromatic, depending only on their rod cells and seeing the world in black and white. One way to explain such distinctions is to posit units of nerve connections which react differently to cone excitations (Rossotti 1985:133). For example, one such set might be as given in the top of Figure 2.1.

At first this figure might appear rather odd; what is all this “inhibitory” or negative stuff? Well, as De Valois and De Valois (1975 [1997]:100) state, “the single most important finding of twentieth-century sensory physiology is that every neuron in the sensory pathway has a combination of excitatory and inhibitory influences playing on it.” What this means is, sensory information processing is the result of comparisons of excitatory and inhibitory inputs. So the top of Figure 2.1, then, says that the sensation of blue and yellow colors result from different amounts of excitatory signals coming from red cones and inhibitory signals coming from the blue cones. This is shown in the diagram in the bottom of Figure 2.1.2

Figure 2.1 is a simplified version of what is called the **opponent-processor theory** of color vision.3 This theory claims that there are three channels or processors in the brain: (1) the blue-yellow channel, (2) the red-green channel, and (3) the black-white achromatic channel. These, of course, are the “distinctions” shown in the right side on the top of Figure 2.1. As we saw in Section 2.3.1 color responses are generated not by the mere excitation of cones sensitive to particular wavelengths (e.g., red cones firing due to red light). Instead, the sensation of “red” seems to result in both the stimulation of red cones and the inhibition of green cones. To make a long story short, there appear to be six types of cells working between the eye and the brain.4 Differential excitations and inhibitions of these cells cause the sensation of the six physiologically privileged colors: red and green, blue and yellow, and white and black. We will have more to say about these pairs of polar opposites later when we consider the details of color naming; we will see that these colors have a special privileged position linguistically as well.

Before we go on we might briefly mention that there are many other color properties which are apparently more neural and/or psychological than retinal and/or visual. Two are **color contrast** and **color constancy**. Color constancy is the human ability to compensate in discerning a color as illumination changes. For example, a yellow book outside in the sun actually looks rather different when looked at indoors under a lamp. However, we tend to “see” the same yellow in both cases. Color contrast here refers to how colors are affected by their surroundings. For example, if a yellow and and an orange sample are placed next to get other, both may appear less bright than when standing alone (i.e., the yellow appearing more greenish, and the orange appearing more reddish).

2.3.3. Comments. The physiology and psychology of color are fascinating fields, but we we don’t have much time to go into in any more details here. Let me leave you with a few final comments. One question which might be asked is can different kinds or qualities of light produce the same sensation of color? The answer is yes. For example, yellow light, say, (being projected on a screen through a yellow filter) can appear to have the same hue as the color found in the overlapping of a red light source and a green light source. Such problems have kept philosophers busy for centuries: is color then something inherent in an object or purely an internal subjective experiential phenomena? Even Isaac Newton was perplexed by this. It gets even more weird when we find that there are certain colors, such as green, that we cannot make by combining colors. And some colors can only be made mixing. For example, the color we perceive of as magenta does not correspond to any single wavelength of light (Rossotti 1985:119-120) which is why we don't see magenta in the rainbow spectrum (which we will discuss in the next section).

2.4. THE PHYSICS OF COLOR. Why isn't the world grey, or at least not grey to humans? It has to do with the the nature of light, of course. Light (for our purposes here) can be considered as waves of various energies and wavelengths. All waves, as you know, are the transference of energy in an cyclic and oscillating matter. For example, if you have ever bobbed up and down in the ocean, or surfed, or watched a bottle wash ashore on the beach, you know about wave crests (highpoints) and troughs (lowpoints), and how energy or motion can be conveyed via waves.

The top of Figure 2.2 shows some of the properties of waves, at least for for two dimensions (we'll see in a minute that light waves are actually three dimensional). The distance between two successive crests is called a wavelength. Frequency is just the number of wavelengths per second. If the top of Figure 2.2 depicts how far one wave has gone in one second, then the frequency of the wave shown there is "2 cycles per second" (i.e., it oscillates two wavelengths in one second). Amplitude is the height of the crest taken from a hypothetical horizontal axis that wave oscillates around.

Maxwell, Einstein, and others showed that the speed of light is very fast, but constant; that is, in a vacuum light travels at about 186,000 miles per second (300,000 meters per sec.), or almost 670,000,000 miles an hour. Everyday visible light vibrates between 400 and 800 trillion times per second, and wavelengths vary between 400 to 700 billionths of meter (or 15 to 27 trillionths of an inch). The usual unit for speaking of visible wavelength is the angstrom (with one angstrom—A, or Å—being 10^{-10} m, or 4 trillionths of an inch). Thus, visible light ranges from 4000 angstroms (the violet colors) to 7000 angstroms (the red colors).

The relationship between speed, frequency, and wavelength is as follows:

$$\text{(speed of light)} = \text{(wavelength)} \times \text{(frequency)}$$

Because the speed of light is constant, wavelength and frequency are inversely related, That is, if wavelength decreases, frequency increases; if wavelength increases, frequency decreases. This shown in Figure 2.2. Compared to the wave drawn on the top, the wave on the bottom has a slightly shorter wavelength, and hence, a little higher frequency. If another wave was drawn with even shorter wavelength, there would be even more crests in the picture, i.e., an even higher frequency.

This relationship between frequency and wavelength is important because it turns out that visible light is just a special case of the more general phenomena of electromagnetism. “Ultra-violet radiation,” for example—such as “black light,” X-rays, or tanning rays of the sun—are just “light” of higher frequency (and shorter wavelength) than everyday visible light. “Infrared radiation”—such as radio and TV waves, or the thermal waves of heat that we give off that some insects “see” to bite us—are “light” of lower frequency (and longer wavelength) than everyday visible light.

I have claimed, so far without proof, that light is a wave. The history of physics, however, has a been a long and ongoing examination of the true nature of light (Baierlein 1992)—i.e., is it made up of particles like small billiard balls, or is it streams of waves? For us, we can ignore much of this fascinating controversy and just focus on the wave aspects of light. To prove to yourself the wave nature of light, you can repeat a little experiment you probably did in sixth grade science class. Hold your hand up to your face (palm towards you) and look at a light sources (but NOT directly at the sun!) between the small “slot” between two fingers.5 You probably need to close one eye for this to work. Slowly adjust the space between the two fingers until they almost touch. You should see numerous fine dark straight lines running parallel to your fingers. These are lines of diffraction and “interference” between different waves of light. Figure 2.3 shows how waves can affect (interfere with) one another. If two waves (1 and 2) are present that are “in sync,” their crests will add to produce an even bigger crest (i.e., be brighter if these were light waves), as seen in the bottom of the figure. If the two waves were completely “out of sync”—that is, a crest in one wave meets a trough from the other and vice versa—no motion takes place at all (and dark lines would be seen, if these were light waves).

But anyway, what does all this wavelength business have to do with color? Well, it is precisely wavelength that determines what hue we will perceive. Figure 2.4 shows the associated wavelength with each color in the (English language) spectrum. This is the same spectrum that you got from another experiment you probably did in the sixth grade: passing white through a prism and getting the colors of the rainbow. Reds, then have the longer wavelengths and the purples shorter wavelengths. Energy is also associated with color; to over-simplify, the photons (packets of light energy) associated with the purple colors are more energetic than the red colors. But to talk about all this, we need to have a good way of naming colors, which is what we will take up now.

2.5. COLORIMETRY: THE MEASUREMENT OF COLOR. The human color visual system is really quite remarkable. We can perceive millions of colors—and we have names for thousands of them. It appears that physiologically our color perceptual ability is among the best, if not the best, of all the animals in the world. Oddly, at the same time, our color sense is also somewhat limited. For example, we are unable to decompose light into its spectral components (MacAdam 1985[1997]:37). We cannot, for example, perceive all those different wavelengths we just talked about in everyday “white” sunlight unless we use a prism. This is quite unlike our sense of hearing: we can easily discern the different waves produced by different instruments playing in an orchestra, or pick out the different voices in a heated conversation when everyone is talking at once. And yet, while we have many many names and modifiers for color terms—deep blue, crimson red, olive, blond—we have relative few names for sound. And for those sounds that do have names, only the few of us that have musical perfect pitch can name them with some degree of certainly. Acoustically, most of our judgments are relative, then, not absolute.

To find a way to describe colors we might look at what physical properties are involved in their creation. We have already talked about one already: **hue**, or that psycho-physiological sensation that we get when we see something as red or blue or whatever. That is, in careless everyday parlance, hue is what “color “ something is. As we have seen, hue depends on wavelength. But in the real world, it is rare to find something that consists ONLY of one wavelength; what we call hue, then, is basically the dominant wavelength of the many that are given off the object in question (a light source, or a reflection of light off some thing). If we say something is blue, a majority of the waves coming off that item are in the 4900 angstrom (blue) range. But not all. The proportion of the dominant wavelength to all other waves given off is called **saturation**. The more of the dominant waves there are, the deeper or more vivid the color will be (e.g., compare the pale faded blue in old bluejeans to the deep “thick” blue of new ones). The more white there is in the light being given off, the more the saturation decreases (and the more “washed out” something will appear to be). The last property is called **brightness**, and is one of the odder qualities of color. It is the lightness or darkness of a color, and is a measure of the degree of intensity of the light in question. (We will see in a moment that the brightness that someone detects or feels or sees cannot actually be objectively measured by some instrument. In that sense it is only a psychological construct. But more on that later).

The thing to remember, however, is that psychologically these variables are not independent, and changing one will affect the sensation of the other two. This is because the color “cone” is not a perfect sphere oriented in three mutual perpendicular axes. This is just a fancy way of saying that the ball is not perfect, but is lopsided and stretched out. Again, this is because the human visual apparatus is not equally sensitive in all dimensions (with maximal total sensitivity being to yellow light). For example, decreasing the brightness of a sample—while actually holding everything else constant—can alter a person’s perception of the saturation. Again, we will have a bit to say about this in a second.

The neat thing about doing physics is that all three of these properties can be objectively measured by instruments such as light meters and projectors and such. But what do these numbers mean? As an analogy, consider this: we really have no way to measure how “cold” someone is. Certainly we can look at the thermometer and make a temperature reading, but this says very little about that person’s subjective experience. A room with a 78 ^{0}F temperature may be pleasant for one, but unbearably hot for another. Then, too, the same person who was sweltering at 78 last summer may find that room nice and toasty in the middle of January. Likewise with color. If I say a beam of light is 5000A, what does that actually mean? In some ways, subjectively nothing. The best I can do is say that this sample is so much more, or less, than another sample. This is the idea behind the so-called **tristimulus value** of a color. What we do is present a sample color to a subject on one side of a screen, and give them three projectors of say, red, green, and blue light, shooting light on the other side. Informants are asked to play with different mixtures of all three lights until they get a match to the sample color. If the control knobs are calibrated, we can then simply write down the values for that experiment. Such a device is called a **colorimeter**. Scientists can now take average tristimulus values for any number of colors from many subjects, and indeed there are many such tables or color “dictionaries” now available. Thus, theoretically, each wavelength of light can now be given a particular set of tristimulus values. Figure 2.5 shows how three primary color light sources—say, red, green, and blue—interact to produce various colors when they overlap.

2.5.1 Color systems. Now that we have seen how we might assign numerical values to colors, the next step is to put them into some kind of organized system. There are several dozen commonly used, each based on slightly different premises and assumptions. The idea is, if I have some color **here**, we would want to have some kind of name or number that can let another person **there** reproduce that color (or at least know exactly which color I am talking about). However, there at least two difficulties we need to overcome.

2.5.1.1 Replicability and metamers. At first glance it might appear that all I need to use are the tristimulus values. In fact, basically such a system does indeed exist. The CIE (*Commission Internationale de l’Eclairage*) System—or the system of the International Commission on Illumination—in 1931 established standards for colorimetry, defining a “illuminant C” light source upon which other colors could be measured (much like the meter stick held in the Bureau of Standards which determines official units of length). However, there is a problem with replicability; because the human eye is very sensitive, tristimulus values only are comparable when made under the **exact** same conditions (including size of the stimulus, the angle when viewed, the luminance—or amount or intensity of the light—and so on). But everyone knows that in everyday life there are many factors involved in deciding what “color” something is: the material it is made of, how it reflects light, the kind of surrounding environment where the judgment is made, and a hundred other conditions. For example, the color of the dress that looked good on you in the store might suddenly appear awful when you wear it outside. Such factors affect our system of color nomenclature, because the whole idea is to have a way of comparing and naming two or more colors. **Metamer** matches are two samples thought to be the same color, even though they are produced by different stimuli. For instance, the “red” of a ripe tomato observed under outdoor sunlight on a bright summer day might appear quite different than the same red-colored cloth ball observed indoors at dusk under a neon bulb. So for a set of tristimulus values to be valid, they must have been colleced precisely the same way, but the problem of metamers makes such a system a little cumbersome for practical everyday use, especially when we do not have access to finely calibrated equipment.6

2.5.1.2. Numbers of color. The second problem is the shear number of colors that the human eye can potentially perceive. No one knows exactly what the sensitivity might be, but it is likely that between seven and ten million colors might be distinguishable. Obviously, to make a manageable color system, to say nothing of a dictionary, a lot of “lumping” is going to have to occur. Also, this sensitivity is much better than current print, film and optical technology available. Any color system, then, is going to be, at best, a compromise.

2.5.2. The Munsell Color System. We saw in the section above that the CIE system, and other such devices, were based on trying to objectively measure color (both the light stimulating the eye and the observer’s responses to it). Another technique is to look at subjective arrangements of color space, using the three physical dimensions we talked about in Section 2.3. Of the several such arrangements available, the Munsell color system is the one that has been used most frequently by anthropologists and linguists (including Berlin and Kay). One reason for this is that it is a very robust system to use under fieldwork conditions; no special optical instruments are required, sample materials are pretty strong and light, and experimental stimuli are (relatively) inexpensive and readily available from the *Munsell Book of Color*. Also, it is sensitive enough to do the job in the field—that is, of obtaining significant informant color discriminations—while not cluttering the collection process with too many non-essential or time-comsuming tasks. By now there has probably been data collected on more than five hundred languages using the Munsell color chart, so it is now the de facto standard, for better or worse.

The Munsell color nomenclature was developed by Albert Munsell (1858-1918), an artist and teacher, around 1905. The basic idea behind the Munsell system is to visualize the three dimensions of color in terms of a sphere or color solid. First, imagine taking the rainbow color spectrum—such as the one drawn in Figure 2.4—and cutting it off at the ends and pasting it together (i.e., the red end and the purple end gets connected). Such a situation is depicted in the circle in Figure 2.6, which shows the continuum of hues from the reds to the yellows to the greens to purples and back to the red again. Of course these names and divisions are arbitrary. In fact, Munsell decided to refine this a bit by giving the hues 10 names, dividing the circle up into 10 segments. This is shown in Figure

2.7, where his ten names and capital letter abbreviations are given. Munsell put brightness as the vehicle axis, and stuck this in the middle of his circle depicting hues. That is, he took the circle given in Figure 2.7 and raised it off the page, giving it a 3D quality. Then his vertical dimension in the middle would vary from white to grey to black. Extending out from this vertical brightness axis is the dimension of saturation; the most saturated example of a particular hue would be placed on the outside, while less saturated examples would be placed nearer the brightness axis.

The top of Figure 2.8 shows how these three dimensions interact together. The bottom of the figure shows the solid three-dimensional color sphere or cone; this is actually more of a cone or sphere than a cube because as colors become increasingly brighter, they become more “washed out” or less saturated, eventually vanishing into white. Likewise as colors become increasingly darker their vividness disappears, with eventually all colors turning into black.

The so-called color sphere must be modified in another way as well. As one color scientist (Evans 1948:210) succinctly put it, “It is apparent that there are tremendous variations in eye sensitivity in different parts ...” [of a color chart, and] “at any given point the sensitivity to change in dominant wavelength” [that is, hue] “may be many times that to excitation purity” [that is, what we are calling here saturation]. Figure 2.9, for example, shows some of the ways that the human eye is not equally sensitive to all colors. People respond to yellows more readily, meaning that the yellow colors are brighter—perceptually closer to white—than other colors. Likewise the darker purples, blues, and reds are responded to less easily. These two properties cause the hue “circle” to tilt at an angle, and give the color sphere its bulges at the yellows and the purples, as shown in Figure 2.10.

Now that we have constructed a model—the color solid—we need to have some way of calibrating it. After we have done so, the color solid could be divided up into an atlas. Imagine going to a paint or hardware store and looking at all the different little strips of paper carrying paint samples on them. If you had hundreds of them covering the whole spectrum, and put them together in the pages of a book (keeping all the reds together in order, etc.) you would have the *Munsell Book of Color*. (Of course, the color samples in the Munsell book are reproduced much more accurately and consistently than hardware store paint samples, though the organizational idea is similar.) But how many samples should go in the book, and how different should each “chip” be? As we saw, the CIE system was based on the physical properties of the light used in creating colors, and psycho-physical measurements of informants comparing these different lights. The Munsell system is based on a different approach: the appearance of colors, rather that the physical properties that make them up. In theory (and this is actually quite a technical caveat), the “step” between each sample chip in the Munsell book are psychologically equal in terms of appearance of surface colors (and not necessarily in terms of actual physical stimuli).

The nomenclature system devised by Munsell and later modified by the Optical Society of America (Kelly and Judd 1976) divides the dimensions of the color sphere in the following ways:

hue: forty steps, of ten named colors each divided into four subsections:

red	(i.e., 2.5R, 5R, 7.5R, 10R)
yellow-red	(i.e., 2.5YR, 5YR, 7.5YR, 10YR)
yellow	(i.e., 2.5Y, 5Y, 7.5Y, 10Y)
green-yellow	(i.e., 2.5GY, 5GY, 7.5GY, 10GY)
green	(i.e., 2.5G, 5G, 7.5G, 10G)
blue-green	(i.e., 2.5BG, 5BG, 7.5BG, 10BG)
blue	(i.e., 2.5B, 5B, 7.5B, 10B)
purple-blue	(i.e., 2.5PB, 5PB, 7.5PB, 10PB)
purple	(i.e., 2.5P, 5P, 7.5P, 10P)
red-purple	(i.e., 2.5RP, 5RP, 7.5RP, 10RP)

brightness: ten steps, going from 0 [black] to 9 [white]
(i.e., 0/-,1/-, 2/-, 3/-, 4/-, 5/-, 6/-, 7/-, 8/- , 9/-)

saturation: nine steps going (by twos) from 0 (grey) to 16 (vivid)
(i.e.,-/0, -/2, -/4, -/6, -/8, -/10,- /12, -/14, -/16)

Each chip in the Munsell book has a specific number, written in the following order:

hue brightness / saturation

Thus, 5R 4/12 represents the chip of Red hue at the fifth step, at the fourth level of brightness, and 12th level of saturation. Figure 2.11 shows how a page from a Munsell color book appears.7 Brightness is given on the vertical axis and saturation on the horizontal axis. Each page represents a separate hue designation (the examples given in Figure 2.11 show the chips for hue level "5R," read "five-red"). The arrow in the figure shows where our example chip just mentioned—5R 4/12—lies.8

Some 1,600 color chips make up the *The Munsell Book of Color.* We should note just in passing, however, that these are just practical divisions made for ease of use. In theory, of course, finer divisions can be made, and the Munsell Color Company and other organizations can produce other color chips "in between" the spaces of the ones in the color atlas.

The next step in making a convenient fieldwork tool is to find a way to make a rather clumsy seven pound two-volume book into someone more portable. An assumption was made that colors that were the most pure or vivid—

i.e, the most saturated—would be the best examples to use for comparative research. The most saturated colors, of course, are the one that lie on the surface of the color sphere. What early researchers did, then, was to reduce the Munsell color sphere into a two-dimensional array. This was an exercise in projective geometry, a process much like reducing a three-dimensional world globe to a flat paper map. Such a flat projection for color chips is shown in Figure 2.12.9 We arbitrarily divided the hue circle at the 10RP and 2.5R line (i.e., at the line separating the red-pinks from the purples) putting the green colors in the center. Just as North America does not necessarily have to be in the middle of a Mercator projection map of the world, likewise we can shift these boundaries around. Indeed, many color researchers use two color arrays—one with greens in the center and one with reds in the center. Regardless of how the array is centered, however, a chart such as Figure 2.12 shows the 400 most saturated colors at each hue and brightness level; the less saturated chips are not present. Figure 2.13 shows this missing dimension that we do not see in the array.

Figure 2.14 is a clear HUE x BRIGHTNESS array template showing two systems of notation used to label color chips. The usual Munsell notations are given on the bottom and the right. However, because the Munsell notation can be slow in the field, a shortcut system is often used (on the top and on the left) that works much like normal street addresses. For example, instead of writing the color chip in the upper left-most corner as “2.5R 9/-” we can just use the simpler “A1.”

We now have a relatively easy to use color standard and notational system to investigate the world’s color terminology. But are we done? Is this a perfect system? Hardly. Here is some food for thought: Assume for the moment that the ten million estimate for the number of colors that a human can perceive is correct. Most Munsell color books contain less than 2,000 chips, so that means each sample must somehow stand for some 5,000 colors. Actually our situation is even worse than that if we consider real names of colors rather than just numeral Munsell designations. *Color: Universal Language and Dictionary of Names*—the standard reference book used in business and industry put out by the U.S. Department of Commerce—only uses some 300 names (Kelly and Judd 1976). This means that the “average color range denoted by a single designation must contain nearly 40,000 distinguishable colors” (Kelly and Judd 1976:4). Clearly some other clues need to found before we are anywhere close to solving the mystery of color. But rather than reinvent the wheel, let’s look at the work of some of the earliest detectives.

3. Early Anthropology and “Primitive Mentality”

<u>3.1 THE RISE OF ANTHROPOLOGY</u>. At the turn of the twentieth century, anthropology was just starting out as academic subject. Degrees were now being offered by fledgling departments, journals and professional societies were started, and practitioners using the term “anthropologist” could now be found in

both university and museum settings. In many ways, the position of anthropology in 1900 is like the situation of “cognitive science” in 2000; a new set of theories, issues, and problems had been identified, and many people felt that these were significantly different enough from other fields of study to merit their own discipline. For anthropology, the main task lying before it was to explain the almost limitless variety found throughout the—by now fairly well-charted—world regarding, race, language, and culture.

People, to be sure, had always been aware—often acutely aware—of all sorts of variations between humans probably for hundreds of thousand years when early hominds discovered that the folks over the next ridge looked, spoke and ate differently than themselves. Many theories were proposed as to why such variety should be found, but by the late nineteenth century, biological explanations—in particular, the new powerful theory of evolution—were the norm. That is, the reason Tribe A was different from Tribe B was due to “blood.” No one claimed that societies could not change due to present day circumstances or, say, culture contact; indeed less advanced cultures could be absorbed or die out in the face of competition from more robust neighbors. But in the final analysis, Group A was more “advanced” than Group B, presumably because Group A was at a higher stage of evolution (with everyone, of course, being on the road to that apex of civilization: becoming an Englishman).

Much of early anthropology was concerned with documenting and categorizing these evolutionary steps. Modern genetics was still in its infancy so the precise carriers of these “traits” had yet to be identified, but there was little doubt that all human differences were due to inheritance.The important thing to remember is that it was not just “race” and human physical variation that was being accounted for in this way; everything from material culture to language to religion was believed to be due to biology as well. Perception and mental capacities were felt to be no exception.

3.2 PRIMITIVE MENTALITY AND COLORS. “Primitive mentality,”—and how this might be different from “civilized man”—was a subject, then, of great interest and curiosity to Victorian scholars. For example, it was found that many “primitive” languages seemed not to make a distinction (in naming, at least) between BLUE and GREEN colors. The shades of blades of grass, for example, and the color of the sky, might be labeled with the same term. [Following the common practice found in the literature on color nomenclature, I will call terms that inclusively name such colors GRUE (this label obviously being a combination of **gr**een and bl**ue**)].

The ancient Greeks also seemed to behave this way, as found in their poetry and mythology. For example, the color of the green tarnish found on bronze vases would be labeled with the same terms as for the deep ocean or other “blue” items. Actually, it was the classical scholar William Gladstone—later to become famous as one of the most influential Prime Ministers in English history—who, in his study of the *Iliad* and the *Odyssey* , asked this most precisely: “Homer’s perceptions of the prismatic colours and *a fortiori* of their compounds were, as a general rule, vague and indeterminant ... Are we to suppose a defect in his organization, or in that of his countrymen?” (1858:483). In other words, the question was did these people have the same phenomenological experience as English speakers? Gladstone, to be sure, had his own opinion about this: “... the organs of colours and its impressions were but partially developed among Greeks of the heroic age” (p. 488).

4. Rivers and the Torres Straits Expedition

4.1 THE CAMBRIDGE ANTHROPOLOGICAL EXPEDITION. The year 1898 was a kind of milestone for anthropology, as well as cross-cultural psychology. Alfred Cort Haddon organized the Cambridge Anthropological Expedition to the Torres Straits (a dangerous and rocky passageway between New Guinea and the northern tip of Australia). Haddon was perhaps the first European scientist to attempt to make systematic and controlled psychological measurements in a non-western setting, under natural non-laboratory conditions. Six investigators went on this seminal fieldtrip:

Alfred Haddon	physical anthropology, zoology
W.H.R. Rivers	medicine, experimental psychology
William McDougall	medicine, experimental psychology
Charles S. Meyers	medicine, physical anthropology, music
Charles Seligman	medicine, anthropology
Sidney H. Ray	Melanesian linguistics
Anthony Wilkin	expedition photographer

Haddon previously had conducted a natural history trip in the area in 1888, but this was to be strictly an ethnographic fieldtrip. Work began upon arrival in April; Rivers and Wilkin returned to England in November while others stayed on up to another four months. Investigations began at Murry Island, and also were carried out at other places along the Papua coast and smaller islands in the area. Research was conducted entirely in Pidgin English (Stocking 1983:77)—a lingua franca common throughout much of the Pacific—and by modern standards the fieldwork was undoubtedly rushed and imprecise. Still, this expedition produced the first scientific attempt to untangle the “riddle of color” that plagued nineteenth century anthropologists. The man most responsible for this was W(illiam) H(alse) R(ivers) Rivers.

4.2 COLOR RESEARCH AND THE TORRES STRAITS EXPEDITION. Rivers was aware of Gladstone’s hypothesis, as well of some substantiating work done by other contemporary philologists. The argument boiled down to this: do these differences in color naming reflect differences in actual perception? For example, can people with a GRUE term in their language distinguish GREEN and BLUE colors as easily or as accurately as those with two separate terms? If they cannot, the implication seemed to be that the human color sense had evolved—and indeed was still evolving—in a rather strict way. That is, the literature suggested that light and darkness was discriminated first; followed by red, and then the other colors in the spectrum in roughly that order. Others, however, such as the eminent psychologist Rudolph Virchow, argued that there was no necessary link between color perception and color language. The Torres Straits would allow a tentative answer to this question (Rivers 1901: 46).

Working with threads and wool yarns of different shades and hues, Rivers had the closest thing to a replicable psychological test for color nomenclature at the time. He would conduct a number of different protocols, such as directly asking for the names in the native language of experimental stimuli presented to informants, as well as asking them to discern differences between stimuli by asking them to sort yarns into different piles. Rivers believed that he found evidence of four progressive stages of color term evolution in the languages he investigated in the Torres Straits (Rivers 1900d:47):

(1) "... in the lowest there appears to be only a definite term for red apart from white and black;" For example, in the Seven Rivers tribe in northern Queensland, Australia, there are only the following three color terms, given below with their approximant referents:

manara	black, blue, indigo, violet
yôpa	white, yellow, green
ôti	red, orange, purple

I will call these terms MACRO-BLACK, MACRO-WHITE, and MACRO-RED respectively. I use the MACRO- prefix as each term includes much more than simple English "black," "white," and "red."

(2) "... in the next stage there are definite terms for red and yellow, and an indefinite term for green;" For example, on Kiwai Island off New Guinea, they have terms for MACRO-BLACK, MACRO-WHITE, and MACRO-RED as above, but also a MACRO-YELLOW term.

(3) "... in the next stage there are definite terms for red, yellow, and green, and a term for blue has been borrowed from another language;" For example, on Murry Island, he reports terms for MACRO-BLACK, MACRO-WHITE, MACRO-RED, and MACRO-YELLOW as above, but also a MACRO-GREEN term and a borrowed BLUE term.

(4) "... while in the highest stage there are terms for both green and blue, but these tend to be confused with one another." On Mabuiag, for example,

Rivers says there are terms for MACRO-BLACK, MACRO-WHITE, MACRO-RED, MACRO-YELLOW MACRO-GREEN, and MACRO-BLUE.

To explain this data, then, Rivers appealed to a cross-cultural evolutionary argument: “It is interesting to note that the order in which these four tribes are thus placed on the grounds of development of their colour languages corresponds with the order in which they would be placed on the ground of their general intellectual and cultural development” (ibid.). He also argued for biological causes. The poverty of color terms in “primitive” languages having “some definite cause, probably of a physiological nature” (1901d:46) “ ... the retina of the Papuan [being] more strongly pigmented than that of the European” (p. 52).

Examining the work of of the *Iliad* and the *Odyssey* on his own, Rivers agreed with Gladstone’s general tenets: “It is possible that to the ancient Greeks of the time of Homer green and blue were less definite, possibly duller and darker colors than they are to us.” That is, while not claiming the ancient Greeks were “blue-green blind,” he did believe that the Torres Straits work suggested “fairly conclusively that [for the Greeks] they had a certain degree of insensitiveness to this [blue] colour, as compared with a European. We have, in fact, a case in which deficiency in colour language is associated with a corresponding defect in colour sense” (p. 58). But rather than reducing these differences completely and totally to biology, Rivers left the possibility of language-determinism open: “It is however, possible that the language used by Homer was only a relic of an earlier defect of this kind, the defect of nomenclature persisting after the color sense has become fully developed” (p. 58). It was this direction—language-determinism—that American linguists and anthropologists decided to explore in the years immediately after World War I. These assumptions that American linguists and anthropologists made will now be examined.

5. The Americanist Tradition in Anthropology and Linguistics

Many anthropologists and linguists are loath to admit it, but—along with old bones, colorful costumes, and lost phonemes—there are many dark skeletons in the proverbial closet. The development of British anthropology, for example, had a close connection to that nation’s nineteenth century imperialism (Harris 1968:134-136). Someone, after all, had to give advice on how to best handle the local natives, be they East Indians, West Africans, or the “central highlanders” of whatever place the sun was not setting on at that moment. The United States and Canada, too, had their own “native problem:” the quarter of a million people speaking some 600 languages (Powell 1891), whom Columbus and his cohorts named “Indians.” And at this time, both in America and on the Continent, the common way to explain the great linguistic and cultural diversity that was becoming increasing apparent was to reduce things to biology (that is, race and evolution). Both the disciplines of anthropology and early descriptive linguistics burst forth in this climate.

I suppose at the onset, a definition must be given as to what an "Americanist" tradition is. Some see it as a site of research, that is, native North America. In earlier times, then, an Americanist would be someone who studied American Indian languages and cultures, studied under people like anthropologist Franz Boas or linguist Leonard Bloomfield, and published in such venues as the *International Journal of American Linguistics.* Today, many if not most would probably take a broader view: An Americanist tradition incorporates a very particular theoretical perspective, resulting from training in, as well as study of, North America. In fact, Darnell (1999:39) even suggests that not working with Native Americans is even "beside the point in terms of intellectual affinities and continuities;" the Americanist tradition is a "theoretical substratum for virtually all sociocultural anthropologists trained in North America" (p. 38).

But what exactly constitutes this Americanist tradition? It is probably worthwhile to elucidate some of the main tenets. Though such tabular summaries are always very dangerous, the following points are a start (most are taken directly from Darnell [1999: 45-48] or Stanlaw 2000:). Some premises of the Americanist Tradition in linguistics and anthropology I believe would include the following:

1. language, thought, and reality are presumed to be inseparable; that is, cultural worlds are constructed from linguistic categories; this, then, posits or implies the following:

• a. linguistic determinism (a relationship between language and thought): language determines the way people perceive and organize the world

• b. linguistic relativity: the distinctions encoded in one language are not found in any other language

• c. linguistic equality: anything can be said or thought in any language; no language is more complex or simpler or easier than any other; no language is innately harder or easily to learn than any other (save for the prejudices specifically present due to the similarities or differences with languages one already knows)

• d. linguistic indeterminacy: the distinctions a language makes are arbitrary; there is no *a priori* way to predict ahead of time what distinctions a language might make or not make.

2. for each linguist assumption given above there corresponds a cultural counterpart:

linguistic determinism => cultural determinism

linguistic relativity	=>	cultural uniqueness
linguistic equality	=>	cultural relativism
linguistic indeterminacy	=>	cultural indeterminacy

3. culture is seen as—indeed, is defined in terms of—a system of symbols; in turn these symbols reify and legitimate the culture;

4. discourse and "texts" of various kinds are the primary basis for both linguistic and ethnographic study;

5. an intimate, intensive, and long-term working relationship with a number of key informants, using the native language, is an absolute necessity;

6. it is assumed that there exists a link between linguistics and what anthropologists sometimes call "culture and personality" studies (i.e., the integration of the internal personality with external cultural events, as expressed in language; in other words, culture and the individual are inseparable);

7. it is assumed that culture is mutable and historic; that is, traditional cultures are not static, to be preserved for some future archeologist; native peoples—like Euro-Americans—also have a history;

8. there is an emphasis on long-term fieldwork (oftentimes two or three decades in the same community);

9. there is a strong commitment to preserving knowledge encoded in the oral tradition;

10. native peoples are not objects to be studied; there is a dialogic relation between the researched and those doing the researching;

11. there is also a strong link existing between the informant, the researcher, and the researcher's work as well; some native peoples are linguists and anthropologists themselves, and many are at least readers and commentators on the research product;

12. there is often a rather strong emphasis on emics over etics; "native" categories are at least as important as the researcher's categories;

13. there often is a de-emphasis on theory over data (at least in the pre-World War II era);

14. the strict separation of race, language, and culture is something never to be forgotten; indeed, when this *is* forgotten, dire social consequences can result;

15. while relativism is assumed, this by no means implies that linguistic and cultural universals are to be dismissed or ignored.10

The person who probably did the most to establish this Americanist tradition was Franz Boas; I believe he would quite satisfied subscribing the fifteen points just listed above. Boas came to the United States from Germany in 1888, the son of a political and socially liberal Jewish family. He studied physics and geography, and did his dissertation on the color of water. This prompted him to do hands-on research for himself, and he did his first fieldwork with “Eskimos,” investigating the color of sea water under Arctic conditions (he became interested in ethnology when he discovered that different peoples would name water in ways rather different from the Indo-European languages). This established a pattern that has survived in American anthropology to this day: that first-hand personal fieldwork is a prerequisite for all good research. And this fieldwork <u>must</u> be done in the local language. Boas almost singlehandedly established anthropology as an academic discipline in the United States. For a generation—almost two—just about everyone who became an anthropologist studied directly under him.11

Of the many many things Boas did, the most important for our purposes here are (1) his insistence that linguistics be part of anthropology, and (2) his activities as an incipient cognitive scientist. The following quote—taken from his treatise on the mind of “primitive man”—is insightful:

> Differences of principles of classification are found in the domain of sensations. For instance: it has been observed that colors are classified in quite distinct groups according to their similarities, without any accompanying difference in the ability to distinguish shades of color. What we call green and blue is often combined under a term like “gall-color,” or yellow and green are combined into one concept which may be named, “color of young leaves.” In course of time we have been adding names for additional hues which in earlier times, in part also now in daily life, are not distinguished. The importance of the fact that in speech and thought the word calls forth a different picture, according to the classification of green and yellow or green and blue as one group can hardly be exaggerated” (1911[1963]:190).

Clearly what we see here is a agenda, a agenda that not only includes cultural relativism, but linguistic relativity and linguistic determinism as well. Being the most influential teacher of his times, Boas no doubt molded the thinking of Edward Sapir, perhaps his brightest student.

6. Linguistic Relativity, the Sapir-Whorf Hypothesis, and Color nomenclature

6.1. INTRODUCTION. In this section, then, we will examine in detail one of the most intriguing ideas in linguistics, philosophy, or anthropology to come out of the Americanist Tradition: the Sapir-Whorf Hypothesis.12 Simply put, the Sapir-Whorf Hypothesis claims that language acts not merely to report on the world, but to a large extent defines it, helping us—and even hindering us—in the communication and interpretation of experience.

We first begin by discussing the origins of the theory, and introduce Benjamin Lee Whorf—Sapir's most naturally gifted student and co-worker—who went on in the two years that he survived Sapir to popularize it. We next discuss the basic assumptions that seem inherent in any version of the Sapir-Whorf Hypothesis, and give some examples. We then look at a case study using color terminology, one of the most fruitful domains of study in linguistic relativity. We will see that critics and refutations abound, and in the next section we will meet with the project that many believe has killed the Hypothesis once and for all. However, in the end of this module, I will argue that this setback is only apparent, and that the Sapir-Whorf Hypothesis will become an important research item on the agenda of all the cognitive sciences.

6.2. SAPIR, WHORF, AND THE ORIGINS OF THE SAPIR-WHORF HYPOTHESIS. The beginnings of the so-called Sapir-Whorf Hypothesis may have had its origins in the following statements of Sapir's in the influential journal *Language* in 1929:13

> Language is a guide to "social reality." ... Human beings do not live in the objective world alone, nor alone in the world of social activity as ordinarily understood, but are very much at the mercy of the particular language which has become the medium of expression for their society. ... The fact of the matter is that the "real world" is to a large extent unconsciously built up on the language habits of the group. No two languages are ever sufficiently similar to be considered as representing the same social reality. The worlds in which different societies live are distinct worlds, not merely the same world with different labels attached. ... We see and hear and otherwise experience very largely as we do because the language habits of our community predisposes certain choices of interpretation. (Sapir 1929[1949]:162).

Two years later, in *Science*, the prestigious journal of the American Association for the Advancement of Science, Sapir reiterated these views even more forcefully:

> Language ... not only refers to experience largely acquired without its help but actually defines experience for us by reason of its formal completeness and because of our unconscious projection of its implicit expectations into the field of experience. ... Such categories as number, gender, case, ... and a host of others, ... are systematically elaborated in language and are not so much discovered in experience as imposed upon it because of the tyrannical hold that linguistic form has upon the orientation in the world. ... Inasmuch as languages differ very widely in their systematization of fundamental concepts, they tend to be only loosely equivalent to each other as symbolic devices and are, as a matter of fact, incommensurable ... (Sapir 1931[1964]:128).

To be sure, the idea that language is the door to experience and perception is not wholly new with Sapir in the 1930's. Franz Boas, as we have seen, alluded to this decades earlier, to say nothing of the Enlightenment or ancient Greek philosophers. However, there are three significant reasons why this theory became so influential, and why the Sapir name has forever become associated with it. First, Sapir and the other proponents had a special concern with Native American languages. As these languages had grammars and lexicons vastly different from the Indo-European languages, their claims of the impact that language had on experience seemed especially compelling.

Second, by the 1930's, Sapir was one of the foremost American linguists of his day, and his opinions mattered. More importantly, the claims that Sapir was making at this time were rather different from the ones he was making a decade earlier. For example, in his book 1921 Language, Sapir argued that

> The latent content of all languages is the same—the intuitive science of experience. ... But this superficial and extraneous kind of parallelism [of language and culture] is of no real interest to the linguist ... (Sapir 1921:218)

He even seemed to anticipate the universalism of Chomsky when he goes on to say

> Indeed the apprehension of scientific truth is itself a linguistic process, for thought is nothing but language denuded of its outward garb. The proper medium of scientific expression is therefore a generalized language ... of which all known languages

> are translations. (Sapir 1921:223-224)

These comments are at least different in emphasis from the linguistic relativism seen in his later claims given above. No doubt many took seriously these changes in Sapir's thinking.

Third, one of Sapir's students, the brilliant amateur linguist Benjamin Lee Whorf, took Sapir's incipient notions and carried them to their logical conclusions (if not logical extreme). Whorf's detailed analysis of selected Native American languages made "as convincing a case as has ever been made for believing that we must acknowledge the view expressed by Sapir [in his later works] as true in a quite radical, untrivial sense" (Sampson 1980:83). And not only did Whorf write for professionals; he went to great lengths to bring the ideas of linguistic relativity to a popular audience, which in the 1940's and 1950's was fascinated by these claims. Thus, it is worthwhile to examine briefly Whorf's background and training, and the contributions he made to the Sapir-Whorf Hypothesis.

Whorf was born in Massachusetts in 1897, and his family's ancestors were descendants of the Pilgrim colonists. He received his Bachelor's degree in chemical engineering in 1918 from MIT, after which he took a job with the Hartford Insurance Company as a fire prevention inspector. He became interested in linguistics around 1924 through such roundabout ways as studying Maya hieroglyphs and Biblical philology. However, he also noticed in the course of his work that sometimes the "name of the situation" affected behavior:

> I came in touch with an aspect of this problem before I had studied under Dr. Sapir ... Around the storage of "gasoline drums" ... great care will be exercised; ... while around a storage of "empty gasoline drums," it will tend to be different—careless, with little repression of smoking or of tossing cigarette stubs about. Yet the "empty" drums are perhaps the more dangerous, since they contain explosive vapor. (Whorf 1939[1956]:135)

When Sapir moved to Yale in 1931, Whorf enrolled in Sapir's first class on Native American linguistics, as well as nominally beginning his pursuit of a doctorate in linguistics. (However, Whorf never quit his job with the insurance company, and he never completed his graduate studies.) Around this time, Whorf began his intensive study of Hopi, which provided much of his data that he would use in the development of the theories of linguistic relativity that both he and Sapir had been working on.

<u>6.3. ASSUMPTIONS OF THE SAPIR-WHORF HYPOTHESIS.</u> The term "Sapir-Whorf Hypothesis" was never used in the lifetimes of either man, probably

because neither ever synthesized their notions of linguistic relativity in a formally precise way. The term was first used in 1956 by the linguist John Carroll (1956) in his edited volume of selected writings of Whorf. Though there are numerous variations on this theme and different degrees to which adherents may subscribe—that is, "weak" or "strong" forms—the following postulates probably underlie all versions of the Sapir-Whorf Hypothesis (some obviously, are expansions on the tenants of Americanism mentioned in the previous section):

6.3.1. Linguistic relativism. Linguistic relativism simply means that all languages are equal. This, of course, is a notion carried over by Sapir and Whorf from earlier anthropologists and linguists such as Boas. Specifically, it refers to the idea that there are no superior or inferior languages. That is, no language is "good" or "bad, or "beautiful" or "ugly," except for personal opinion. Likewise, no language is "pre-logical" or "primitive" in any way.

However, as we shall see shortly, linguistic relativism on the moral level—as described here—should not be mistaken for a general linguistic relativism. Linguistic relativism is not the same thing as dismissing the importance of differences among languages. According to (at least a strong) Whorfian view, it is not true that all languages are basically all the same, or just different ways of saying the same thing.

6.3.2. Linguistic relativity. Linguistic relativity (as opposed to "linguistic relativism" above) is the idea that each language's encoded categories are unique. That is, the distinctions made in one language are not necessarily found in another. These ways of dividing up reality may occur at different levels. For example, on the level of vocabulary, one language may divide up a domain in numerous ways, based very fine and subtle distinctions (e.g., "sports cars," "luxury cars," and "compact cars," etc., in English, compared with a language that has only one word for automobiles). Or they may also be expressed on the level of grammar; one language may have a complicated tense system of not only present and past tenses, but also past perfects or pluperfects as well. Another language may have no tenses at all.

6.3.3. Linguistic determinism. Linguistic determinism is the claim that language structures thought, or that thought is dependent upon language. That is, how we talk determines how we think. Obviously, the kinds of vocabulary items in a language will in large part dictate what a culture might talk or think about. But advocates of the Sapir-Whorf Hypothesis believe things are a bit more subtle. For example, Whorf argued for the existence of "crypotypes" or "covert categories" that operate almost subliminally (Whorf 1939[1956]: 79).

6.3.3.1. Example I: English articles. For instance, English nouns can be classified into three groups—or semantic classes—depending on if they take "the," "a," or nothing as an article. Rules learned in an ESL class say that unique and well-known nouns always take "the" (e.g., "the Moon," "the Imperial Palace"), specific instances takes "a" (e.g., "a dog," "a book") and proper nouns always take nothing ("Prince Charles," "God"). But none of these properties are encoded into the noun itself (say, as a special suffix or marker). Why—or however it is—these nouns take one article or the other, it is clear that it is NOT simply to fulfill some grammatical requirement. These subtle covert categories can be seen in the following three sentences concerning English diseases. It might be thought that because flus, colds, and AIDS are all illnesses, they might take the same article. We see this is not so:

(a.)	He	has	the	flu.
(b.)	He	has	a	cold
(c.)	He	has	ø	AIDS

It could be argued that in (a.) above, people perceive the flu as being of one type, all-pervasive, and well known. In (b.) someone's cold is thought to be just one of many repeatedly occurring maladies possibly going around. In (c.), the person is suffering from a specific, individually named, syndrome.

6.3.3.2. Example II: Japanese numeral classifiers.Similar things can be found in every language. For example, counting nouns in Japanese requires the use of a “numeral classifier.” Numeral classifiers are terms that a language must use when counting objects. There a few numeral classifiers in English: e.g., a pair of glasses, two cups of coffee, three head of cattle, fours pairs of jeans, five heads of lettuce, six sheets of paper etc. The difference between English and other languages is that numeral classifiers are generally optional in English; “Give me a coffee,” or “Give me a cup of coffee” are both acceptable in English. However, almost all the languages in southern and eastern Asia require the use a classifier when counting, as in “one flat-thing magazine,” “two tails of dogs,” “three round thin-thing pencils,” and so on.

Of the several hundred such numeral classifiers in Japanese, hon (for round cylindrical objects) and dai (for machines) are common. We might assume that if a number of nouns are all counted with the same classifiers (say "hon"), presumably they all share some sort of literal or imagined semantic property in common (say, "longness," "cylindrical-ness," etc.). So, for example, if enemy rocket ships in Japanese anime animated films or manga comic books are counted using hon (instead of dai for machines), Whorf would argue that people are placing these things in the covert category of long, round, cylindrical objects, and presumably thinking about them in that way. We will investigate numeral classifiers in more detail in Section 10.

6.3.4. The primacy of language in perception. To those who adhere to a strict Whorfian position, there is no such thing as pure perception. All perception involves an act of interpretation, but all interpretation is mediated through language. Thus, ultimately perception is predicated upon language.

As a case in point, Whorf often spoke of SAE ("Standard Average European") conceptual systems that were found in most Indo-European languages. In these languages, it was the case that many ideas were expressed as empty forms filled with an imposed content. For example, the noun "grass" in English seems to be a kind of empty container, into which adjectival properties are poured ("green," "soft," "fresh," "sweet-smelling" and so on). This is reflected in the use of the copula ("to be" verbs) in SAE languages, carrying over some property onto a noun:

(a.)	The grass	is	green
(b.)	The grass	is	soft

In (a.) above the form "green" is having the feature "green-ness" being attributed to it. It could have just as easily been "blue," "brown" or any other adjective. If there are any modifications, such as negation or past tense, they do not take place in either form ("grass") or content ("green"), but in the copula:

(c.)	The grass	was	green
(d.)	The grass	was not	green

In a non-SAE language like Japanese, however, the structure is somewhat different. Consider these Japanese equivalents of the sentences above.

(a.')	草は <u>Kusa wa</u> the grass	青い <u>aoi</u> green
(b.')	草は <u>Kusa wa</u> the grass	柔らかい <u>yawarakai</u> soft

The property feature here behaves in a very "verbal" kind of way. The separation between the noun and the property is not one of attribution, but almost one of activity. For example, if you compare the structure of these sentences above with the following, the verbal aspects of <u>aoi</u> and <u>yawarakai</u> become apparent:

(e.)	草は <u>Kusa wa</u> the grass	生えている <u>haete-iru</u> grows

So a more literal translation of Japanese (a.') and (b.') might be "The grass greens" or "The grass softs." This verbal/activity is seen even more clearly in Japanese equivalents of (c.) and (d.) below:

(c.')	草は	青かった
	Kusa wa	aokatta
	the grass	(was) blue
(d.')	草は	青くなかった
	Kusa wa	aokunakatta
	the grass	(was not) blue

Here, the adjective "conjugates" just like a verb. The question now is, do both Indo-European speakers and Japanese speakers perceive things the same way when looking at a mountainside covered with grass? Those who hold a strong Whorfian position would take the data from the above examples and say probably not.

6.3.5. Linguistic arbitrariness. The assumption of linguistic arbitrariness claims that languages select and create their categories in a largely random way. To be sure, there are environmental and cultural influences—Pacific Islanders no doubt have a rich vocabulary for ocean sea life and a poverty of ways of talking about frost and cold weather. However, there is nothing in a language that would allow us to predict in any a priori way ahead of time what classifications would be found.

For many years, one of the primary examples of this was found in the domain of color. For a number of reasons, color perception has been one of the most fruitful areas of research on the Sapir-Whorf Hypothesis, perhaps the most favorable of all (Sampson 1980:95). Color perception can be investigated without some of the cultural baggage that is involved with other concepts. As humans may be able to distinguish between seven to ten million different colors, the way they are put into classes is hardly trivial. And physics provides us a neutral standard against our results might be compared.

Until the 1970's, introductory linguistic textbooks would often give an illustration something like that found in Figure 6.1 to show how differently languages might divide up the color spectrum (such as that made by a prism or found in Figure 2.4). This figure shows how the divisions made by Bassa (a language of Liberia), Shona (a language of Zimbabwe), and English line up. Where English uses six terms, Bassa uses two and Shona three. If some Native American languages would have been added, they could have divided the English Orange-Red areas into three terms instead of two. As Gleason said in his standard text of the time, "There is nothing inherent in either the spectrum or the human perception of it which would compel its division in ... [any particular] ... way" (Gleason 1961:4) We will see in the next sections that color actually turns out to be more problematic (and more interesting) than first thought; but these general claims made about color show why advocates of the Sapir-Whorf Hypothesis believe in the arbitrariness of categories.

6.3.6. The inevitability of linguistic diversity. This assumption relies on believing in several others: Because language structures thought, and different languages have different categories, and these categories are largely arbitrary, it is obvious that great linguistic diversity is going to develop. For example, Whorf compared the two sentences "I see that it is red" and "I see that it is new" in both English and Hopi. He found that English—unlike Hopi—fused two different kinds of relationships (perceiving the sensation red vs. inferring the condition of new-ness) into a single grammatical form. In this sense, he found Hopi more parsimonious and brilliant:

> Does the Hopi language show here a higher plane of
> thinking, a more rational analysis of situations,
> than our vaunted English? Of course it does. In this
> field and various others, English compared to Hopi
> is like a bludgeon compared to a rapier.
> (Whorf 1939[1956]:85)

In other words, it is possible that some languages would have a different (if not better) way of perceiving or explaining reality than others. One wonders what the Theory of Relativity might have been like had Einstein been a Native American—speaking a language with no tenses but very involved systems of aspect—instead of German. Or could the intricacies of the Buddhist notions of "karma" and "reincarnation" be properly understood by speakers of non-Asian languages? Those who hold strong Whorfian views might say probably not.

6.3.7 Linguistic experiencialism. The assumption that I have termed "linguistic experiencialism" is that belief which holds that the language one speaks determines how one sees and experiences the reality. If language determines world view, then people speaking different languages live in different phenomenological "worlds."

I tell my students the following story, augmented from Whorf's examples and some of our textbooks, to make this point: Suppose three different cowboys—a Japanese, an American, and a Navajo—are riding along and see a number of broken fences. All three will go back to their foreman and utter a very simple sentence—say, "Two fences are broken"—which will take about the same amount of time in all three languages. However, what their vocabularies and grammatical categories make them attend to will put them in different "realities."

First, all three cowboys must choose a subject noun, fence. The Japanese and Navajo, however, will have to notice whether the noun is animate or inanimate—because their later choice of verbs will require them to have done so—while the American will not need to worry about such things at this time. Likewise, both the Japanese and Navajo cowboys will have to choose a numeral classifier. If they choose one for "long thin objects" their foreman will know right away that the fence is probably wire, and not stone or board. When choosing a verb, the Navajo cowboy, unlike his Japanese or American colleagues, will choose one that reflects some of the characteristics of the noun (say, in this case, consisting of many stands—like barbed wires—implying that it is probably not a chain-link or electric fence). Again, when choosing his verb, the Navajo must indicate whether the fences were intentionally broken (say, by some human act) or broken accidentally, as in a thunderstorm. The Navajo must choose a grammatical form to indicate the present status of the fence (whether it is stationary or flapping in the breeze). Both the Japanese and the Navajo cowboy must choose a verb form to indicate whether this report is something within their personal experience, or something they just heard about. The American and Japanese cowboy would have to make some sort of specification time, using tense markers. And so on. The point is clear; the perceptions that all three cowboys had, and even the actual experiences, were all rather different.

6.3.8. Other comments I: levels of analysis in the Sapir Whorf Hypothesis. Two other remarks should be made before we discuss an example of a Whorfian effect. The first concerns the level of analysis at which the Sapir-Whorf Hypothesis might be applied. According to some sociolinguists, such as Fishman, language might have an effect on behavior or cognitive processes in numerous ways (Fishman 1960:336). I argue that this may happen on at least six levels, as seen in Figure 6.2 (though, of course, they are all inter-related). Language may be an influence on behavior and cognition lexically, at the level of vocabulary, semantically, on the level of categorization (as with the covert categories mentioned above), and grammatically. Likewise, there are at least two realms of behavior/cognition to be influenced: linguistic, and non-linguistic. For example, an anthropological linguist doing research on color categorization might be looking at potential Whorfian effects on levels A or D of Figure 6.2 (seeing how people respond to sample color chips or color terms).

6.3.9. Other comments II: habitual thought vs. possible thought. One of Whorf's major theoretical contributions was his notion of "habitual thought" (Whorf 1939[1956]:134). This is still a point where the Sapir-Whorf Hypothesis is sometimes unjustly criticized. Sapir and Whorf were interested in the ways languages normally—or habitually—conditioned people to think. They never claimed that people could not ever imagine another point of view, or even another linguistic reality. For example, to return again to the example of gasoline cans, people could learn that "empty" here does not really mean a vacuum. Once explained, people could readily understand the danger of lingering gasoline fumes, and behave accordingly. However, regarding most things in everyday life, they do not have to worry about "empty" sinks or "empty" tin cans, so their "linguistic habits" are just fine. Likewise, when Japanese speakers are learning English, it is certainly not impossible for them to learn the grammar for "future tense" (or "plurality" for nouns) even though these are not necessarily part of their daily linguistic habits when speaking their native language.14

6.4 LANGUAGE, COLOR, AND COGNITION: AN EMPIRICAL EXAMPLE OF THE SAPIR-WHORF HYPOTHESIS. As I mentioned earlier, color nomenclature has been one of the most popular areas of research concerning the Sapir-Whorf Hypothesis. One of the most important—though, ironically, also somewhat neglected—studies in this area was conducted by Eric Lenneberg and John Roberts in the mid-1950's (Lenneberg and Roberts 1956).

The basic idea behind the Lenneberg/Roberts project was to use an array of color chips taken from the flattened "Mercator" projection of the color sphere; in essence they used color charts like those given in Figures 2.12 and 2.14. They took 320 color chips from *The Munsell Book of Color*, varying on the dimensions of hue and brightness, and put them together on a physical chart. They put a sheet of plastic over the array and asked informants to mark on this erasable acetate which colors would match a particular term. They worked with Zuni Native Americans from the American Southwest and native English speakers, and asked them to map out on this chart all the chips of some color category (e.g., "please circle all the GREEN chips").

The results of this experiment are found in Figures 6.3 and 6.4 (based on data presented in Lenneberg and Roberts 1956:26). The black shaded squares represent those chips that everyone (of the speakers of that language) said was a particular color. For example, in the upper left hand corner of Figure 6.4, the second chip down was called PINK by every native English speaker in the experiment. The dotted shades represent chips that were chosen less than 100% of the time, but still fairly often (about 60 or 70 percent of the time). Slashed lines represent agreement only half the time, and no shading represents unnamed regions.

Even a quick perusal of these two figures show that there are significant differences between the Zuni and English languages, both in terms of how the shadings look as well as the number of color terms. Though the main intention of Lenneberg and Roberts was to provide a comparable methodology that could be used for further research, they did conclude that the basic tenants of linguistic relativity were supported. For example, they found that while English YELLOW and ORANGE categories were separate, in Zuni they were one category. Also, they discovered that in English categories vary greatly in size (i.e., RED being very small and GREEN being very large), but Zuni categories were generally about the same size.

6.5. PHILOSOPHICAL AND EXPERIMENTAL ARGUMENTS AGAINST THE SAPIR-WHORF HYPOTHESIS. The data from the Roberts and Lenneberg study seemed particularly compelling for Sapir-Whorf. The fact that this was probably the only real extant experimental evidence to support it did not weaken the faith of the true believers. However, throughout the 1950's and 1960's there were people who opposed it, at least on philosophical grounds. We will now briefly discuss eight of the more persuasive counterarguments that could be made against the linguistic relativity hypothesis.

6.5.1. Translatability. Simply put, translation across languages IS possible and occurs every day, even between quite disparate languages. This should not be possible if we are really experiencing different "realities." Thus, at least a strong Sapir-Whorfian position—that speaking different languages causes us to live in different and incommensurate perceptual worlds—is questioned.

6.5.2. Mutual linguistic comprehension. Likewise, even if we grant the possibility that translations can never completely capture what was said in the original, we can still usually get at least the general idea. And even if we cannot know what it is like to actually BE a Hopi or Navajo—or to think their thoughts or have their experiences—we can at least entertain the possibility of what another metaphysical system might be like. Such things should not be possible according to the Sapir-Whorf Hypothesis.

6.5.3. Language and thought. It is not clear that all thinking is linguistic in nature. For example, imagining to ourselves how we go to work (probably highly visual) is a very different process than describing it to someone (probably highly verbal). If this is true, how can Whorfian effects manifest themselves in a non-linguistic realm.

6.5.4. Multilingualism. What does the Sapir-Whorf Hypothesis say about people who grow up learning to speak a number of different languages at the same time? Which "linguistic world" does such a person live in? A strong Sapir-Whorfian position does not seem to allow for the possibility of a person being able to go back and forth between two different "realities" depending on the language being spoken. Nor does it seem to allow for some sort of mixed hybrid mental structure combining these two or more linguistic worlds.

6.5.5. Language, and perceptual or philosophical changes. One of the problems of the extreme linguistic determinism of the Sapir-Whorf Hypothesis is that of change. Obviously, languages and cultures change over time. Both the English and the physics of Newton's day are different than today. Did one cause the other? How did the replacement of Newtonian Mechanics with the Theory of Relativity occur? Why didn't the Theory of Relativity get "thought" 400 years ago? Or did the change in physics come about because of the change in language? Unfortunately the Sapir-Whorf Hypothesis is hard-pressed to answer these questions.

6.5.6. Untestability. One of the main criticisms leveled against the Sapir-Whorf Hypothesis is that it is untestable, and therefore vacuous no matter how intriguing it may be as speculation (Black 1962) Many philosophers of science require that a useful theory offer stipulations as to what kinds of evidence would be support or refutation. Until recently, the possibility of finding experimental evidence either way for the Sapir-Whorf Hypothesis was, indeed, rare.

6.5.7. Language universals. Since the 1970's linguists have—with great success—become increasingly absorbed in the search for those things that all languages have in common, as opposed to only describing particular languages. For example, all languages are spoken in sentences, and seem to have some sort of notion of subject vs. verb. Most languages have many sounds in common; that is, almost all languages use only a small subset of a rather limited number of potential phones. The existence of these many linguistic universals seems to suggest that languages, and the construction of linguistic categories, may not be as totally arbitrary as Sapir and Whorf have implied.

6.5.8. Language and perception. It appears that at least some aspects of perception are beyond the reaches of language influence or interpretation. For example, cross-cultural psychologists such as Rosch (1973) have found certain basic colors—such as pure "fire engine" red—are easier to remember and recall than off-colors, even if your language has no name for that color. It is not yet clear if such findings are due to anatomical universals (say, something in the structure of the eye), neurology, or other factors. Whatever the cause, it seems that at least some concepts are not perceptually arbitrary, and some categories more "natural" than others.

In the context of the time and place—the 1950's United States—to many the results of the Lenneberg/Roberts study were probably not especially surprising (aside from the extreme methodological sophistication of the experiment). As mentioned, probably most contemporary linguists and anthropologists tacitly bought into many of the tenets of the Sapir-Whorf Hypothesis, even though there was little evidence either supporting or refuting it. The few confirmations from color research seemed overpowering and solid, if scant. However, in the 1960's, because of the rise of Chomsky, generative grammar, and universalism, the Sapir-Whorf Hypothesis came under heavy criticism. And in 1969 two American anthropological linguists, Brent Berlin and Paul Kay, took the Lenneberg/Roberts color data and turned it around. As Robert MacLaury (perhaps the most knowledgeable person currently working on color nomenclature) put it, by this time the “relativity of language had become a crusade with color as its banner“ (1997:30). We will now discuss the results of the seminal Berlin and Kay's experiments.

7. The Berlin and Kay’s “Standard Model” of Color Nomenclature and the Triumph of Universalist notions

7.1 THE BERLIN AND KAY EXPERIMENTS. In 1969, Berlin and Kay, and their graduate students, replicated the Lenneberg/Roberts experiments (with in essence the same set of materials)15 for 20 languages, and gathered written materials on 78 others (Berlin and Kay 1969) Both studies found many similar things. For example, while Lenneberg and Roberts found that not every language has the same number of color terms, languages do tend to use only ten to a dozen "basic" color terms (that is, excluding unusual or modified colors such as "light purple"). They also found that the color categories in one language (that is, the chips chosen by informants to represent ideal COLOR X) were often quite similar. Berlin and Kay supported these same conclusions.

7.2 THE CRITERIA OF BASIC COLOR TERM STATUS. The critical theoretical insight made by Berlin and Kay was that color terms need to be restricted and operationalized. There are many local colors in every language, for example, which mostly depend on the particulars of the environment. “This shirt is ‘the color of the jaguar’ ” makes sense, and is a perfectly good term, if everyone in the village has seen a jaguar. Westerners, of course use thousands of these “secondary color terms” as well: Denim blue, fire-engine red, olive green, birch white on so on. In fact, much of modern marketing probably depends on the creation of secondary color terms for products (such as the colors of automobiles or paints) which are appealing particularly because their secondary referents are very vivid and conjure up certain emotions, such as “chili pepper red” for a hot new sports car. But what do you do if there are no fire engines—or jaguars—where you live? Are there some more general abstract notions of colors that all cultures seem to have?

It was precisely this question that Berlin and Kay realized needed to be asked. They decided to operationally define abstract “basic” terms using the following criteria (1969:5-7):

1. The term in question is **monolexemic and unanalyzable**. This means that compound terms or terms that are grammatically or morphologically modified should not be thought of as basic. Thus, “red” and “blue” are basic colors in English, but “reddish,” “blue-green,” or “light red” are not. Also, a term's meaning should not be predictable from the meaning of its parts (thus excluding words like "sunburst" or "olive green" as basic in English).

2. The meaning of the term in question is **not included** in the range of any other term; the focus of a basic color term should not be included within the boundary of any other color term. Thus, because "khaki" is "a kind of brown" it would not be an English basic color term. This means, also, that subsets of colors are not basic colors. “Navy blue” presumably is a kind of blue, and therefore not a basic color term in English.

3. The term in question must have **wide applicability**, and not be restricted to any single referent—or just a few referents—but should exist as an abstract label widely applicable to all objects. Using this criteria, then, a term like “blonde” is not basic in English because it usually only refers to hair color. Likewise for “peach” which generally refers only to the light pinks of peaches.16

4. The term in question must be **psychologically salient** with respect to the number of speakers who use the term, and the number of occasions it is used; that is, the term must be psychologically conspicuous, either in terms of frequency of usage or extensive occurrence and acceptability in a speech community. Thus, "sepia" in English would not qualify as a basic color term as it is not well known to all speakers. This best way to grasp the notion of psychological salience is do a little experiment yourself. Take a moment and write down the first ten color terms that come to mind. I suspect your list has words like “white,” “red,” “blue,” and “black” in it. There is probably no “mauve” or “chartreuse” (just as in a box of Crayons you would not find these colors unless you bought the giant unabridged set). This psychological salience is one of the most important criteria demonstrating basic color term status.

5. Basic color terms are **consistently productive** using various morphemes in the language. Thus, "red-d<u>ish</u>" and "green<u>-ish</u>" substantiate the status of "red" and "green" as basic color terms in English because it makes grammatical or sociolinguistic sense to use them. However, the questionability of "crimson-<u>ish</u>" confirms that "crimson" is not really a basic term.

6. Terms for basic colors should **not name an object.** Thus, terms like “gold” or “sliver” or “ash” are probably not basic in English.

7. Recent foreign **loanwords** are suspect (though I will argue in Section 9 that this is a problematic assumption.)

8. **Morphological complexity** can be given some weight in determining a lexeme's status, particularly in questionable instances. Presumably basic color terms are the less morphologically complex terms (i.e., their words have less “parts”).

Before, it really made little sense to compare Englishes’ “candy apple red” with the Japanese “<u>daidai-iro</u>” (the “color of the daidai fruit”) as it was like ... well, comparing apples and oranges. But now Berlin and Kay had a replicable tool to work with. Informants could be asked to name all the colors in their language, and basic color terms could be extracted from the list using the criteria above. Most of the time the basic ones appeared very early on in the elicitation process. But the important thing was that now there were common abstract terms—not secondary local ones—that could be compared cross-culturally.

<u>7.3. MAPPINGS AND FOCAL COLORS.</u> After a list of basic colors was determined, informants were then given the Munsell color array covered with acetate and asked to pick out the one chip that best corresponded to a term. These best examples are called **focal colors**. They were then asked to map out the range of each term (e.g., “please circle <u>all</u> the chips that you think are Color X). Later work altered the steps somewhat; for example, as well as using an array, individual color chips were also later presented to informants individually in

a prescribed randomized order and color names written down.17 (In Section 9 I give more details on experimental processes when I discuss my work in Japanese. Also, we will see in Section 8 that Robert MacLaury has changed the mapping task into a three step procedure. But, for the most part, similar results have been found regardless of differences in experimental protocols.)

7.4. EXPERIMENTAL RESULTS. The results of the Berlin and Kay experiments were quite surprising. In brief, their conclusions were as follows:

1. In all languages, there were at least two, but no more than eleven or twelve, color terms that could be considered as "basic."

2. These basic color terms were thought to label universal perceptual categories ("psychological referents") of which there are probably no more than eleven.

3. These basic color categories are historically encoded in a given language in one of two possible orderings, as given in Figure 7.1.

This last finding is most intriguing and very important. Languages seem to develop color categories in severely limited ways, in seven steps or stages (as labeled in Roman numerals Figure 7.1). All languages world-wide have at least terms for WHITE and BLACK (Stage I).18 If a language has only three basic color terms (Stage II), these color categories would always cover the same chips: WHITE, BLACK, and RED. Next, either GREEN followed by YELLOW, or YELLOW followed by GREEN (Stages III and IV) appear. The next terms to appear are BLUE and then BROWN. At Stage VII, PINK, ORANGE, PURPLE, or GREY could appear in any order or combination.

The significance of these findings were that ultimately the way languages divide up the color spectrum is not arbitrary at all. If we assume for the moment that there are only eleven basic color terms, there could be 2048 different possible color figurations (i.e., 2^{11}) taking these eleven terms and permuting them on their presence or absence in any given language. We could theoretically find, for example, languages that have the following set of color terms: RED, BLUE, PINK, and GREY; or BLACK, BROWN, and PURPLE; or BLUE, YELLOW, BROWN, PINK, PURPLE, and WHITE. But these are never found. If a language has, for example, six basic color terms (WHITE, BLACK, RED, GREEN, YELLOW, and BLUE), we know that the term that will always appear next is BROWN and no other.

Berlin and Kay also found a high degree of consistency in the naming of focal colors. For example, the chip that most informants named as the best example of RED in English usually matched closely with chips selected in other languages. Also, later experimental results from the field by Rosch (1973) and others indicated that even for languages that did not have a particular color label for a color, the focal color chips were always the ones most easily recalled or remembered. Berlin and Kay, then, concluded that these "basic" color terms were psychologically special, naming universal perceptual categories.

In the 1970’s and 1980’s, with the collection of more data, a more nuanced approach was taken to color naming (though the fundamental claims of Berlin and Kay remained in tact). The most important of these was the discovery—or articulation—of so-called composite categories. As mentioned before, many languages had GRUE (i.e., BLUE and GREEN) terms, and the theory had to more adequately account for them. What was proposed was that instead of focusing on particular focal colors, ranges should be examined in more detail. What appears to be happening is that color terms develop in the way that they do because of differential divisions of the color array. That is, WHITE color terms do not just label classical “white” colors, but also cover the “warm” yellows, oranges and pinks. Likewise BLACK color terms cover the purples, the brown and the deep blues, as well the blacks.

For languages with just two color terms, then, the whole Munsell array is divided into two categories: WHITE and BLACK. This is shown is Figure 7.2. For languages with three terms, the reds and pinks seem to split off from the warm white colors, as shown in Figure 7.3. (Actually, because these terms “contain” other colors I will more precisely call them MACRO-WHITE, MACRO-BLACK, and MACRO-RED, as I did in Section 4.2). Next the GRUE terms may spilt off from the blacks, as shown in Figure 7.4; or the yellow terms may split off from the reds and whites, as shown in Figure 7.5. But in either case, by Stage IV we have an array divided in five colors, as shown in Figure 7.6: WHITE, BLACK, RED, YELLOW, and GRUE. Next, the GRUE term divides into GREEN and BLUE as shown in Figure 7.7. BROWN emerges out of the YELLOWs, BLACKs, and GREENs in Stage VI as shown in Figure 7.8. Finally we see in Figure 7.9 how all of the eleven terms might appear.

The grand evolutionary ordering of the colors shown in Figure 7.1, then, is modified into something like Figure 7.10. Figure 7.10 also shows that GREY is kind of a wild card, which can appear spontaneously anywhere in a Stage III sequence and onwards. For those who would like to see the actual grown of the terminology system, Figures 7.11 to 7.18 show in a step by step fashion how specific color terms develop by splitting off from the macro colors (e.g., the macro-reds breaking off from the macro-whites in Stage II in Figure 7.13; how GRUE terms split into yellows and blues in Figure 7.16, and so on).

<u>7.5. CHOMSKY AND LINGUISTIC UNIVERSALS</u>. The impact of Berlin and Kay's work was noticed immediately, if nothing else for its damage to the Sapir-Whorf Hypothesis. In the past three decades, hundreds of others studies seem to support the basic tenets of the Berlin and Kay model. However, in all honesty, Berlin and Kay alone did not tap the final nails in the coffin of linguistic relativity.

In the mid-twentieth century the intellectual climate underwent a real sea change in attitude towards languages and their structures. Until the 1950's scholars were relativists. They were most fascinated by the wonders and plethora of linguistic diversity found throughout the world. Non-western languages did marvelous things that the Indo-European languages did not: time was counted in different ways, and words were found for concepts that Europeans hadn't an inkling of. Categories were created almost out of thin air: what did women, fire, and dangerous things, for example, all have in common that made the Dyirbal aboriginal Australians put them in the same class, presumably thinking of them as being all the same on some level?19 And in many ways this was a holdover from the days of Franz Boas (Section 5), who made passionate arguments for relativism, mostly in a valiant attempt to undermine the scholarly racist claims popular until even the Second World War. To Boas, a belief in universalism usually led to comparisons that left the non-western world wanting. And such beliefs were only one small step away from dangerous biological reductionism: people, and their language, are the way they are due to their biology (that is, their race). The rise of Nazi Germany and Nazi science did little to allay his fears.

But in the 1960's, a brilliant young linguist named Noam Chomsky wrote a series of books and monographs showing that "grammar" across all the world's languages is very much the same, if you peel away at the language onion. On the surface it at first appears that the almost infinite variety of structures and forms could not possibly be reconciled, much less shown to have the same underlying "deep" structure. But this is exactly what Chomsky and his students have done. They have made a compelling, if at times overstated, case; and there is no doubt that there is much more linguistic similarity in the world than previously thought even a few decades ago. But more importantly this "transformational grammar"20 movement has swayed the court of scholarly opinion to a rejection of relativism in favor of universalism. The Berlin and Kay findings, coming when they did, were at the proverbial right place at the right time. But does this mean that linguistic relativity is dead (at least in the domain of color)? We will see soon that the theories of Sapir and Whorf, at least in their weaker versions, are still viable theoretical paradigms and are still promising areas of research. But before we examine that in more detail, we will discuss one of the most promising lines of inquiry for cognitive science to some out the Berlin and Kay tradition: vantage theory.

8. Later Developments from the "Standard Model:" MacLaury's Vantage Theory

<u>8.1. MACLAURY'S WORK ON THE MESOAMERICAN COLOR SURVEY.</u> In 1997 Robert MacLaury wrote a new book on the color terminology systems found in one hundred Mexican and Central American languages. This was is a ground-breaking study on how the human mind apprehends the physical

universe, and was the most important work on color nomenclature theory to appear since Berlin and Kay's study thirty years earlier. MacLaury's color research began in the 1970's at the University of California, working with Berlin and Kay on several studies in Latin America. Eventually, Berlin and Kay along with researchers at the Summer Institute of Linguistics finished the World Color Survey, a investigation of 111 "exotic" languages in Asia, Africa, the Americas, New Guinea and Australia, while MacLaury and his co-workers finished the Mesoamerican Color Survey, an investigation of 116 languages in Mexico and Guatemala. These two vast studies, together with MacLaury's later work in the Pacific Northwest, have now provided a sufficiently large and comparable set of data to allow for the analysis of the intricacies of color nomenclature in great detail. MacLaury's new book was the first attempt at such a broad synthesis.

8.2 COEXTENSION, A NEW SEMANTIC RELATION. MacLaury attempts to do many things in his Mesoamerican study, and only a few high points can be described here. Perhaps the most important discussion for linguists and cognitive scientists—as well as anthropologists, obviously—is his interpretations of the processes of human categorization. MacLaury examines in depth the semantic relation of "coextension," an association "that did not fit our preconceptions of synonymy, near synonymy, inclusion, or complementation" (p. 111). During the course of his field investigations, MacLaury and others found that informants would often use different words to label the same color. That in itself, of course, is not surprising; but sometimes informants would use these two terms in rather peculiar ways that would only become apparent in mapping tasks. As an example (and I do not mean to imply here that this analogy actually applies to the basic English color term system), say an native English-speaker labels the same several dozen color chips presented to them individually as either TAN or KHAKI, with maybe KHAKI being also applied to a few more colors.

From a naming point of view, then, it appears that the two terms either label the same category (with TAN or KHAKI being used in free variation), or that TAN is included within the KHAKI category. However, the mapping task (where informants are asked to delineate which colors in a whole array of chips belong to some color term) might reveal that this informant places different different attention to each term. For instance, KHAKI terms might center around a light yellowish chip and disseminate outward from it. Likewise, the TAN colors might be focused around some darker brown color and proceed from there. So the name of some particular color category is contingent, depending on the point of view or perspective taken by an informant. If the informant calls the category KHAKI, he or she is coming at it from the light or yellowish side and extending it down into the darker brownish TAN's (see Figure 8.1). If it is called TAN, the category focuses around some ideal tan-ish color and extends upwards towards the yellows (see Figure 8.2). This is not a mere case of two terms simply being applied to the same referents; presumably the two experiences are, psychologically or experientially, somewhat different.

8.3 VANTAGES. While this type of phenomena is found in many of the world's languages, it is especially prevalent in the Mesoamerican WARM (red and yellow) category, where most of these colors are used coextensively. The ethnography and formal experiments clearly demonstrate that coextension in this case shows a "dominant-recessive" pattern, with one range generally larger and more centrally focused than the other. MacLaury interprets these results using what he terms "vantage theory," the method by which "a person makes sense of some part of his world by picking out specific points of reference and plotting their relation to his own position, a process that is spatial and temporal in the first order but *incidentally* visual" (pp. 138-139; emphasis mine). In other words, MacLaury claims that (1) the processes of categorization are constructed by analogy to space or time dimensions, and (2) color categorization itself ultimately is predicated upon various shifting figure-ground relations (similar to those famous optical illusions where either a face or table might appear to an onlooker, depending on which part of the picture is being attended to at any given time). Color categories arise, then, by alternating shifts of emphasis: At first colors are grouped together with an elemental hue on the basis of similarity (e.g., yellows being included in the category RED, as many yellowish colors seem *similar* to some light reds). After that, the category YELLOW may be develop on the basis of how distinctly *different* these hues may appear to be from the reds. While others (e.g., Stanlaw and Yoddumnern 1985) have argued that taxonomies and other methods of classification are based on spatial analogies, MacLaury's detailed linguistic and ethnographic data make the most compelling case to date.

Vantage theory seems to have the potential to clear up a number of perplexing issues in color nomenclature, including the multiplicity of Russian BLUE terms, or the problems of the GRUE (green and blue) categories. MacLaury reminds us that the work on classification and color nomenclature belongs to neither the universalities nor the relativists, but necessarily is a blend of the two approaches. Current research on color vocabulary is at a theoretical crossroads, giving advocates of both persuasions an opportunity to finally understand that no culture is limited only to biological or psychological universals, while at the same time realizing that no culture can vary without constraint. The wonders and mysteries of the human conceptual system will be more fully appreciated as more work such as MacLaury's is read.21

9. Cultures in Contact: the Japanese Case

9.1 PRELIMINARIES. In this section I will discuss several results from my recent research on Japanese that offer contributions to color nomenclature theory, the specific tenets of the Berlin and Kay findings, and notions of linguistic relativity. I will examine three issues. The first concerns language and culture contact. Because of their concern with making an overall cross-cultural comparison, Berlin and Kay—necessarily—neglected several crucial things regarding the Japanese color nomenclature system. They failed to examine the pervasive use of loanwords in the Japanese language in general and in the color term vocabulary in particular. When loanwords are also brought into the picture, several intriguing things are found. For example, several English loanword color terms *pinku* (PINK), *orenji* (ORANGE) and *guree* (GREY)—are more salient than their native Japanese counterparts (*mono-iro, daidai-iro,* and *nezumi-iro* or *hai-iro,* respectively).

It even appears that the Japanese color lexicon consists of two sets of mutually exclusive terms, one of native origin, the other borrowed from English. I suggest that English loanwords are often REPLACING native Japanese color terms, and that they seem to be doing so in reverse order in Berlin and Kay evolutionary sequence. Second, I will also argue that Japanese might actually be a twelve term system, having the color label (kon)22 and color category (DARK BLUE) not proposed in the standard Berlin and Kay model. Finally, though not in this section (but at the end of module in Section 10) I will show an experiment with Japanese stoplight color terms that strongly suggests the necessity of a Sapir-Whorf explanation.

9.2 JAPANESE COLOR NOMENCLATURE AND ENGLISH LOANWORDS. While conducting research on the use of English loanwords in Japan (1992a, 1992b;), I also collected data on color terms because much of the color vocabulary in contemporary Japanese is borrowed from English. The methods I followed were similar to those described by Berlin and Kay, and generally used by most researchers on color nomenclature. I first collected a list of color terms by simply asking informants to name what they thought to be the salient color terms in Japanese. If nothing else, I thought it might be useful to attempt to corroborate Berlin and Kay's original findings (which were collected in English from a single bilingual informant living in California). The results for this first task are shown in Figure 9.1. 23

Figure 9.1 presents the frequency counts for 29 Japanese color terms given as responses, including both native Japanese vocabulary items and English loanwords. Ninety one people of various ages were asked to write down those color terms they thought were most common or most important in everyday life in Japan. Participants were encouraged not to deliberate too long over this task (three to five minutes at most), and told that no more than the first 15 terms would be examined. They were also informed that less than the maximum number of items was perfectly acceptable, and that they should use their own judgment regarding the number of terms they considered sufficient.

Participants in this survey ranged form 8 to 62 years old. For tabulation, informants have been divided into the following five groups: (1) elementary school students (aged 8, 9, or 10), (2) junior high and senior high school students, (3) university students or people in their early twenties, (4) adults aged 26 to 45, and (5) adults over 45.

Younger students generally completed the task in groups in a classroom, or class-like setting. Older students and adults often completed the task individually or in small groups, in locations suiting the convenience of the participants or research (e.g., an office, a private home, a university building). Discussion and instruction was generally conducted in Japanese, except in a few cases where the participants preferred using English.

Figure 9.2 presents the number of times participants, broken down by age, cited a particular form as an important color term in Japanese. The percentages next to each number indicate the fraction of the informants in that age-group who cited that term. For example 96% of the elementary school students (or 22 out 23 school children) believed shiro (WHITE) to be an important and basic color term. In the TOTALS column the percentages represent responses for all age categories taken in aggregate. For example, 97% (or 88 out of all 91 respondents) considered shiro (WHITE) to be an important color term. Note that all percentages have been rounded off and terms that appeared fewer than four times are not cited. To facilitate reading, the data in both Figures 9.1 and 9.2 have been grouped into three sections: the original basic color terms in Japanese given by Berlin and Kay, other native Japanese color terms mentioned by informants, and English loanword color terms given by informants.

Figure 9.3 lists the color terms given in Figures 9.1 and 9.2 in decreasing order of saliency for all informants. This table takes the percentages given in Figure 9.2 and puts them in rank order, highest to lowest, regardless of a term's status as "basic," loanword, or native Japanese color term.

As many fieldworkers have noted, it is not always easy to determine the real basic color terms in a language.24 In Japanese, the difficulties in defining basic color terms are compounded by several factors. First, the Japanese morphological system regarding color terms is rather intricate. Every Japanese color term can, or must, interact with a number of productive morphemes. For example, there are many complexities regarding color adjectival forms, and the use of productive morphemes to indicate the degree of saturation of hue (e.g., ... -gakatta, "tinged with ... ;" or ... -ppoi, "... -ish") are often problematic. And, almost any Japanese noun can be made into a color term by simply adding the suffix -iro ("colored") (Stanlaw 1987:85-118).

These problems are exacerbated even more when we consider the second point: how color terms are used in the Japanese writing system. Simply put, the problem comes down to what actually constitutes a word in Japanese. Is it a spoken set of phonemes? Or is it a written character or set of characters that are the units of analysis? Because Sino-Japanese characters were borrowed more than a millennium ago over the course of several centuries, most Japanese characters today have a multitude of pronunciations. For example, if the BLUE color term is thought to be ao-iro (青色), what is the status of the alternate pronunciation of this set of characters, sei-shoku?

We see, then, that the traditional Berlin and Kay criteria of unanalyzability, productivity, and morphological complexity—as given in Section 7—may not be sufficient to determine a lexeme's basic color term status in Japanese. However, recall that two other criteria remain. Berlin and Kay claim that a candidate basic color term's signification should not be included in the range of any other term. They also argue that a basic color term must be psychologically salient for informants. Evidence for this would include occurrence at the beginning of elicitation lists, and occurrence in the ideolects of all informants. Therefore, I used these two criteria as the main determinants of basic color term status in Japanese: frequency salience, and the evidence of inclusion from the mapping tasks.

The literature suggests that frequency salience is actually a very good indicator of basic-ness. For example, Hayes, et al. (1972) in a statistical analysis of five literary languages (English, Spanish, French, German, and Russian, with additional evidence from Hebrew and Romanian) found that salience—when defined as frequency of use—correlates with the order of the Berlin and Kay evolutionary sequence. That is, in general, the most frequently used terms in these languages are WHITE and BLACK, the next most frequently used term is RED, and so on, throughout the evolutionary order. Using later sets of English frequency tables (e.g., from Francis and Kucera 1982 and Carroll et al. 1971), I found support for Hayes' conclusions (which used data gathered in the 1940's). Evidence, too, from Bolton (1978) and Bolton, Curtis, and Thomas (1980) generally is confirming.

In examining frequency data of Japanese newspapers and magazines gathered by the Japanese National Language Research Institute (Kokuritsu Kokugo Kenkyuujo 1964, 1970, 1971, 1972, 1973), I found that frequency/salience seems to correlate with the Berlin and Kay evolutionary sequence (1987:111-116). Thus, there appears to be strong evidence to believe that the salience data given in Figures 9.1, 9.2, and 9.3 reflect basic color term status in Japanese to at least a fair degree.

Informants were also asked to perform a mapping task using the most frequently found terms in Figure 9.3. This was an extension of the Berlin and Kay data given for Japanese (p. 123) using both (1) a much larger number of informants, and (2) a greater sample of candidate basic color terms (namely, English loanword color terms and some other native Japanese color terms that appear to satisfy many of the "basic" criteria). Figures 9.4 and 9.5 give the modal focal colors for the eleven Berlin-Kay color categories in Japanese, both for native terms and English loanwords. Figures 9.6 and 9.7 do the same for category ranges.

An examination of these figures shows several things. In particular, we should notice that English loanword color terms are not mapped synonymously with native Japanese color terms. This was common for most informants interviewed. For example, Figures 9.8 and 9.9 show the native Japanese and English loanword color maps for one typical informant, Y. K, a 25-year old female. Figures 9.10 and 9.11 show the data gathered from a 21 year male.25 In both cases, it is easily seen that the focal colors (marked with a plus sign) and the ranges vary extensively. In general, the number of chips chosen as focals for native Japanese color categories is different than those chosen for English loanword colors, and most focals seem to be brighter by at least one step on the brightness level than their native Japanese counterparts. When considering the ranges of the color terms, a similar phenomena is found. That is, in general, English loanword color terms seem to be thought of as brighter than their native Japanese correspondents.

Using the mapping data above, and the salience data given in Figures 9.1, 9.2, and 9.3, a set of basic color terms might look like that found in Figure 9.12. The first thing to notice about this list, or the data given in Figure 9.3, is that the Berlin and Kay proposed order is closely followed, at least for the first eight Japanese color terms. The sole exception is that aka (RED) is just slightly more salient than kuro (BLACK). Aside from this very minor deviation, the rank order does nothing to contradict the theoretical evolutionary sequence. However, after this, from rank eight on, the connections with the Berlin and Kay order are almost completely severed.

In places 9, 10, and 11 of Figure 9.12, the Berlin and Kay sequence predicts that we should find mono-iro (PINK; literally "peach-colored"), daidai-iro (ORANGE; literally "orange-colored"), and nezumi-iro (GREY; literally "mouse-colored") or hai-iro (GREY; literally "ash-colored) as the next color categories, in any order. Instead, in the next three ranks we find two English loanword color terms— *pinku* ("pink") and *orenji* ("orange")—and a native Japanese color term, kon (something like "dark blue"). Interestingly, both loanwords *pinku* and *orenji* appear in the sequence where we would expect the PINK and ORANGE category terms to be. However, the native Japanese mono-iro (PINK) was only given by 4% of informants, while the English loanword *pinku* was given by 43%. Likewise, daidai-iro (ORANGE) was named by only 4% of informants while the English loanword *orenji* was cited by 39%. Apparently, these two English loanword color terms are, in effect, substituting for the native Japanese terms as labels for the PINK and ORANGE categories.

The next five ranks in Figure 9.12 are also in contradiction to the standard model. Hai-iro (Berlin and Kay's Japanese GREY term), appears. but so does *guree* (the English loanword "grey") shortly afterward; both were named by about 12 to 15 percent of informants. The other Japanese GREY term, nezumi-iro, was only named by 5% of respondents.

Several English loanword color terms, then, are highly salient in the minds of most Japanese informants. *Pinku*, *orenji*, and *guree* are used much more frequently than the corresponding Japanese terms mono-iro (PINK), daidai-iro (ORANGE), and nezumi-iro (GREY) which are cited as basic by Berlin and Kay. These native Japanese color terms do not appear until the very bottom of the list in Figure 9.12. In other words, at least these three English loanword color terms— *pinku* , *orenji* and *guree* —seem to be as basic as their native Japanese equivalents, and in fact, may be replacing them for all practical purposes. Indeed, English loanword color terms may be in the process of replacing a number of native Japanese color terms, and I suggest that Japanese may be substituting English loanword color terms for native Japanese forms in reverse order of the evolutionary sequence. For example, we might predict that native Japanese murasaki (PURPLE) or cha-iro (BROWN) could be the next color terms that are replaced (by the loanwords *paapuru* and *buraun* respectively).

9.3. THE DARK BLUE (KON) COLOR CATEGORY. In my fieldwork investigations there were a few terms that seemed quite common and kept coming up in my discussions with informants. These included ki-midori ("yellow-green"), mizu-iro ("light blue," or lit. water colored), and kon ("dark blue"). Some people insisted that these terms were as fundamental as any of the other RED or BLUE terms we normally think of as basic. It could be argued that "yellow-green" or "light-blue" cannot be basic because of the operational definition of basic-ness outlined in Section 7.2. But certainly kon was an intriguing candidate. The Japanese National Language Research Institute tabulations seem to indicate that kon is actually more salient than many "basic" Japanese color terms.26 It was monolexemic, unanalyzable, and psychologically salient (as looking at Figures 9.1 or 9.2 show). These are the usual standards upon which a term is usually judged. On top of that, kon never really seemed to be a "kind of" of another term (unlike, say, English "navy"), nor was it restricted to a single referent. Could this be a basic color term?

There were two difficulties. First, for a number of reasons, current color nomenclature theory seems to hold the eleven-term/category limit sacrosanct.27 There have been proposals for other possible twelve term systems (e.g., a light blue for Russian, or two red terms in Hungarian) but these have never been accepted by the vast majority of theorists. The second trouble was, there was great variability in what chips informants chose for kon (as seen in Figure 9.13). In any case, I decided to dig a little deeper into the use of this color term.

Puzzled, I recalled one of Munsell's old maxim: "Much of the popular misunderstanding of color is caused by ignorance of those three dimensions [i.e., hue, brightness, and saturation] *or by an attempt to make two dimensions do the work of three"* [emphasis mine] (1905:16). After a bit of soul searching and color-array pondering, I came up with the idea that perhaps kon is a term that depends not on brightness or hue but saturation. Remember, we saw in Figure 2.13 that the chips that are in the Munsell array (Figure 2.12) used by Lenneberg/Roberts, Berlin/Kay, and most other researchers are at maximum saturation, because in essence the color "solid" is collapsed into two dimensions and the chips on the outside of the color "globe" are at their maxim vividness for that level. I decided to investigate some of the less saturated dark blue colors to see if informants might select some less saturated color chip as kon. I knew that the kon terms were usually selected in the neighborhood of the lowest three levels of brightness in the 7.5 Blue-Green to 2.5 Purple hue areas; that is—using the coordinates in the Munsell chart, Figure 2.14—from G23 to G33, H23 to H33, and I23 to I33. This is the shaded area in Figure 9.14. I made new charts of color chips for each of these three levels of brightness based on saturation (the level that you actually cannot see in Figures 2.12 or 2.14). The blank template is shown in Figure 9.15. The vertical axis shows the hue dimension (from 7.5 Blue-Green to 2.5 Purple, or Coordinates 23 to 33). This actually corresponds to the horizontal dimension of the original Munsell array; it is like taking the Munsell array and rotating in 90 degrees and standing it on its side.

The horizontal dimension in Figure 9.15, however, is not brightness but saturation (the dimension that is not shown in the original Munsell array). Because I collapsed the brightness dimension in favor of saturation, I had to make new charts for each different level of brightness I wanted to investigate. I decided to look at three levels of brightness: row Coordinates G, H, and I as shown in Figure 9.14. The three corresponding saturation charts are Figure 9.16 (which corresponds to the vertically shaded lines in Figure 9.14), Figure 9.17 (which corresponds to the horizontally shaded lines in Figure 9.14), and Figure 9.18 (which corresponds to the diagonally shaded lines in Figure 9.14). Ignore the numbers and markings in Figure 9.18 for the moment. In each of these new charts there is a dark black line running up and down towards the right. This represents the “border” of the surface of the Munsell array, which we see when we look at Figure 9.14. That is, the chips, for example, of the vertically shaded lines in Figure 9.14 are the chips G23 to G33 marked in Figure 9.16. Note once again that saturation is not constant across hue (i.e., the black ”border” lines in Figures 9.16, 9.17, and 9.18 are not straight), as we found in the discussions in Section 2.5.2.

Once I made these three new arrays I asked 25 native Japanese speakers if they saw any kon colors in any of the charts I presented them.28 The results were consistent and surprising. No one said chips of any saturation were kon terms at the G and H levels of brightness (Figures 9.16 and 9.17). However, at the I level of brightness many kon chips were selected, as shown by the numbers in the shadings in Figure 9.18. For instance, chips 7.5Purple-Blue 2/6 and 7.5Purple-Blue 2/8 were selected as kon 10 and 12 times respectively. It is clear, then, that saturation is playing an important roles in the selection of this term. I would suggest that kon is a basic color term in Japanese, but one not simply based on hue and brightness.The implications of this still need to be investigated.29

9.4. THE SIGNIFICANCE OF JAPANESE COLOR CATEGORIES AND LANGUAGE CHANGE. There are two fundamental questions regarding the Berlin and Kay evolutionary sequence (i.e., the order shown in Figure 7.18): (1) Why does the evolutionary sequence exist in the first place, and (2) What are the mechanisms that cause a language/culture to move along the sequence? As yet, no one has given a definitive answer given to the first question, though some (e.g., Kay and McDaniel 1978) have argued for a physiological or neurological explanation. I will not go further into the first question here, though I have argued previously (1987:191-213) that languages encode color terms by alternating on extremes of brightness and hue. The second question, however, is no less vexing, and is equally as important. The Japanese data again suggest that the standard Berlin and Kay model needs to be extended in several crucial ways.

Berlin and Kay have tried to explain the dynamics of the evolutionary color term sequence as due to cultural and technological complexity. They argue that in small societies, where the local environment is well known to every one, secondary color terms are not only sufficient but actually advantageous. If all people know "plant X," then the secondary color term "color of plant X" carries more information than some hypothetical abstract color name. When technology and group size increase, general abstract color terms are required to convey information to people who may not have the same referent in their environment. Increasing technology, especially with regards to color-processing such as dyeing, would also require more emphasis on abstract color terms.

These arguments no doubt contain some truth. The Berlin and Kay data (p. 16) indicate that cultures with small populations and limited technologies have few basic color terms, while complex and highly industrialized societies have the most. But what happens when a culture reaches a certain level of technological sophistication and linguistic development with respect to basic color terms? Do they stop evolving? There is no reason to assume so, though it might be hard for (say, English) speakers at the pinnacle of the sequence to imagine how subsequent stages would appear. But it is probably equally bizarre for the Dani—with only two basic color terms in their language—to imagine how the Europeans construct their color world, and for what purpose.

The Japanese data suggest at least three techniques which could encourage further development of the evolutionary sequence: (1) a language/culture could create new basic color categories (such as a "dark blue" or a "yellow-green"), (2) a language/culture could increase the number of terms available for basic color term status through extensive borrowing of loanwords, and (3) a language/culture could replace native terms in the evolutionary sequence with loanwords. All three processes are found in the Figures in this section.

The first case would posit the existence of unanalyzable, mono-lexemic, "basic" terms labeling a distinctly defined color space. Native Japanese terms such as kon (dark blue), and possibly a few others, indicate that Japanese may have twelve or more basic color categories (as opposed to the maximum of eleven cited by Berlin and Kay).

The number of English loanword color terms found in Japanese is extensive. Besides some of the "basic" English labels, even several borrowed English secondary color terms, like *kaaki* ("khaki"), *beeju* ("beige"), *remon* ("lemon"), *kurimu*-iro ("cream-[colored]"), or *Iemuraudo guriin* ("emerald green"), are more salient than many Japanese basic or secondary color terms. Thus, a pool of abstract terms (i.e., those not as strongly connected to a referent as are many native Japanese labels) could be available for use in creating new color descriptions or creating new color categories.

The third mechanism, replacing native Japanese color terms by English loanwords, could let the native terms become re-lexified, possibly taking new denotative and connotative meaning. They might even eventually come to label a new basic color category.

Obviously, the presence of every English loanword color term—basic or secondary—will not imply the existence of a new category in the Japanese color nomenclature system. But considering the length of time required for languages to evolve, availability might increase probability. An awareness of English loanword color terms—presumably known by speakers to be different somehow from native Japanese color terms—might prompt people to experiment with these auxiliary terms in a wide variety of ways.

9.5. LOANWORDS, UNIVERSALS, AND PARTICULARS. The English loanword color term evidence shows interesting universalist and particularist interactions when colors and cultures come in contact. General universalist properties—like the Berlin and Kay encoding sequence—are found for the Japanese data, but we also saw how specific social and linguistic situations—such as borrowing—modified them. That is, the universalist arguments of Berlin and Kay do not necessarily refute all Whorfian considerations under all conditions. Languages can certainly vary semantically, but obviously not without constraint; people cannot just call anything anything, after all. But these constraints are often a complex interface of both human cognitive universals, AND the particulars of cultures and languages in contact. It is on this edge that much of the linguistic and social action takes place.

10. Final Verdicts: Is Sapir-Whorf Dead?

10.1 PRELIMINARIES. In this section we examine a few of the latest findings concerning the Sapir-Whorf Hypothesis. Last time we saw that the Berlin and Kay color experiments seemed to cast a cloud of doom over the whole enterprise of linguistic relativity. We will see this time, however, that there is also much experimental evidence for the claims of Sapir and Whorf. First, we look at two different research programs from the domain of color: Kay and Kempton's work on Tarahumara and English green-blue terms, and my own work on the colors of Japanese traffic signals. We then look at Sapir-Whorf effects in number and numeral classifiers in Mayan and Japanese. I conclude by showing that the universalist claims of Berlin and Kay and the present-day Chomskyian syntacticians are not really at odds with linguistic relativity. The differences are more a matter of level of focus rather than contradiction. Finally, we make some comments about Sapir and the current trends in cognitive science.

10.2. The KAY-KEMPTON EXPERIMENTS. In 1984, Paul Kay, one of the investigators in the seminal Berlin and Kay experiments discussed previously, authored a paper in the *American Anthropologist* with a young colleague, Willett Kempton. In this paper, Kay and Kempton reviewed the literature on the Sapir-Whorf Hypothesis up to that time, and presented some new experiments demonstrating "a clear Whorfian effect" (Kay and Kempton 1984:65). As Berlin and Kay had made strong universalist arguments against the linguistic relativity hypothesis in their 1969 book, these results were quite surprising.

10.2.1 Background. The Kay and Kempton experiments were designed around the well-known differences in color categorization between English and Tarahumara, an Uto-Aztecan language in Mexico. While English has separate labels for the basic color categories GREEN and BLUE, Tarahumara uses one term—siyoname—to refer to both these colors. Actually—as we saw in Section 3.2—in having this property Tarahumara is not unlike many other past and present languages in the world (including ancient Greek and medieval Japanese). Again, as I mentioned, because such a GREEN/BLUE color category is so common, researchers often use the word "GRUE" when speaking of it.

The idea of the Kay and Kempton experiments was to find out if a difference in language (i.e., having GREEN and BLUE terms vs. having a GRUE term) would have manifestations in the way informants would subjectively view colors. The Sapir-Whorf Hypothesis would predict that color stimuli near the green-blue boundary would be "selectively pushed apart by English speakers precisely because English has the words green and blue, while Tarahumara speakers, lacking this lexical distinction, [would] show no comparable distortion (Kay and Kempton 1984:68).

10.2.2 The experiments. One of the tasks in the Kay and Kempton experiment—a so-called "triads test"—involved informants being given a series of sets of three color chips, and asking them (in their native language) to tell which of the three was most different. All of the chips were either greens, blues, or bluish greens; and some chips were at the actual "edge" of the blue-green boundary. This edge was defined as that wavelength where an equal amount of green and blue was perceived by English-speaking informants. The Sapir-Whorf Hypothesis predicts that when one chip lies across this green-blue boundary, English speakers would tend to exaggerate how different it is from other chips (or at least notice it), while Tarahumara speakers would tend to ignore it. For example, consider the chips in the generalized set shown in Figure 10.1.

Let us take a hypothetical case and suppose that the three chips in Figure 10.1—A, B, and C—are all equally distant in terms of psychological "just noticeable differences." If that is so, then it should not really matter which chip is thought to be most different (A from B and C; or C from A and B) because they are actually the same perceptual distance away. In this particular trial, Tarahumara speakers basically chose A or C as being different about an equal number of times (about 13 out of 24 times). However, given a situation like this, English speakers almost would always (29 out of 30 times) select C as being the different chip (Kay and Kempton 1984:72)

<u>10.2.3. Explanations</u>. How might we account for such a vast difference in performance (assuming the men in both groups were physiologically and nutritionally sound, anatomically similar, and not color-blind)? The best explanation, according to Kay and Kempton, is that because of the lexical boundary between GREEN and BLUE, English speakers must notice that chip C, for example, lies in a different color category. Tarahumara speakers, having a GRUE term instead of different words for blue and green, make no such distinction. For them, it is a coin toss.

The question now remains, however, what would English speakers do if the chips in the diagram above did NOT cross a lexical boundary? Suppose chips A, B, and C were all kinds of greens, and all equally distant perceptually (say, "darker green," "green," and "lighter green"). In such a situation, the English speakers performed very much like the Tarahumara speakers. That is, the language-category effect seemed to disappear (Kay and Kempton 1984:70).

So what we have here is a case where a language difference seems to be reflected in experimental outcomes. But what kind of individual psychological mechanism might explain this? Kay and Kempton posit a possible rationale they call the "naming strategy." A native English-speaking person, when confronted with any of the above experimental tasks, might reason something as follows: "I am given a very difficult job here, as all three chips look very similar. What kinds of clues might I use? Hey, chip A and chip B are both <u>called</u> "green" while chip C is <u>called</u> blue. OK, then, I guess I will pick C as the most different." This naming strategy is not available to Tarahumara speakers because they do not have these lexical labels or criteria at their disposal, so they will choose A or C relatively equally.

But do these results actually confirm the claims of the Sapir-Whorf Hypothesis? And, if so, how can Kay reconcile these results with the earlier (and well substantiated) findings of the Berlin and Kay study? We we address these issues after we look at another case of a possible naming-strategy effect: the colors of the Japanese stoplight.

<u>10.3 THE COLORS OF THE JAPANESE TRAFFIC SIGNAL.</u> I mentioned in Section 9 that I would present another Japanese color example of Sapir-Whorf effects. Here I will discuss how, oddly enough, a modern invention—the everyday traffic stoplight—interacts with traditional notions and ancient colors to produce some very interesting cognitive effects.

<u>10.3.1. The Japanese GRUE color concept</u>. Perhaps has late as eight hundred years ago the modern Japanese term for BLUE, <u>ao</u>, included most of the green hues—that is, colors which today would be called <u>midori</u> (GREEN). So, like modern Tarahumara, medieval Japanese had a GRUE term. Though the Japanese GRUE category split into the two terms we have today, there are still many differences in connotation between them. While <u>midori</u> has relatively few special referents or associations, <u>ao</u> has many. <u>Midori</u>, for the most part, means green colors or verdure. <u>Ao</u>, on the other hand, is also associated with notions of "freshness," "youth," or being "unripe." By extension, <u>ao</u> is also associated with being inexperienced or naive. Other semantic extensions include <u>ao</u> referring to being "pale" or "sickly." In fact, most of the English "green" metaphors—such as "He's still a green recruit" or "This apple is to too green to eat" or "Your face looked pretty green after that roller coaster ride!"—would use <u>ao</u> in Japanese.

<u>10.3.2. The Japanese "go"-light</u>. It is also true, interestingly, that Japanese uses <u>ao</u> to refer to the go-light of the traffic signal. To be sure, different lights in different locations may tend to be rather "bluish" but in terms of actual hue, most Japanese go-lights are probably closer to <u>midori</u> than <u>ao</u>. This is not unexpected; just about ALL traffic signals the world over use green as the color of the go-light—and this is NOT due to mere diffusion or borrowing (cf. Leach 1970; Gamst 1975; Sahlins 1976). Actually, for the most part, both historical and contemporary stoplights in Japan have had hues and shades very similar to those found in the United States or Europe. Today, the colors of the stoplights in Nagoya look pretty much the same as the ones in Normal. However, the "green" go-signal in Japan is called the <u>ao-shingo</u> (lit. "the blue light"), as in
信吾が青になってから道を渡たて苦代s下さい <u>Shingo ga ao ni natte kara, michi o watate-kudasai</u> ("Please cross the street after the light has turned green [BLUE]).

But why do the Japanese call their signal <u>ao</u> instead of <u>midori</u>? Of course, it is difficult to say for certain, but I have speculated about this at some length (cf. Stanlaw 1987, 1997). What the Japanese seem to be encoding in their use of <u>ao</u> is the idea of "starting," or "beginning-ness." As several informants told me, when they are speaking of things plainly grown, they use <u>midori</u> (GREEN) or <u>aka</u> (RED), but "when we want to indicate things that are in the process of growth we use <u>ao</u>."

It is likely that the Japanese people were cuing in on this notion of "starting" or "freshness" when they decided to use <u>ao</u> as the name for the green-light in their traffic signal. To put it in structuralist terms, a car must begin to accelerate when the light changes. This notion of process and change was probably even more of a central factor than hue itself when a label was chosen for the go-light. Thus, neither the native Japanese green term midori, nor the English loanword guriin, was selected.

This choice of color labels has several interesting implications. On the Berlin and Kay Munsell chart (Figure 2.14), we would guess that most Japanese go-lights in most cities are in the E or F rows between the 19th to 22nd columns. This is well within the range that most informants labels as midori (GREEN) on mapping and naming tasks. If color was just pure denotata, then, the term midori should have been used to label this light. (Of course, cases such as this also make us question "naturalist" or biological explanations of color naming; e,.g., that RED and GREEN are opposite neurologically or psycho-physiologically, and therefore subject to to some privileged linguistic position.) And there is one other aspect of this Japanese "blue-light" phenomena to notice: the way this color label affects memory and recall.

10.3.3. Experiments. I have conducted a number of studies asking overseas Japanese informants to pick the best Munsell (Berlin and Kay) chip which matches the color of the go-light in the Japanese traffic signal. In one such study, I showed 21 informants various blue and green chips from the middle section of the Berlin and Kay array/Munsell color chart. I asked them to choose the best chip that they REMEMBER as the color of the ao-shingo ("go-light") to be back in Japan. Each informant had been residing in the United States for various lengths of time, from 6 months to over 15 years.

Well into the experiment the results suggested that there is a relationship between length of time spent in America and the hue of the selected chip. Figure 10.2 shows the results of this test. The Figure shows a section of the blue and green chips of the Munsell chart blown up for ease of viewing. The letters in the squares represent which of the informants chose that chip as their best recollection of the go-traffic light back in Japan. At the bottom is listed how long (in months) each informant had been residing in the United States. We see a clear linear (i.e., diagonal) relationship across the chart; that is, the longer people have been residing the United States, the more “blue” they remember the Japanese go-light to be. For instance, one informant, a male professor who has resided in the United States for over 15 years, picked a chip that was even very close to the modal "best" ao (BLUE) color during Berlin and Kay mapping experiments—i.e., a chip that most Japanese back in Japan thought was the best blue on the chart—as the color he remember the go-light back in Japan to be. So we find that informants who have resided longer in America generally tended to pick more bluish chips than Japanese who have resided in the United States for shorter periods of time; but how might we explain such an odd finding?

10.3.4. Explanations. It seems likely that Japanese people overseas, when asked to name the color of the stoplight back in Japan, have no other recourse except to turn to the linguistic code. This is, of course, a memory-variation of the "naming-strategy" technique discussed by Kay and Kempton. In the absence of the stimuli itself (the actual "green"-light), the linguistic label (ao, or BLUE) is the only clue they might have to make a selection. And it appears that the longer people have been away, the more they trust the label: the light is named ao so therefore it probably IS really BLUE-colored. This is all the more intriguing when it turns out that actually the stoplights all around them in America are not very different than those back in Japan.

To put the results of this experiment in terms of the Sapir-Whorf Hypothesis, here again is a situation where we find a cognitive effect—i.e., recollection of the color of the "green" light—due to the structural properties of a language—i.e., the encoding of certain greenish hues as BLUE because of cultural and sociolinguistic reasons. Both this experiment, and the previous one by Kay and Kempton, suggests a Sapir-Whorf effect, then, but one of a rather reduced kind. In other words, in certain rather difficult situations—distinguishing closely colored chips or recalling colors long since forgotten—the experimental results seem to show that there can, indeed, actually be Sapir-Whorf incursions of linguistic categorization into areas of non-linguistic cognitive processes, even in psycho-physiologically constrained realms such as color perception. But are there domains besides colors where Sapir-Whorf effects can be found? In the next sections we will look at how number and plurality corroborate,and even extend, the findings of the experiments on color.

10.4. THE YUCATEC MAYAN ENGLISH NUMBER EXPERIMENTS: ANOTHER DOMAIN. For over a decade and a half John Lucy has been examining the Sapir-Whorf Hypothesis in a domain other than color. In his latest studies he investigated whether or not the grammatical notion of "plurality" had any manifestations in behavior. In a series of ingenious and intriguing experiments, he demonstrated the presence of very observable Sapir-Whorf effects in Yucatec Maya and American English speakers (Lucy 1992)

10.4.1. Mayan numeral classifiers. Like Japanese and many other Asian languages, Yucatec Maya uses obligatory "numeral classifiers" when counting head nouns. Like English, Yucatec marks for plurality (i.e., having special devices to indicate "one" vs. "more than one" noun), but it does so with much less frequency. One of the differences between how these two languages handle plurality can be seen in Figure 10.3 (Lucy 1992:61).

Figure 10.3 indicates that English "marks" for plurality (usually by adding a final "-s" to the noun) for both animate objects ("dog"/"dogs") and inanimate objects ("shovel"/"shovels"). It does not pluralize tangible substances which have no solid form (such as "mud" vs. *"muds"). Yucatec Mayan likewise does not mark malleable mass nouns. And it likewise does pluralize animates. However, unlike English, it generally does NOT pluralize discrete inanimate objects. Lucy asked if these differences in grammatical features—that is, the greater propensity for English speakers to use plural forms—would show up in how subjects responded to experimental stimuli. That is, if the linguistic feature of plurality (one vs. many) indicates a greater sensitivity to number by English speakers, then in a correctly designed experiment they should habitually attend to the number of various objects of reference more often than Yucatec Mayan speakers.

10.4.2. The first experiment. One of the experimental techniques Lucy used was to give people sets of six drawings to examine. Each set consisted of simple line sketches of daily activities and objects. One picture was the "original" picture and the others were slight variations on the first, differing in the presence, absence, or quantity of some target item. For example, in one set the original drawing was of a man feeding three pigs and a chicken, with a little boy walking out of a hut (with firewood, a broom, a bucket and a bottle next to it). The second picture was exactly the same as the first, but one of the persons was absent. The third picture was like the first, but was missing a bottle. The fourth picture added a hoe leaning next to a tree. The fifth picture was the same as the first with the addition of a puddle. The sixth differed from the first by the greater amount of feed the animals were being given.

The other eight sets were constructed in similar fashion, but for different scenes and different items. However, every set followed the same pattern given above: (1) an "original" picture; (2) one picture where an animate object like a person or animal was changed; (3, 4) two pictures where inanimate objects like bowls or hoes were changed; (5, 6) and two pictures where mass nouns (e.g., puddles or corn dough) were changed.

If we look at Figure 10.3 again, we can see what Lucy was trying to do with these pictures. He wanted to devise experimental protocols which corresponded to the ways English and Yucatec Mayan handle plurality. In other words, the pictures contained three types of target nouns: animate objects (animals or people), discrete inanimate objects (tools or containers), and non-discrete inanimate objects (mass nouns).

Lucy administered his experiment to a dozen Yucatec Maya men in Mexico and a dozen American men in the United States. The average age for both was about 21 years. He asked his informants to do a number of things after viewing these pictures. One task was just to show people these pictures and get a simple description of what the informant saw (e.g., "I see three pigs being fed by an old guy, and .... "). The mention of target objects found in the pictures was noted (as well as the lack of such mentioning), and indications of plurality, if any was noted.

Lucy found that all English speakers and almost all the Yucatec-Mayan speakers detected the people and animals in the pictures. Presumably, as these are items that must be pluralized in both languages, they are highly noticeable. Likewise, only a bit more than half of both groups of informants noticed changes in the amount of mass nouns, like mud or trash, in the pictures. However, twice as many English speakers as Mayan speakers (8 to 4) noted changes in the number of discrete inanimate objects between pictures. This would suggest that English speakers are attending to changes in the number of inanimate nouns more closely. Presumably, this is because the number of inanimate nouns is something that must be noted to speak of them correctly (in terms of the English syntactical rules for plurality).

10.4.3. The second experiment. A second task involved asking informants to pick which of five variants was most like the original picture. The prediction was that English speakers would regard changes in the number of animals or implements as important (because they must pluralize them when counting them or referring to them). Pictures where there were changes in mass nouns were thought to be not especially noteworthy by English-speaking informants, as these things are generally not pluralized, and hence, less attention is given to them. Thus, when asked to pick which picture was most like the original—in other words, which one has changed the least—they would NOT select pictures where there were changes in animals or implements. Instead, they would choose pictures where the number of mass nouns were altered as the one most like the original. Indeed, this was the case for all twelve informants.

Like English speakers, Yucatec Maya speakers were expected to regard changes in the number of animals as significant because they, too, pluralize animates. However, discrete inanimate objects are NOT pluralized in Maya (nor are mass nouns, in both languages). Thus, Yucatec Mayan speakers should believe that pictures where there were changes in the number of animals or people would be important, but not so for inanimate OR mass nouns. In other words, Mayan speakers would probably think that pictures that had changes in mass nouns or inanimate to be not very different from the original picture. The experimental results supported this prediction: five said pictures with the changes in the number of inanimate objects were most like the original, and six said that the pictures with the mass-noun changes were most alike the original.

The critical thing to note here is this: both English and Mayan speakers regarded changes in the number live animate objects—e.g., greater or lesser people or animals—to be important. And both regarded changes in mass nouns—e.g., greater or less amounts of water or smoke—to be relatively unimportant. But almost half of the Mayan-speakers thought that changes in the number of inanimate nouns, such as buckets or ladders, were not important, while none of the English speakers thought so.

10.4.4. Lucy's conclusions. Several other such experiments confirm the results of the above tasks. In all cases, Lucy feels that the Sapir-Whorf Hypothesis is empirically supported. The main difference between this work and the experiments on color is that the experimenters on color took "reality" as a given, and asked how a given language divided up, interpreted, or reflected this reality. Lucy believes that "reality" is more problematic, and is many ways a product, or a construction, of the interplay between language structure and language function (Lucy 1992:152). In the next section, we will find how the construction of this reality also has a cultural context.

10.5. JAPANESE NUMERAL CLASSIFIERS: ANOTHER VIEW OF THE SAPIR-WHORF HYPOTHESIS. In this last section I will present some data from Japanese numeral classifiers that I believe demonstrates Sapir-Whorf effects in very clear ways. I will look at how rabbits are counted in Japanese (yes, this is tricker than it sounds!), show how the numeral classifier hon (for long cylindrical objects) is used, and discuss how numeral classifiers might be acquired. The broader implications for cognitive science will be discussed at the end.

10.5.1. Theoretical Considerations. Sapir, of course, suggested early on that the lexicon and syntax of a language might compel a speaker to attend to certain environmental features and presumable pay less attention to others. For example, when using pronouns in English we must know something about the sex of the being we are referring to, as we are forced to choose among "he," "she," or "it" when we talk about them. Another way of saying this version of the Sapir-Whorf Hypothesis is:

- languages have categories
- these categories are encoded in linguistic features
- therefore, these linguistic features affect cognition and behavior

However, what Sapir and Whorf believed was the most important part of these language-compulsions was not the particular syntactic feature itself but the categorization that was the underpinning of this feature. But where did these categories come from (setting aside for the moment those universal or biologically based)? I suspect that categories are not given to a language out of thin air. They must be motivated, and come from somewhere. It is most likely that this underpinning or conceptual framework is largely culturally-dependent.

Thus, there is another way of looking at the Sapir-Whorf Hypothesis that is often neglected: the cognitive or mental schema that underlie the categories, and ultimately the language itself. That is, instead of viewing language as modifying perception in some way via grammar or vocabulary, another way is to look at the conceptual scheme-work that must be underling it. We see this not so much as turning the Sapir-Whorf Hypothesis around, as extending it. This extended version of the Sapir-Whorf Hypothesis given previously, then, then might look something like this:

- culture, society, and environment interact to produce physical-psychological reality

- people handle this reality through mental models and cultural schemas
- these mental models and cultural schemas are instrumental in the creation of categories
- languages obtain these categories from the above models and schemas
- (so) languages have categories
- these categories are encoded in linguistic features
- therefore, these linguistic features affect cognition and behavior

By this logic, then, the reason that I pay attention to an object's sex when speaking English is not because I use the word "he," "she," or "it" when choosing a pronoun; it is because I know ahead of time that I must be making a gender-based pronoun choice that I will be looking at the sex of things as I speak. In other words, it is not that fact that I have said "he" or "she" that makes me notice things about individuals' sex; rather it is because I know before hand that I can and must grammatically make these decisions as I construct sentences that I notice them. What this means is that I must a have mental construct or schema in my head for how reality works—in this case, a world where gender is important, indeed so important that it is encoded in my syntax.

To use another example, as we saw in the case of the Yucatec Mayans and English speakers above, the ways of counting objects are different because the two languages handle plurality differently. But why do Americans notice differences between pictures with different numbers of inanimate objects more often than Mayans? The strategy—no doubt unconscious—may be something like this (a "counting-strategy" analogous to the "naming strategy" suggested by Kay and Kempton before): "I see a bunch of stuff in all these pictures. They are supposed to be different, but how? Well, let's see what I can count?. Two dogs over here, but only one here. Ah, this seems to work. What else might I find? Three brooms, ..." and so on. This person does not notice—or notices less—things that cannot be counted easily (i.e., things like mass nouns that do not get pluralized). For the Tarahumara speakers the things that do not get counted as easily (i.e., do not take a plural) also include discrete animate objects. Thus, they are attended to less.

So a more sophisticated way of viewing the Sapir-Whorf Hypothesis does not make the claim that language determines behavior or thought in a simple or reductionist way. What we must consider is where the categories and schema that underlie "language" come from. That is, there has to be room for culture. Consider the following case of how Japanese people count rabbits.

10.5.2. Cultural schema in language choice: counting rabbits. We spoke at length of Japanese numeral classifiers in Section 6.3.3.2. The central notion of the numeral classifier wa is "feathered animal," or "bird." This numeral classifier is used, of course, to count birds of all kinds (e.g., 三羽のあひる san-wa no ahiru [“three ducks”], or 二羽の鶴 ni-wa no tsuru [“two cranes”], etc.). However, rabbits are also counted using wa. The reasons for this are cultural and historical, and today even some adults do not know them.30 When Buddhism was introduced into Japan about 1500 years ago the usual proscriptions against eating animals (i.e. "four-legged creatures") were also imported. This dietary rule did not prohibit the practical eating of the plentiful fish or birds, as the enforcement of strict vegetarian laws did not fit well in Japan's climate. Legend has it that after some time people wanted to eat the numerous (and high-protein) rabbits, or were perhaps eating them already. Thus, it was decided that rabbits have only two legs (because they hop) just like birds. They could now be EATEN with impunity—but COUNTED only with difficulty unless they would use the same classifier, wa, as birds. Without this cultural knowledge, the use of wa for rabbits seems only a freak linguistic accident. Figure 10.4 shows how culture, categories, schemas, and language all interact to produce individual behavior for this particular example.

10.5.3. Cultural extensions in language choice: the case of hon. Another example is seen in the many metaphorical extensions found in the use of the Japanese numeral classifier hon. Hon, is used ideally for long, thin, cylindrical objects such as pencils, knives, or beer bottles. However, research has shown that Japanese adults consistently apply hon to a wide variety of other disparate objects such as "home-runs," "movies," "TV commercials," "telephones" and "video tapes" (cf. Lakoff 1987:104-108). The grounds for this are not transparent. The reasoning may go something like this: "How can I count home runs? Hon is used for long thin objects, and a baseball makes a long thin trajectory as it flies into the stands. Therefore I will count them using hon. Likewise, telephones are ultimately connected to long thin poles and their messages travel on long thin wires. Hon should work for them as well. Film, video tapes, and TV commercials all use rolls of acetate or plastic tape, and the important part of the message is exposed over a camera or tapedeck stretched as a hon-like object." Now such explanations cannot tell us ahead of time that we will use hon for certain objects, but it nevertheless does allow us to do something extremely important—it can tell us why it makes sense (Lakoff 1987:108). And the critical thing to see here is that we are dealing with a largely cultural phenomena, because many many Japanese people make these same hon extensions. We should notice, too, however, that this is the OPPOSITE of the Kay and Kempton "naming strategy" because here speakers are not using language to help them make a perceptual judgment—"these two are GREEN, so the BLUE item must be the odd one out"—but are using perception ("it makes a long thin arch") to make a language judgment (that is, the choice of a numeral classifier).

10.5.4. Cultural environment in language choice: numeral classifier acquisition. Kay and Kempton claim that one of the main tenets of the Sapir-Whorf Hypothesis is that "the structure of anyone's native language strongly influences ... the world view he will acquire as he learns the language" (1984:74). I would again say that there is a cultural factor involved here that also needs to be addressed, as it is the basis for much of the categorization and schemas that underlie the linguistic code. To take the example of hon again, we have found that in Japan, there is a clear and strong developmental transition from the use of hon for prototypically long and cylindrical objects by children to its various extensions by adults. For example, research has shown that Japanese 10 year olds generally have added "home run" to their category of things that can be classified by hon, high school students add "video" and "movie," and adults add "telephone" and "letter" (Inoue 1993). However, Japanese students who live outside of Japan tend to abandon many of these extensions (such as using hon for "video" or "letters"), *even when the native language being spoken at home is Japanese.* Thus, there seems to a strong cultural component involved in the making, maintenance, and use of these categories and schemas.

10.5.5. Summary: culture, language, and cognition. In summary, what might be going on is something like this: Japanese culture provides an environment—and certain categories, and common metaphors and image schemas—for people to use. The Japanese numeral classifier system implies a way of counting things and looking at the world based on particular types of physical features, such as flatness, or cylindricality, etc. A linguistic feature—numeral classifiers—exist, and is used to reflect this. Presumably, then, Japanese people behave and think about the world in these terms. That is, if given a kind of triads test conducted by Lucy or Kay and Kempton, Japanese people might group items together on the basis of some property denoted by a numeral-classifier more than say, English speakers. However, to explain why a triads test might find people grouping video tapes and pencils together, we would have to extend the Sapir-Whorf Hypothesis a bit. If such an experiment were conducted and such a result found, we could say that people ARE putting pencil and video tapes together on the basis of language (i.e., both being labeled with hon), but there is a cultural component to be considered as well. That is, overseas Japanese may not perform on this test in the same way as their domestic counterparts at all.

So, what do Japanese numeral classifiers say about the half-century old problem of the Sapir-Whorf Hypothesis? Is incorporating culture and conceptualization models the key to answering some of the Sapir-Whorf critics? Because the final verdict is still out, we should not count the chickens before they are hatched (yes, pun intended). However, there is probably little doubt that in the future the study of numeral classifier systems world-wide could contribute much in these days of incubation.

10.6. SAPIR, LINGUISTIC RELATIVITY, AND COGNITIVE SCIENCE.

We have seen that the breakthroughs of the Berlin and Kay color research established some important universal constraints on the way color categories can operate in a language system and culture. These universal constraints seemed to be so strong—and the evidence presented so overwhelming—that many believed the Sapir-Whorf Hypothesis to be dead, merely another historical detour pursued by enthusiastic supporters, however misguided. But we have also found in the experiments discussed in this section that there still seems to be much life left in the linguistic relativity hypothesis. Can the two extremes be united, without contradiction? I believe so.

Neither Sapir nor Whorf ever really advocated the most radical versions of linguistic relativity, lest we could not even imagine talking about Hopi time classifications, much less understanding them. This is simply an admission that languages are not limitless in either what they can do or the structures they can create. There are indeed universal biological, psychological, and probably even social constraints which prohibit what we can say and what we can think. These were some of the kinds of things that Berlin and Kay were touching on in their research. One just cannot say anything in a language, after all, or construct a system of categorization of any kind. In this sense, the relativist's claim of complete arbitrariness is obviously false.

But at the same time—between these various constraints and universals—there is enormous variability in how languages can differ from each other semantically and grammatically, and these have cognitive implications for their speakers. We saw this with the English, Japanese, Mayan, and Tarahumara experiments described here. So the problem is not so much one of "Is the Sapir-Whorf Hypothesis correct or not" as "When is it most appropriate to look for Sapir-Whorf effects, and when should we look at universals?" This is probably the more fruitful research question to ask in the future.

Sapir was both linguist and psychologist, anthropologist and poet. If he were alive today, no doubt he would be tremendously excited by the new developments in the new field of cognitive science, if not one of its leaders. Sapir asked questions about the relationships between language, culture, and thought that in many ways were ahead of their time. The "cognitive anthropology" revolution in America which began in the mid-1950's would have disappointed him several ways. First, many cognitive anthropologists simply equated cognitive categories with linguistic categories. The assumption was, then, that if we were looking at language we were looking at the mind. Linguistic structures and mental structures were isomorphic. Second, many cognitive anthropologists at this time believed that formal devices such as "elicitation procedures" would insure cross-informant, cross-researcher, and cross-cultural replicability. Sapir understood that things were not so easy.

Today, cognitive scientists are more sophisticated, and most are quite sensitive to such philosophically naive assumptions. Sapir, no doubt, contributed to this through the legacy of his writings, and the challenges he left for others to continue. People from a variety of disciplines are now coming together to study some of the most basic problems of humanity: what is the nature of knowledge? What is the nature of thought? How is the mind structured? What, if anything, is innate or biological? What is environmental? Just what can we think about ... or cannot think about? But Sapir reminds us that social-language and individual-psychology meet daily on the playing fields of culture to negotiate meaning, struggle for primacy, and spritefully keep all the participants amused. The cheers from the fans insure their continual return. In these contests it truly is not whether you win or lose at all, but how you play the game. Sapir, if nothing else, taught us this.

12. Appendix: The Life of Edward Sapir

12.1. WHY READ A SAPIR BIOGRAPHY?. Sapir, perhaps more than any other interdisciplinary scholar of his era, had an integrated view of language, culture, and personality. The way Sapir worked, one set of ideas was never undertaken only after finishing a previous set. Instead, constellations and relations of ideas all evolved simultaneously, and Sapir was interested in how they were inter-connected. And, as we will see, this was how Sapir conducted his professional activities, artistic interests, and personal affairs. In other words, Sapir's life and work, too, cannot be separated; hence, it is worthwhile in order to study the Sapir-Whorf Hypothesis to examine a little of the very full, and very complex, career of a very sensitive and humane man.

12.2. SAPIR’S LIFE AND TIMES:EARLY YEARS. Edward Sapir was born in Lauenberg, Germany (now Lebork, Poland) on January 26, 1884, the eldest son of Jacob David Sapir and Eva Seagal Sapir.31 The Sapir family were Lithuanian Jews, and Edward's first language was Yiddish. Before Sapir was three or four years old, he moved to England. The family later moved on to the United States around 1890 when he was five or six.

Sapir's father pursued his work on the Lower East Side of New York City as a Jewish cantor, the lead singer in the synagogue. Thus, Sapir was brought up in the conservative traditions of Orthodox Judaism, and even studied Hebrew with his father when he was seven or eight. Sapir was surrounded by English, however, and grew up as a native speaker.

The Sapir family was never well off, but Edward was an excellent student and received several academic honors, including a Pulitzer fellowship to attend the prestigious Horace Mann High School and Columbia University. He entered Columbia in 1901 and graduated with a Bachelor's degree in Germanic languages in only three years in 1904 at the age of twenty. He immediately entered graduate school and received a Master's degree in Germanics and Sanskrit after one year in 1905. For the next four years he pursued his doctorate at Columbia, dividing his course work between anthropology and Germanic linguistics.

It was during this period of graduate apprenticeship that Sapir began his first fieldwork with various Native American groups. For two months he conducted fieldwork with the Wishram,32 an American Indian group along the Columbia River in Washington in the Pacific Northwest of the United States. The whole summer of the next year he wrote a grammar of Taklema, a language spoken in Oregon; these 400 pages he eventually used as his doctoral dissertation.33

Sapir's coursework was essentially finished by 1907, but job prospects in the still new fields of anthropology and linguistics were grim. As no positions could be found in New York, Sapir spent the year 1907-1908 as a research assistant at the new Department of Anthropology at the University of California at Berkeley. For almost this whole year Sapir worked with the Yana, an Indian group in California. Columbia awarded Sapir his Ph.D. in 1909 at the age of 25, majoring in linguistics and minoring in anthropology and German languages and literatures. But how did Sapir go from Germanic philology to Native American ethno-linguistics?

<u>12.2. BOAS AND SAPIR</u>. Columbia University in the early part of the twentieth century was a tremendously exciting place for a young graduate student to be. Academic programs in essentially almost brand-new fields were being developed—such as those in anthropology, linguistics, and psychology. Provocative professors, old and new, walked the halls and visited the classrooms. One of these—the one who had the most influence on young Sapir—was Franz Boas, whom we met in Section 5.

Boas himself has often been called the father of American anthropology, and is thought to be one of the early founders of modern American linguistics. Indeed, though there were American anthropologists before Boas, it was he who established the first departments at American universities and museums in the late 1880's and 1890's, and set the direction the new discipline was to follow. And it was Boas who dictated that linguistics was to be a part of anthropology, and that all American anthropology departments teach linguistics.

It is hard to UNDER-estimate the importance of Boas in anthropology and linguistics. Literally hundreds of his students went on to build programs throughout the United States, but his writings have influenced generations of scholars world-wide. Among other things, Boas instilled at least two—almost religious—dogmas on his followers. The first—sometimes called linguistic or cultural "relativism"—is that no language or culture is any more superior or inferior to any other. A corollary to this is that ALL things can be said in ALL languages, though it is granted that different languages may have different ways of doing so. The second notion—we may call it "non-determinism"—is that there is no necessary connection between race, language, and culture. For example, people of different races will grow up speaking any language they are exposed to, while very different cultures may speak the same language. These were controversial notions for their time. We will also see that both these themes will become repeated and reinterpreted by Sapir throughout his career.

By the time Sapir first saw Boas at a linguistics conference, Sapir was already well grounded in most of the Indo-European languages, including Old Saxon and Celtic. Much of his training, however, was philological; that is, involving the scholarly analysis of classical written texts. Still, he believed he understood much about the nature and general process of human languages. Nonetheless, for every generalization about language that Sapir could make, Boas would offer a counter-example from some Native American language. It was this—along with the possibility of working with living languages and actual real native speakers—that fascinated Sapir, and prompted him to undertake his first field trips under Boas direction and encouragement.

Boas soon found Sapir to be a first-rate fieldworker. In recommending him as a research assistant to Alfred Kroeber (another former Boas student) at Berkeley, Boas said "He [Sapir] is a born linguist, and his work in that direction is about the best that any of my students have done." However, the University of California was unable to give him a permanent position, so Sapir went to the University of Pennsylvania as a research fellow and instructor. The Museum arranged for him to conduct fieldtrips to investigate the Ute language in Utah, and to have a Pauite informant come to Philadelphia. This work, though published much later, is said to be a major contribution to comparative American Indian linguistics.34 .

<u>12.4. THE YEARS IN OTTAWA</u>. In 1910 Sapir arrived in Ottawa as chief of the newly established Division of Anthropology of the Geological Survey of Canada. At only 26, Sapir was tremendously excited about this position for at least three reasons. First, he saw it as a unprecedented scientific opportunity. Canadian linguistics and ethnography was still relatively unknown, and to run something that was the Canadian equivalent to the Bureau of American Ethnology was a professional and personal achievement of the highest order, especially for one his age. If nothing else, there would be ample opportunity for significant fieldwork among scores of groups and languages. Second, the position offered intellectual and academic independence from seniors such as Boas (who could be well-intended but, as often as not, dogmatic and overbearing

as well). Finally, this position seemed to offer extraordinary job security and financial rewards, benefits that did not go unnoticed by a son of a poor family just having struggled though graduate school.

Sapir's personal life at this time also became more involved. His parents moved to Ottawa, though they did not live with him. He also married Florence Delson, a second cousin on his father's side, who's family had also immigrated from Lithuania. However, Sapir's mother was afraid that Florence's family—having come from the cultured Eastern European city of Vilna, unlike the small country town of Kovna that the Sapir's had come from—would not accept Edward. She was right. They were not impressed by Sapir's Kovna roots, did not like their daughter moving away to Canada, and found the name of his field of study unpronounceable (Darnell 1990:46). Still, Sapir was a devoted husband and the marriage produced three children: Herbert Michael (1913), Helen Ruth (1914), and Philip (1916).

Sapir spent the next fifteen years of his life at Ottawa. It was during his period that he did his major fieldwork among the Nootka of Vancouver, and began his comparative Athabaskan studies. He also branched out into studying French Canadian folk songs, and even Chinese humor and stories with local Chinese informants. During this period Sapir also wrote some his most famous works, including Language (1921), a book for a general audience; "Time Perspective in Aboriginal American Culture" (1916), a major monograph of historic anthropological and linguistic reconstruction; and various works on his re-classification of the American Indian languages of North and South America.

However, he was well aware of his intellectual isolation at Ottawa, and he was also beginning to become more concerned with the psychological aspects of culture, an interest that not all his local colleagues shared. Sapir also appeared to have less skills in public affairs and museum curation than he did in linguistics and ethnography, and the administration pressures of his job also became burdensome.

During the stay in Canada, Sapir's personal life took a turn for the worse. His wife, Florence, developed a lung condition, and this was aggravated by the trials of managing an academic household with three small children. The Canadian climate also did not help her recovery. She was often depressed and was even diagnosed as having severe melancholia. She was having an increasing difficult time, and fought off intermittent bouts of both mental and physical illness. The addition of Sapir's mother to their home—ostensibly to help out—only added to the tension among all the family members. Florence finally died in April, 1924, at the young age of 34.

While at Ottawa, Sapir also developed an professional interest in psychology, and its role in culture. It is quite possible that this interest came about, at least in part, from his wife's illness, but Sapir always seemed to have an interest in mental phenomena ever since the time of his initial contact with Boas. Boas, in his seminal book *The Mind of Primitive Man* (1911)—mentioned in Section 5— discussed the connections between anthropology and psychology, though he always remained skeptical and suspicious of psychoanalysis. Another Boas student, Alfred Kroeber, wrote an influential paper entitled "The Superorganic" (1917,)35 where he argued that culture exists as kind of an entity in and of itself; that is, culture exists apart from any individual. This prompted Sapir to give a reply "Do We Need the Superorganic?" (1917)36 —his first significant foray into psychological anthropology—saying culture is unique within each individual. This notion, actually, can be more easily seen in Sapir's renewed interests in his artistic endeavors, which he started to take more seriously around this time.

While many social scientists of Sapir's day indulged in creative writing, Sapir, during his later period in Ottawa, appeared to define his personal and professional identity in terms of his poetry (Darnell 1990:151). Altogether, he wrote over 150 poems and published many of them in literary and popular journals. He also began writing book reviews and music criticism, and began to explore the possibilities of ethnomusicology.

But this exploration into the arts helped Sapir explore his notions of how culture, language, and the individual all articulate to produce social phenomena and communication, and allow for creativity. In music, Sapir saw repetitions of formal patterns, and an adherence to constraints imposed by form. But at the same time, he saw how the individual could use these parameters in their own creative ways to demonstrate a variety of emotions and expressions. In this sense, music—or any art—and language are exactly the same: an individual's personal manifestation of self within a larger social or artistic context. Instead of viewing culture or language, then, as imposing unyielding doctrines or rules, Sapir saw individuals unconsciously intuiting "patterns" around them. But because these "unconscious patterns" are not especially obvious—and people's intuitions about them incomplete—each individual will have, in a sense, a similar but nonetheless slightly different culture, language, and sense of esthetics. Thus, there is ample room for individual creation and expression with a constrained formal social network.

The last years at Ottawa were stifling and confining for Sapir, even though by now his steady publication record made it clear that he was one of the preeminent anthropological linguists of the day, especially in the area of Native American linguistics. Even transitory infatuations with Ruth Benedict and Margaret Mead—two of the most important anthropologists of their generations—left him unfulfilled and ever more restless. He was hoping to get back to the "mainstream" at Columbia in New York, but a Chicago job offer seemed like a good alternative. After some complicated negotiations, Sapir accepted a post as associate professor at the University of Chicago in 1925, a position he would hold for the next six years.

12.5. THE YEARS IN CHICAGO. This period of Sapir's life was one of his most productive and enjoyable, perhaps his high point. Sapir was only Chicago's second anthropologist (other being another Boas student, Fay-Cooper Cole). Thus, he was in a position to greatly influence the direction the new discipline would take at the university. He attracted many enthusiastic students in both linguistics and ethnology, and could make good use of his teaching abilities for the first time. Within two years he was promoted in rank to Full Professor of Anthropology and General Linguistics.

Sapir also become quite popular outside the university setting. He gave lectures on the radio, taught extramural classes, and socialized with some of Chicago's rich and famous. And in 1926 Sapir remarried, to Jean Victoria McClenaghan, a women Sapir got to know well in Chicago, but who ironically was from Ottawa. Though 16 years his junior, they got along well. Their first son, Paul was born in 1928, and their second, David, in 1932.

Sapir was occupied with a wide variety of interests while at Chicago. His field work continued with trips to study the Navaho in the American Southwest and the Hupa in the Pacific Northwest, and persisted in his lifelong research on Athabaskan. He also continued to work with local informants, such as Charles Blooah, a Grebo-speaking immigrant from the African nation of Liberia who Sapir found working in a bowling alley. But Sapir's interest in culture and personality also continued to grow, as well as a deeper appreciation of the need for semantic research. Sociology, however, especially quantitative sociology, generally left Sapir feeling cold.

12.6. THE YEARS AT YALE. In 1931, the President of Yale University wanted a superstar on his campus who would draw several social science research projects together under one unified unit. He recruited Edward Sapir for this task. Sapir might have been ripe for an offer: his teaching schedule at Chicago was over-filled and burdensome, and external financial aid was slow in coming. Yale offered Sapir the chairmanship of a new department of anthropology, a position also as a professor in the new graduate linguistics program, and the opportunity—and expectation—to expand his personality and culture studies. The very generous salary of $12,000 was "almost unheard-of" (Darnell 1990 234) in those days. Sapir was also to receive $5,000 for himself and his student to conduct fieldwork. However, not everything was perfect. Being Jewish, Sapir was discouraged from teaching undergraduates. Also, there were few areas of Yale academic life where Sapir's interdisciplinary appointment was not seen as threatening. Still, Sapir became the prestigious Sterling Professor of Anthropology and Linguistics in 1931.

While at Yale, several dozen students who were to help define the course of anthropology and linguistics for the next thirty years studied with Sapir. These included Morris Swadesh, Carl Voegelin, Mary Haas, George Trager, Charles Hockett, and Zellig Harris (the future teacher of Noam Chomsky). However, it was at this time that Sapir met his most intriguing and anomalous student, Benjamin Lee Whorf (1897-1941), who took Sapir's first course on American Indian linguistics at Yale. Whorf was brilliant, though unusual, and even replaced Sapir in 1937-1938 during his sabbatical year. This was to be Whorf's only academic position. Though a specialist on Hopi, Whorf is primarily known for extending and augmenting several of Sapir's earlier claims on language and thought into the "linguistic relativity hypothesis" (as discussed in Section 6.2).

12.7. FINAL YEARS. In spite of his many personal achievements—and those of his students—Sapir's final years at Yale were also marred by frustration and illness. The rise of the Nazis and anti-Semitism in Germany was disturbing, and seemed to increase Jewish discrimination in the Yale area. Sapir became more involved in politics, and joined several organizations of Jewish-American colleagues (even though previously he had never been especially devout). More immediately critical, however, was Sapir's deteriorating heart condition. In 1937 and 1938, a series of heart attacks prevented him from conducting his planned sabbatical research. During this time, Sapir was elected president of the American Anthropological Association. Against doctor's orders, Sapir returned to Yale to work in the fall. However, the strain of public speaking and teaching proved too much. Edward Sapir died on February 4, 1939, at the age of 55.

12.7. REASONS FOR A RENEWED INTEREST IN SAPIR. The so-called Sapir-Whorf Hypothesis and linguistic categorization have become interesting areas of research in cognitive science. Recently, cognitive anthropologists and linguists are extremely interested in language categories, and their growth and development. And to what extent do these language categories—and other linguistic structures such as grammar and morphology—influence thought and perception? This has been a debated issue for half a century. But at the present time, there is evidence coming from a number of areas (such as we have described here) which is reformulating these issues in a new way. The ideas of linguistic relativity of Sapir and Whorf may have new contributions to make in these debates.

A another reason for new concern with Sapir has to do with a renewed interest in the relationships between culture, personality, the self, and the individual. The newly emerging discipline of "cultural psychology" is examining things like socialization and enculturation, the cross-cultural universality of psychological processes, and the effects of language and culture on mind and emotion. These are issues that Sapir struggled with throughout most of his career. In fact, to me, Sapir sounds absolutely modern.

Finally, Sapir anticipated many of the concerns of the new so-called "interpretive anthropologists" of the 1980's and 1990's (cf. Geertz 1973). These interpretivists have questioned how it is we should do—and describe—fieldwork. Should we look for general laws of culture and report only objective "scientific" facts? Or should we focus affectively and subjectively on ourselves and our own experiences as we try to apprehend a culture? On this topic, many of Sapir's notions, such as the intuitive unconscious patternings that individuals use to grasp a language or a culture, are remarkably prescient.37

13. Resources

Color nomenclature and color theory have reached their most theoretically sophisticated plateau to date. I recommend the following for a most complete overview: the interdisciplinary studies given in Hardin and Maffi (1997); the collection of readings in Byrne and Hilbert (1997a and 1997b); the second edition of the seminal study by Berlin and Kay (1991); MacLaury's exhaustive study and vantage theory (1997); and Cohen's psychological review (2000).

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A Possible Set of Basic Color Terms in Japanese

1.	shiro	白	WHITE
2.	kuro	黒	BLACK
3.	aka	赤	RED
4.	ao	青	BLUE
5.	ki-iro	黄色	YELLOW
6.	*midori*	緑	GREEN
7.	cha-iro	茶色	BROWN
8.	murasaki	紫	PURPLE
9.	*pinku*	ピンク	PINK
10.	*orenji*	オレンジ	ORANGE
11.	hai-iro / *guree*	灰色 ／グレー	GREY
12.	*kon*	紺	dark BLUE