Hierarchies of the Senses:

Investigating Color, Texture and Scent in American English

Laura Kelly

Department of Sociology and Anthropology

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Dr. John Gatewood, Advisor

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Abstract

Hierarchies of the senses is an anthropological concept that is being explored through ethnography and cross-cultural comparisons. The concept centers on whether there is the same social importance levels of sense experience in different cultures. To have truly comparable understandings of sense hierarchies, empirical research is needed. I am introducing the use of group communication accuracy as a measure of sense importance within a language group. The experimental data is a pilot study of how this research could be conducted using three senses: sight, smell and touch. A hierarchy is found: sight has significantly greater communication accuracy than smell and touch. Smell has insignificantly higher communication accuracy than touch. The problems of design and implementation of the pilot-study are discussed along with potential issues involved in expanding the study to a cross-cultural level.

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Section I: Introduction - The Problem

Hierarchies of the senses is a topic that has gotten some attention recently in anthropology. The heart of the concept is that there are different importances attributed to the different senses in a culture. Should these hierarchies of the senses exist, the next question from an anthropological viewpoint is whether these hierarchies will be the same pan-humanly or if they will vary from culture to culture. In one culture the most important sense could be smell with hearing being least important, and in another culture hearing could be most important while taste is not so important.

What does it mean for a sense to be important? How is that represented in a culture? What should we look at (or should we say sense) to figure this out? Classen (1993:135) claims that the Ongee are a people who have smell as their most important sense because their cosmology is spoken of in smell language. They point at their nose to refer to themselves; they paint their bodies in order to change their smells rather than change their appearance (Classen 1993:128). Classen takes this evidence to mean that smell is the principal sense to this culture. Anthropologists of the senses often refer to Western culture as visual-centric (Classen 1993:6) with hearing a distant follow-up, but well higher on the scale than the 'lower senses' of taste, touch and smell. Yet in Western culture, scent is a huge industry. Perfumes, deodorants, cleaning products and air fresheners sell very well. In American capitalist culture, we often show our support or preference for something with our money. We spend significant amounts of money on pleasant smells and eliminating unpleasant ones. How can these very different ways of considering the importance of smell in different cultures be compared?

When something is important to two or more people, they will talk about it until they are satisfied they both understand it the same way. If you are picking a color of paint and are describing the change over the phone, you may start by describing the color by the factory label. When that description is meaningless to your listener, you quickly start comparing it to other specific colors he or she would know. They might ask questions until they are satisfied they know what you are talking about or give up, needing to see it to understand what you mean. If you were preoccupied with color and were constantly explaining colors over the phone to this friend, you would probably develop an idiosyncratic vocabulary of comparison: "like that green shade my brother painted his house," "remember that hideous brown dress Marie wore to that New Year's party," etc. If it were a preoccupation of your culture and something you could talk about with any acquaintance, the language on the topic would have to be standardized throughout the culture. Two people who had never talked to each other previously would need to be able to understand each other and to surmise they are talking about the same thing.

If importance is defined as ability to communicate about something well, it could be measured. A significant shared vocabulary of distinctions on a particular topic indicates the social importance of the topic to the possessors of the vocabulary. The amount of inter-subjectively shared vocabulary is quantifiable and measureable.

How does this concept of hierarchies of the senses interact with human biology? We, as humans, are one species with the same sensory systems. In human evolution, changes in the sensory apparatuses were a defining feature that separated the primates from other animals (Campbell, Loy & Cruz-Uribe 2006:63). There was an enlargement of the eyes, increasing the quantity of light and detail discriminated, along with changes of the

retina to increase sensitivity to low levels of light and to more colors. The eyes came to look forward with overlapping visual fields that give primates stereoscopic vision. A bony ring or a full bony socket developed to encircle the eyes for protection. To accommodate the enlarged eyes there was a reduction in the olfactory apparatus, especially the snout. Vision became much more advanced in primates, reducing the capabilities of other senses especially the sense of smell. The evolutionary record appears to support *a* hierarchy of the senses.

How can we reconcile these evolutionary facts with the ethnographic evidence of varying sensory organizations and privileging, varying hierarchies of the senses? One way to look at this question would be to do biological work, looking at how fine-tuned the senses are, how many frequencies of light we can see, how fine a concentration of a scent we can smell. This does not take into account culture's influence however. Biologically there are two sexes, male and female. Gender as a cultural construction is not limited by the biology of sex. Physical males can be masculine or feminine; in other cultures there are additional gender categories that are beginning to be recognized in America as transgendered. Biology can tell us the limits of our sensory apparatus and what we are capable of, but it can't tell us how we use our physical capabilities in our lives.

We do not have a way of objectively comparing what people actually experience inside their own minds to see if it is the same. Instead, we will use language as a measure of the social importance of experience. People use language as a vehicle to express experience to each other. In this way, communication accuracy will measure the cultural importance of the senses. Lantz and Stefflre (1964) developed this measure, and a variation, group communication accuracy, was introduced by Lucy and Shweder (1979).

The basic process of group communication accuracy is: (1) all the subjects individually describe the stimuli, (2) the descriptions are semantically narrowed into a single group label for each stimulus, and (3) the subjects match the group labels to the stimuli. If the subjects match the description to the intended stimulus, they are scored as getting that decoding correct, or accurate. Compiling all of the scores into totals by sense domain provides a comparable score. A higher score would mean people are able to communicate better about distinctions between objects, which, if my earlier logic holds, would indicate that the sense with the highest score is most important to the group. If all cultures have the same hierarchy, then biology is dictating how well people can distinguish within the senses and that is being reflected in language. If hierarchies vary, then culture affects the importance of senses.

The bulk of this paper is a pilot-study of this research design. Being an undergraduate surrounded by American English speakers, American English was the language that was investigated. It had the additional advantage of being the language I speak, and therefore I was able to have more control over the portions of the design that depend on a native speaking informant than I would be able to have in investigating any other language. I will elaborate on the anthropology of the senses along with its investigations into hierarchies of the senses. From there I will discuss the methods others have used to examine sense data and explain the logic of choosing my methods. The actual research will be presented, analyzed and discussed. The trials and tribulations of doing this sort of study will be recounted for learning purposes. The pilot-study is intended to be an illustration of how this concept could be addressed in cross-cultural research. I will discuss the additional issues that would need to be dealt with to scale up this research

design. The hope is that this research would be improved upon and conducted to answer the driving question of this experimental design: do all people have the same hierarchy of the senses?

Section II: Anthropology of the Senses - Hierarchies

Sense data and how we interrupt them are an integral part of how we interact with our environment, maintain relationships with people, protect ourselves from threats to our safety, understand ideas, and generally live life. Every moment of everyday we are gathering sense data consciously and/or subconsciously. The sense deprivation experiments conducted at McGill in the 1960's, and the hallucinations that resulted in subjects, show us how integral sensory input is to our very sanity (Vernon, Marton & Peterson 1961). Being such a basic part of the human experience, it is clearly something that should be examined by anthropology, the study of humankind.

The anthropology of the senses has become a recognized sub-discipline in recent years (Herzfeld 2001, Synnott 1990, Ricke 2007). Sensuous anthropology, or anthropology paying attention to the all of the senses, was informally conducted early in anthropological history by ethnographers such as Malinowski and Mead as a normal part of their methodology. According to Howes (2003:17-22), there was a theoretical shift in the 1970's incited by Geertz to reading cultural acts as texts that caused vision to become more hegemonic than it previously had been in anthropological theory and practice. Howes casts the blame on Geertz's metaphor because he thinks that treating events as texts makes them more like articles or photographs, as stable and analyzable as written history. Howes (2003:19-20) views textual interpretation as taking the dynamic reality out of ethnography, as well as taking the anthropologist out of participation and the immersion of the senses in reality, favoring observation and interpretation at a distance. A renewed focus on concentrated work on the senses is something of a recent phenomenon in anthropology (Howes 2003:29).

Some of the earliest work in anthropology of the senses occurred when Concordia University created the Concordia Sensoria Research Team (CONSERT) in the 1980's. Their first project, The Varieties of Sensory Experience, was to generally explore sensation as an aspect of anthropology and ethnography (Synnott 1990). One claim they made was that there were different hierarchies of the senses in different cultures; that privileging information that comes from one sense over information from another sense is culturally learned, and varies from culture to culture. The evidence for this is mostly anecdotal within larger ethnographies not concentrated on the senses.

A major figure in the anthropology of the senses is David Howes. He is a professor at Concordia University and was an original member of CONSERT. His ethnography focuses on the senses among the Kula of the Massim region in Papua New Guinea (Howes 2003:61-172). In addition to his ethnography, a major contribution Howes has made to the study of the senses was to create the trappings of a sub-discipline. He has compiled anthologies (Howes 1991, 2006, in press), started and is the managing editor of a specialized journal *The Senses and Society,* and compiled the history of sensuous anthropology (Howes 2003:3-58). In one of his anthologies he has a section that lists 50 major sensuous scholarly works (Howes 2006:404-406).

There are many other researchers doing studies on the senses. Berg Publishing has put out a series of 'readers' in the senses: a general reader (Howes 2006), one devoted to each of the five traditional senses of the West (Edwards and Bhaumik 2009, Drobnick 2006, Classen 2005, Korsmeyer 2005, Bull and Black 2003) as well as one forthcoming on a sixth sense (Howes in press). The sub-discipline warranted a chapter of its own in a recent text on anthropological theory (Herzfeld 2006:240-253). Anthropology News (2009) featured

an issue half devoted to expressing multisensory experiences through multimedia. The other half of the issue focuses on vision, supporting the general consensus of anthropologists studying the senses that vision is still the primary sense studied by researchers from the West.

The discipline has expanded in the past few decades with more ethnographers starting to focus their attention on the senses. The research has mostly fallen within three main tracks exemplified below via the work of some major figures of the discipline.

Stoller focuses on reflexive sensuous accounts. He is calling for more sensually descriptive ethnography. He believes that the standards of anthropology as science have created a model of publishable anthropological writing that is sterilized of anthropologist's voice and the idiosyncratic nature of ethnographic work (Stoller 1989:49). He instead advocates for including the first hand perceptions of the anthropologist, inviting the reader to understand how the anthropologist felt, to step along side him/her into the world of the other (Stoller 1989:54).

He tells us in his ethnographic accounts of fieldwork among the Songhay of Niger what he feels, tastes, etc. When he tastes a "bad sauce," he tells us about it (Stoller 1989:22). When he temporarily looses feeling in his legs and has a personal crisis of Western secular rationality warring with West African witchcraft, he tells us about it (Stoller 1989: 46). "Although anthropologists, like painters, lend their bodies to the world, we tend to allow our senses to penetrate the other's world rather than letting our senses be penetrated by the world of the other" (Stoller 1989:39). Stoller wants anthropologists to participate rather than observe with scientifically shaded lenses, to experience the world of

the other, then to talk/write/publish about the world that they have experienced rather than just the aspects of their experience that are acceptable to the Western community.

Stoller does not directly address hierarchies of the senses. He focuses on experiencing and describing the very different sensual world of the Songhay, not their different senses themselves.

Stoller would likely critique my research design as too empirical, too rigid in my methods. He is advocating the dynamics of culture that my study will necessarily try to minimize. I critique his method as too idiosyncratic, too based on the perceptual biases of the scholar. Both types of studies have a place in anthropology; they look at similar problems from different angles to give us a better overall understanding in the literature.

Another method of pursuing sensuous ethnography is to rely on native accounts of sense experiences. In this method, the researchers usually deal in some version of hierarchies of the senses. Geurts studied the Anlo-Ewe peoples of coastal Ghana. In particular, Geurts contends that sensorium, the unique combination of varying attention to the senses, is an essential part of a cultural group's identity (Geurts 2002:5,16). She set out to understand the Anlo through their senses, but they claimed not to have any (Geurts 2002:37-38). What she eventually realized was that they didn't have sensations separate from perception and knowing. It was all a single concept: *seselelame* (Geurts 2002:40-43). Rather than imposing her own sensorium on the Anlo, she struggled to understand how they experience and categorize the senses.

Geurts describes the goal of her ethnography as presenting "a society where the senses are understood quite differently than in our own and, through this comparison, to

illustrate that our own approach is only a folk model" (Geurts 2002:3). How much of our ideas about the senses are part of a folk model? How much is biologically determined?

Guerts (2002:25) believes that the role of an anthropologist is to create histories of contemporary peoples rather than to produce scientific documents. I'm not sure if she is discussing ethnographic anthropology, suggesting that it should not be too formal and sterilized of complexity or if she is referring to all of social anthropology and would dislike my study as Stoller would. Regardless, I am proposing that empirical methods would make 'folk models' much more comparable if only to investigate a very specific aspect of what Guerts is trying to explore in her ethnography.

A third pursuit of the anthropology of the senses is to do cross-cultural comparison. Along with others of the CONSERT, Classen (1993) does this type of research. She pursues two types of cross-cultural research: comparing contemporary cultures with each other and doing temporal comparisons of Western historical sensory conceptions with modern Western sensory conceptions. All of these comparisons directly relate to hierarchies of the senses and highlight what she takes to be different hierarchies.

In the historical section of her book, Classen (1993:7-9) traces the changing symbology of the rose as an intersection of olfactory and visual perfection, researches the etymology of sense words, and looks at the enculturation of 'wild children' who were re-assimilated into society. She finds that smell was once much more powerful in the meaning of a rose, while visual beauty is now more important (Classen 1993:7-8). Sense words do not reflect a static understanding of the senses. Instead, meaning morphs with words that refer to one sense coming to refer to another over time (Classen 1993:8-9). Historically people, even our Western ancestors, do not have a static understanding of

sensation and perception. The wild-children Classen recounts had natural inclinations of interpreting the senses that developed outside of human culture that were much different from those of the cultures they ended up in (Classen 1993:8). Natural tendencies in regard to the senses do not provide for easy integration into a culturally structured sense understanding.

In the cultural comparison section, Classen looks at varying olfactory codes, the negative reaction the Andeans had to text as a colonizing force, and compares three cultures that use non-Western metaphors to articulate their 'worldview.' Odor can hold social class meaning, gender meaning, as well as various other classification systems in different cultures (Classen 1993:9-10). Andeans of Peru hold onto their oral traditions and oral mythology that explains the world and humans as spoken into existence (Classen 1993:106-107). They view literacy as a hegemonic force trying to destroy their way of life through silence (Classen 1993:119). The visual culture of the Spaniards becomes a point Andean leaders can argue against reinforcing the cultural divide, and preserving Andean culture (Classen 1993:116). The cultural groups of the Tzotzil of Mexico, Ongee of the Andaman Islands, and Desana of Colombia frame their cosmologies in terms of temperature, smell and synaesthetic colors respectively (Classen 1993:10). Looking at the same phenomenon, fire, "the Tzotzil emphasize the heat of the fire, the Ongee its smoke and the Desana its colours." (Classen 1993:10). With her cross-cultural studies, Classen attempts to display a multitude of sensory models in play around the world.

As briefly recounted in the introduction, anyone reading Classen's account of the Ongee (Classen, 1993: 126-131) will undoubtedly be persuaded that scent is extremely important in that culture. The Ongee are said to believe that living things are "composed of

smell" (Classen, 1993: 127). They do not understand their ceremonial painting of the body as a visual symbol but instead as a redirecting of their scent (Classen 1993: 128). This privileging of smell does not necessitate, however, a reduction of the other senses. Scent is clearly important to the culture, but from this description, it is not clear that scent is better able to be experienced than sound or sight, just that the Westerner looking at the situation without asking for the local understanding would likely jump to the wrong conclusion. Are peoples with different sense cosmologies such as the Ongee speaking metaphorically and have the same sense abilities as other humans? Or do they have particular refined senses that go with their different cosmologies?

The comparison of ethnographic experiences is not a satisfactory place to leave the concept of sense hierarchies. If two people standing side-by-side experience the same event, but it is understood differently at a fundamental level, that is significant. I do not know of a way to directly measure sense abilities. What I can measure is the skill, as a language group, to speak about sensual experiences. While not directly gauging sense abilities, language will provide insight into the social ability to talk about and share sensory experience.

Section III: Methodology – Sensotypes, Conversation and Color Research

There have been a number of attempts to look at sense data empirically. Some of these methods will be recounted and evaluated here in terms of their candidacy for becoming the measure of sense importance to be employed in my study. There was one attempt to specifically look at 'sensotypes', which is Wober's (1966) conception of hierarchies of the senses. There are two other methods that I review: Lerher's (1983) experiments on language of wine, and Lantz and Stefflre's (1964) communication accuracy. Neither of these is exploring hierarchies of the senses, but they do look at the interaction between language and sense data.

Sensotypes

I have found one researcher who attempted to look at the hierarchy of the senses through empirical research. Wober (1966) compared American visual centric analysis to that of West African cultures, specifically in Nigeria, noting that they have tonal and rhythmic distinctions that Americans would not pay attention to. Wober defines sensotypes as "the pattern of relative importance of the different senses, by which a child learns to perceive the world and in which pattern he develops his abilities" (Wober 1966: 182). This is a very similar idea to that I am investigating with the hierarchy of the senses.

Wober's research was done in the tradition of investigating culture and perception characterized by the carpentered world hypothesis. Segall, Campbell and Herskovits (1966) developed a study of visual illusions based on this same hypothesis. They explain the hypothesis as the influence of a person's environment on their typical perception tendencies (Segall, Campbell and Herskovits 1966:84). If a person is surrounded by right angles and straight lines as is typical in a carpentered world, they are more likely to try to

understand the lines and angles they see in terms of right angles and straight lines. Rather than see slightly smaller or larger angles, people from carpentered worlds assume it is their own perspective creating the non-90 degree angles rather than the images having non-90 degree angles in reality, even when looking at a line drawing with no obvious 3D referent. When producing images, rather than perceiving them, Westerners have "the distracting tendency to draw things as 'we know they are' rather than 'as they appear'" (Segall, Campbell and Herskovits 1966:96). Without the constant environmental stimuli to interpret these images in this way, people do not tend to create right angles out of non-right ones.

Wober takes this concept of visual relativism inherent in the carpenter hypothesis and extends it to the senses. If there was no need for the type of visual analysis measured on abilities tests in Nigeria, perhaps that would be the reason why Nigerians performed less well on the tests rather than a difference in intelligence. Wober's methods were to give Nigerians imported American abilities tests and compare their performances to American performances. One test was much less visual than the others, and this is the test that was best performed on by the Nigerians. He creates a tactile version of one of the other tests, but this does not yield any significantly better results.

Wober's subjects are men and he doesn't perform the tactile test on Americans. He does not attempt to examine the whole range of sensory possibility. While these are large holes in his research, he does present the same concept that I am looking to investigate. He notes the work of a colleague, J.W. Berry, that languages other than Western languages that Western educational models have long been working within may not have the vocabulary to differentiate visual concepts such as geometric shapes (Wober 1966: 188). Wober

concludes that the abilities of West Africans are not primarily visual and that other systems of communication and understanding, namely auditory ones, are supreme in these cultures. Even if using a deeply flawed design to investigate this, he is trying to be systematic in his methods, using standardized American tests as a measure.

Wine And Conversation

Lehrer (1983) studied the linguistics of wine. In her study, she looks at the speech of wine novices who have never discussed wine previously, wine novices who talked about wine with each other over a period of weeks, and wine experts, many of whom have been trained together. She had these subjects taste wine for her over a number of weeks, doing different tasks. While she had them do a variety of tasks, I was particularly interested in the communication tasks.

The first novice group was tested using three tasks (Lehrer 1983:80-83). Lehrer paired the subjects, had one subject taste a set of six wines, three red and three white, writing down a description for each with the stipulation that there could be no visual descriptors. The other person would then receive the written descriptions and try to pair the descriptions to the wines. This did not result in correct matching better than chance except in one case, the sweetest wine (Lehrer 1983:81). In the second communication task, she takes a group of three, herself and two others, who create descriptions about a set of wines. The committee discussed the wines to agree upon their group descriptions. They created straightforward descriptions for each wine along with a more far-fetched one. There was no consistency in matching the wines to the descriptions, or to matching the paired straightforward and far-fetched descriptions to the same wine (Lehrer 1983:83). The last task she gave these wine novices was to discuss wine in pairs so that they could

explore the language that they put to the wine and find agreement. These pair agreements did not cumulate into a group consensus (Lehrer 1983:83).

In the second group of novices, Lehrer repeated the task using the committee's descriptions with similar results (Lehrer 1983:99). She then did a variation where the subjects were in pairs, seated at separate tables, but able to talk to each other, without the use of visual language. They were to come to a consensus on which descriptions matched which wines. The results were very mixed on this task (Lehrer 1983:100). The final communication task for this set of subjects was for them all to converse about a set of four wines together without reference to visual clues. In this task, they were able to correctly match the wines to each other significantly better than chance (Lehrer 1983:102).

With the wine scientist group, she repeated the matching task where the pairs were sitting at different tables describing the wines trying to match them through conversation without reference to color (Lehrer 1983:123). Additionally, they were given the task twice more by a different researcher, John Reid (Lehrer 1983:126), who allowed them to use color and appearance in conversation as well as limiting the wines to California varietals that the scientists were particularly familiar with (Lehrer 1983:129). During the first task the scientists did not do any better than the novices (Lehrer 1983:129). When visual clues and familiarity was returned to them, they matched the wines significantly better than chance (Lehrer 1983:127).

Through these experiments it is clear that people don't have a set vocabulary for wine that they can rely on to convey an experience. If that were the case, these subjects would have understood each other much more often. What was particularly interesting was that when able to converse (try out descriptions, get feedback, and then modify the

description or try a different aspect of the wine to describe) the subjects were then somewhat able to figure out what experience was being described, they were able to understand each other. This indicates that the wine was not well coded into language for the subjects, that they didn't have the shared vocabulary to describe it precisely, and were distinguishing more than they had words for, but through conversation, they were somewhat successful at developing an ad-hoc vocabulary to deal with the particular wines. Also interesting, the experts were more successful at wines they were familiar with, though they were also able to use visual language again at the same time so it could be the preciseness of the visual language that made the difference.

Many of Lehrer's measures did not seem to have much history or testing of reliability. In the tasks involving a single set of descriptions for all the subjects in the group to decode, Lehrer's use of a committee of people with sensitive palates seems arbitrary. Conceptually, Lehrer looks beyond one sense, trying to explore a set of sensations that all are effected by the one experience, drinking wine. I wanted to separate the senses out for comparison purposes. Lehrer's isolation of vision and particularly the possible influence that the ability to discuss vision had on the communication abilities of the wine scientists reinforced the intuition that isolation is necessary for the comparison of the senses.

Color Research Tradition

The Sapir-Whorf hypothesis is a long-standing area of debate in anthropology. The hypothesis is that language is a filter through which we perceive the world. Habitual language influences habitual thought so that all input is funneled through familiar channels formed by language, both facilitating quick interpretation and privileging particular construals of reality. The counter argument is that thought and the workings of the human

mind are independent of language; thought works the same way regardless of what language a person knows. There is also the in-between position of a weak Whorfian view of the language/thought interaction. Kay and Kempton end their study on boundaries of colors with the claim that "linguistic differences may induce nonlinguistic cognitive differences but not so absolutely that universal cognitive processes cannot be recovered under appropriate contextual conditions" (Kay & Kempton 1984: 77).

One way this language and thought question has been explored is through taking a cross-cultural perspective of color perception and language. The history of this line of inquiry is summarized by Lucy and Shweder (1979: 582-583). Studies consist of a language task and another task that is supposed to measure cognition without the direct influence of language so that language and cognition can be compared. Originally investigators were influenced by Whorf's belief that language molded thought. As color research continued the researchers became more convinced that there were biological and thought-based influences that were independent of language. Language was reflecting these cognitive influences rather than shaping them. Each new discovery led the leading opinions of researchers to move from one side of the debate to the other.

My research is not a direct continuation of the investigation into the language and thought question. In a way I am re-framing the question and re-directing it in terms of senses: is there a natural distribution of sense capabilities that we are able to utilize and talk about or is the amount and degree of precision we use when talking about the senses shaped by social forces? The color research tradition created methods and concepts that explore the intersection of sense data and language: naming agreement, brevity of description, and communication accuracy.

Lantz and Stefflre (1964) investigated some previous measures (naming agreement, brevity of description) and communication accuracy, a measure they introduce. Naming agreement is a measure of how well descriptions of stimuli from different subjects match each other (Lantz and Stefflre 1964:472). Brevity of description is a count of how few meaningful words are needed to describe a stimulus (Lantz and Stefflre 1964:472-473). Communication accuracy is a measure of how well a stimulus can be described and then understood by a second subject (Lantz and Stefflre 1964:473). These measures were compared to memory, a non-linguistic task. They found that communication accuracy was better able to predict memory and was more correlated to the recognition results than the other two linguistic measures (Lantz and Stefflre 1964:478).

Communication accuracy consists of having encoders describe an object so that someone other than themselves could choose it from the group of stimuli (Lantz and Stefflre 1964:473). The description is given to a decoder who must then match it to one of the stimuli. The score is a composite of the average of correct and incorrect matchings. There are two assumptions made with communication accuracy: that the first language of the encoders and decoders is the same, and that the descriptions will be meant for public communication rather than personal communication (Lantz and Stefflre 1964:473).

Communication accuracy was attractive as the measure for my study since it was related to, but went a step further than, the other measures that Lantz and Stefflre investigated. In addition to being the best of the techniques in relation to memory, the ability to accurately communicate between individuals gets at the social aspect of sensual experience. While language is inherently social, communication accuracy makes this goal

of understanding each other explicit rather than the presumption that encodings would be understood by different subjects found in the other measures.

One major issue with communication accuracy is that it is very time intensive. In order to get a sample of any significant size, communicating about a significant number of stimuli, each subject would have to encode the objects and then decode a considerable number of communications from the other subjects. The data would only be reliable if a significant number of subjects decoded each encoding, leading to a taxing amount of data being collected from each subject.

Fortunately, Lucy and Shwedar (1979) found a way to solve this problem. They designed a variation they call group communication accuracy. In this new measure, rather than have all communications be direct, one-to-one communications, all of the encodings are condensed into a single group label for each stimulus (Lucy and Shwedar 1979:596-597). The condensing, or latent coding, is done based on frequency as well as semantic collapsing. This creates a single set of descriptions to be decoded by all the subjects, allowing more time to be spent on more subjects rather than having fewer subjects doing more work as with the basic communication accuracy design. Group communication accuracy was shown to have comparable results to the original design (Lucy and Shwedar 1979:598).

In both studies the measures were compared against memory tasks. Through the testing, communication accuracy of either variety was found to be better correlated to color memory. Group/two-person communication accuracy was the best indicator of thought related to sense data of all the measures. Group communication accuracy is the measure I decided to work with since it is considerably less taxing on the subjects and

produces a larger sample size for greater reliability of the results in addition to the greater correlation to thought.

Discriminability

A basic assumption of communication accuracy is that the objects of an array are equally different or equally discriminable from each other. Lucy and Shweder (1979:590-591) conduct a series of tests on an existing unequally discriminable color array. They eliminated the colors that were confused for other colors, and then repeated the process again when they found the first modified array to still have biases. The second modified array was free from a significant difference between sets of colors that they had previously been finding.

For my experiment, the stimuli are not comparable directly. Stimuli for different senses cannot be put in the same array with any expectation of equal discriminability. Instead, they need to be in their own arrays that are internally equally discriminable, and then, in order for the sets to be comparable, the various arrays for each sense need to have the same *amount* of equal perceptual discriminability. Without theses two levels of equality of discriminability, the measure of communication accuracy will not function properly for determining hierarchies. This is a problem that did not have an obvious solution.

Unable to think of a more cleaver alternative, I decided to rely on human judgment as the discriminability measure. After informal judgments, I chose to conduct formal comparisons. The discriminability of a group of objects can be tested by triadic comparisons or by pile-sorting. These methods are explained in depth by Weller and Romney (1988). In triadic comparisons (Weller and Romney 1988:31-37), every item in a

set is compared directly with every other possible pair of items from the set. The subject is asked to identify which item is most dissimilar from the other two. In an equally discriminable array, no items are consistently paired as more similar to each other than to any other pair of items. This is a very time intensive method. A less precise and quicker method is to do successive pile-sorts (Weller and Romney 1988: 26-31). In this method all the objects are lumped together and the subject is asked to move one object at a time, separating them out. They can either separate each out from the group or move objects so that they are paired with other objects that have previously been removed from the group. I decided to use successive pile-sorts but I changed the constraints to be the number of piles rather than the number of movements. The subjects would create two piles, then three piles, then four piles, etc. This allowed subjects to separate objects based on multiple dimensions of difference. For example, with the color in the first pile-sort they may decide to do it based on whether the colors are bright or dull, the second could be light, medium and dark and so forth. By not restraining their separations to one movement each pile-sort, the subjects had more freedom to express the different dimensions they were experiencing. The positive result of the pile-sorts would be for all the possible pairings of objects to have been made an equal number of times.

Section IV: The Experiment

In the pilot-study of hierarchies of the senses investigated via group communication accuracy, I used American English as the language of study. In this section, the details of implementing the research are presented followed by the data analysis. Based on the anthropology of the senses literature, I hypothesized that sight would be have the highest communication accuracy, but I did not have a prediction for the order of smell and touch.

Stimuli Selection

This being an undergraduate thesis with restrictions on time, the study only measures three senses: sight, smell, and touch. Sight was an obvious choice in two respects. Anthropologists of the senses repeatedly claim that vision is the primary sense in Western culture. This will serve as a test to see if the data aligns with what is found routinely in the world. The second reason is that the measure of group communication accuracy is being borrowed from a color research tradition. Employing the measure on the stimuli the methods were designed for will serve as a check that the measure is working properly transferred to this new purpose. This second reason to use color is distinct from the alignment with anthropologists' claims. Sight being primary is likely, but not a required outcome for the measure to be working properly. Smell seemed like it would be an interesting sense to investigate because it seems to be particularly hard to discuss scents in American English. We do not have main terms that are taught to us in kindergarten like the colors or flavors. Touch was chosen as the third sense because it seemed to be a bit easier to casually talk about, but its categorization scheme is still not as systematically taught as sight's organization. In a full-scale version of this study all the senses would be investigated, and the reasons for selecting them would become a moot point.

The first step in the stimuli selection process was to choose a narrow domain of each sense for the stimuli sets to fall within. I decided to work with color because of the history in color research and the borrowing of color research methods, as explained above, but also because color is limited to vision it can't be felt nor can it be smelled.

Within color, it would not be very informative to have an object that is within the English linguistic category of blue, another that is in green, another that is in red, and so forth. The information that is sought in this experiment is found at a finer level of distinction. The objects need to be selected from within one basic linguistic category to have a level of discriminability, or distinctness, that is interesting. I chose to select colors that would be identified in American English as purple. When describing the paint chips, the subjects would have to use language beyond just 'purple' since that word applies to all of the objects. The stimuli were chosen to be on the edge of where English has standard language to describe the differences between them and where the descriptions will be novel creations by the subjects.

This conceptual process was repeated with touch and scent. I chose the category of smooth fabrics for touch and the category of floral incense for scents. Since fabrics are subject to sight as well as touch, a way to block visual sense data from being experienced needed to be devised. Incense cones carry different scents but look the same. A way to block the scents from all being experienced at the same time, loosing their distinctness, needed to be devised. These issues will be addressed below.

The next step was to find the actual objects. Since seven is the average number of distinct items that can be held in short term memory at the same time (D'Andrade 1995:43), the number of objects for each set was seven. I acted as my own American

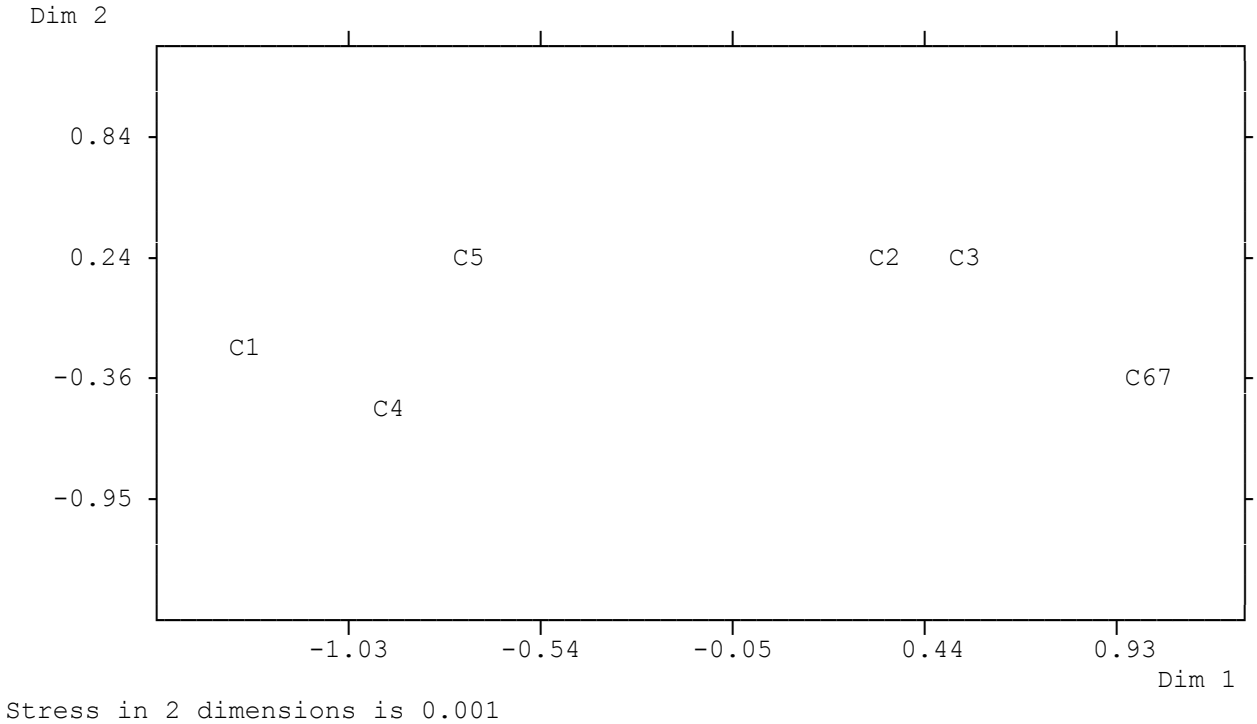
English language informant as a native speaker of the language. When shopping for fabrics, I was able to feel the fabrics and know which ones fell into the category of smooth in American English and which did not. In addition to my own expertise in American English, I relied on an informal panel of three informants to confirm my categorizations.

I asked these informants to judge whether the textures of the fabrics felt sufficiently distinct to be confident that they were all different fabrics. If the stimuli were not perceived as having difference, there would be no need for different linguistic descriptions of them. There being a perceptual difference is imperative; without a need for different linguistic descriptions, there would be nothing to be measured with group communication accuracy.

I also asked my informants to judge whether all the objects were approximately equally discriminable from each other. Ideally, no two objects should be significantly more similar to each other than they are to any other object in the set. For the stimuli to have the same level of difficulty for the subjects to describe, they need to be equally discriminable or have equal difference. Two objects that are very similar would be hard to distinguish causing subjects to confuse them. On the other hand, it would be easy to distinguish an object that is significantly different from the rest of the objects.

After seven stimuli were chosen for each sense (Appendix A), I formally tested the amount of difference or discriminability of the stimuli. I submitted my research design to Lehigh University's Institutional Review Board for approval because I was working with human subjects. I received approval before moving on to the formal testing. With a sample of 8 non-random subjects, I conducted pile sorts of the objects. I had each subject do all three sense sets, varying the order between subjects. The procedure for the pile sorts was

to give the subject a set of stimuli in one pile and ask them, based on similarity, to make two piles, then from the two piles to create three piles, then from the three piles create four piles, etc. until all of the objects were separated. The number of piles required in each successive pile sort was the only constraint. They could move as many of the stimuli as they wished. At the end of the task, the subjects were asked to rank the three sets of stimuli based on the relative amounts of difference internal to each.

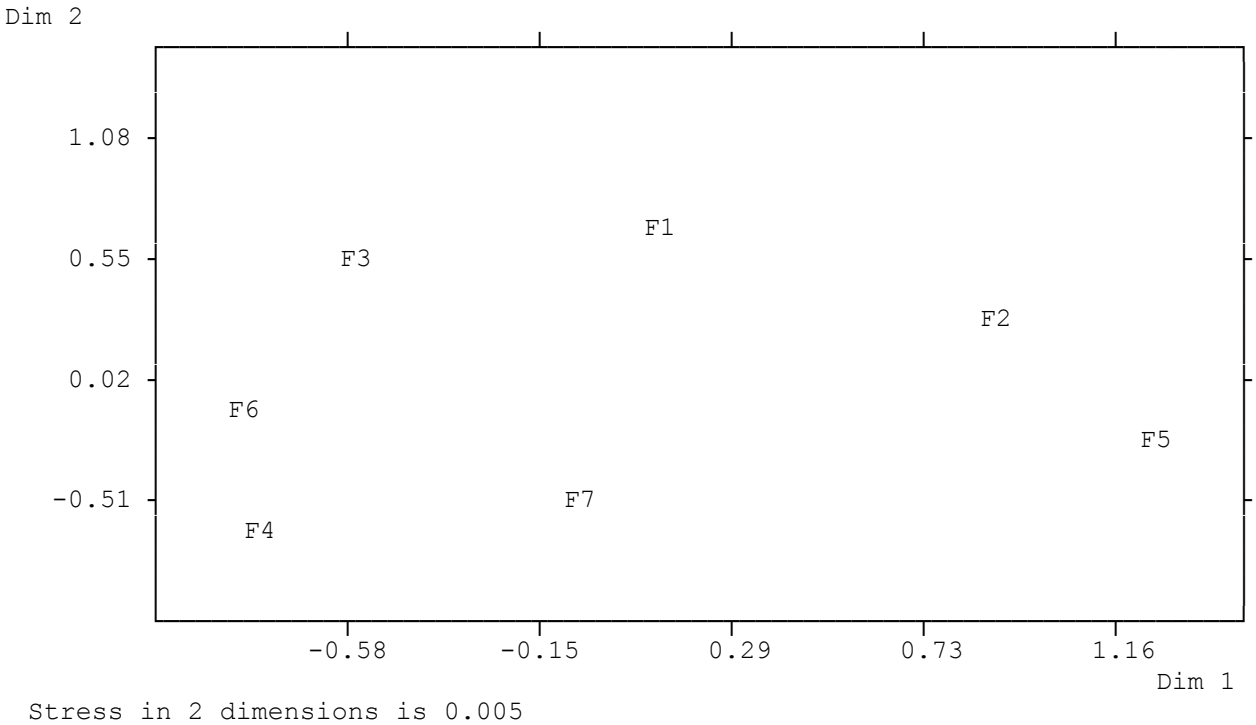


Graph 1: Colors

The pile-sort data were analyzed via non-metric multidimensional scaling using Anthropac (Borgatti 1992). In the MDS graphs from the pile-sorts, a roughly circular shape would be the ideal shape indicating equally discriminable stimuli. The pile-sorts for color showed a distinct structure to the set. As can be seen in Graph 1, the colors are forming more of a line than a circle indicating that they mostly vary along a single dimension, causing objects on one end of the continuum to be vastly different from the objects on the other end, causing the opposing objects to be more discriminable from each other than

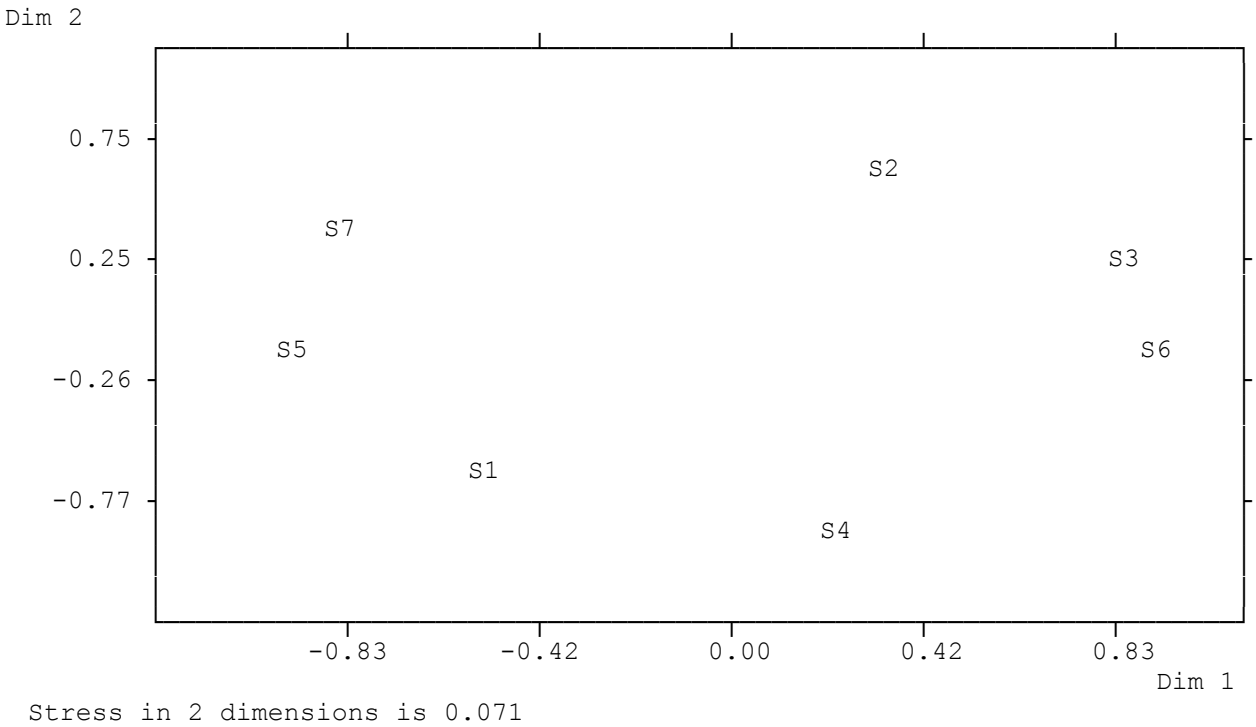
from the other objects. There are two objects (C6 and C7) that are right on top of each other, being judged most similar to each other by almost all of the subjects.

In a non-pilot study that didn't have pressing time-constraints, this evidence of structure would cause the researcher to go back to the beginning and re-select stimuli to get a more evenly discriminable array. Due to the time pressures and the illustrative nature of this experiment, the colors were left as is and used in the encoding and decoding task. This produces a violation of the basic assumptions of the research design and is therefore a known source of error. Two stimuli as similar as C6 and C7 would be expected to lower the decoding accuracy; the subjects are less likely to discriminate well between them.



Graph 2: Texture (Fabrics)

Fabric graph shows weak structure, or a bias of similarity, to the discriminability that is significant but not incredibly strong (Graph 2) and the scents were the most equally discriminable (Graph 3). For a full report of the pile-sort data see Appendix B.



Graph 3: Scent

The Subjects

Subjects were recruited from an introductory anthropology class for extra credit. All interested students were included in testing. The subjects were asked if their first language was American English. One of the requisites of communication accuracy is shared language among the subjects, so any non-American English speakers needed to be identified and eliminated from the results. The subjects were recruited in their class over the course of a week. Interested students signed up for individual experiment sessions. They made an appointment for the follow up session at the end of the first session. The subjects were sent an email reminder the evening before of the time and location of their session. At the beginning of the first session the subjects were given an informed consent form (Appendix C).

The subjects consisted of 40 students of college age (~17-22). There were 24 women and 16 men. There was one male student whose first language was not English, however he appeared to be as fluent as a native speaker and is included in the analysis. For the second task, 3 of the subjects did not return creating a total decoding sample of 37—22 women and 15 men.

Session One: Encoding

The stimuli were presented as distinct sets. The order of the sets being presented was varied from subject to subject. There are six possible orders of the stimuli sets and therefore, the original goal was to have 36 subjects, with each possible order being presented to 6 subjects. The stimuli sets were also assigned based on sex, having equal numbers of men and women responding to each set order. With 24 women and 16 males, the distribution was as even as possible with 4 women and 2-3 men responding to each set order. The order of the stimuli within each set was randomized using Microsoft Excel (2008).

The whole stimuli set for a particular sense was first presented to the subject, in order for the subject to gain an idea of the range of variation. They could take as much time as they wanted getting familiar with the stimuli, usually taking less than a minute with the colors and up to five minutes with the incense and fabrics. Then each stimulus was focused on individually from their left to right. The subjects were asked to "please give a descriptive word or phrase for each the stimuli so that someone other than yourself would be able to pick them out based on your descriptions." The subject was allowed to skip a stimulus and come back to it if they asked or to give a description for a stimulus that was further down the line. The subject was also able to move the stimuli or touch two stimuli at once for

comparison as long as they returned the stimuli to the order they were presented in. The researcher wrote the descriptions down. This resulted in twenty-one descriptions from each subject for the twenty-one total stimuli.

The scents were all in plastic spice jars with the type of lids that have an open 'pour' section, an area with holes for sprinkling and solid plastic 'closed' areas underneath a turning section that has one open section. The jar lids were turned so the open sections were aligned and placed in a line. This proved to be open enough to allow the subjects to smell the distinct scents but limiting enough to avoid the scents all mixing together. For the color task, the overhead fluorescent lights were turned off, leaving a table lamp[1] as the only light source. The chips were placed out in a line. For the fabric task, the subject was blindfolded and the fabrics placed in a line in front of them. The subjects were asked to leave the fabric on the table, only touching the side that was face up.

All three sets of stimuli were presented to the subjects in one session 15-30 minutes long depending on the deliberation time of the subjects. A questionnaire was given to the subjects at the end of the session (See Appendix D).

Session One Results: Latent Coding

After all of the subjects had gone through the encoding task, the group label, or most frequently given description, of each stimulus was identified. As a first step, the lists of descriptions (Appendix E) were run through Anthropac (Borgatti 1992) to get frequency lists. These lists were not decisive because there could be different descriptions with equal frequency for the same stimulus, and also the most frequent description was sometimes the same for more than one stimulus. The decoding task has the subjects matching the

[1] The lamp had a GE energy smart 26 watt/100 watt equivalent bulb

group labels to the stimuli. Having the same description as a group label for multiple stimuli would undermine the objective of the decoding task. With color for example, of the seven stimuli there were three stimuli that had 'dark purple' as one of their most frequent descriptions. There were also three that simply had the word 'purple' as their most frequent encoding. Therefore, the frequencies alone could not determine the group labels.

I took the lists of descriptions for each stimulus and collapsed them semantically in a process called latent coding (Appendix F). For example, for the color chip C4, the original most frequent descriptions were 'plum,' 'bluish purple,' and 'dark purple' all with 3 instances. I took the list and considered extensions of the words as another instance of the same concept. With 'dark purple' I considered 'darker shade of purple bluish tint,' 'dark deep and solid,' 'duller, dark color,' 'darker undertones, second darkest,' 'vibrant darker purple,' 'darkish purple,' and 'dull & dark' as variations on 'dark purple' producing a combined frequency of 10. I included 'darker shade of purple bluish tint' under 'bluish purple' also. With the addition of two 'violet' descriptions, 'bluish purple' had a total frequency of 6. The descriptor 'purple' originally had a frequency of 1; the next step of semantic coding was needed. The terms 'basic purple,' 'medium purple,' 'in between purple,' 'rainbow purple,' and 'plain' were added to 'purple' giving it a frequency of 6. Basic, medium, in-between, rainbow, and plain all refer to the same idea of purple, one without the need for modifiers normally, only receiving them to differentiate it as the quintessential purple among the other purple color chips needing adjectives. All of this coding still leaves plum with only a frequency of 3 and 16 individual descriptors that were not included in any collapsing. Between dark purple and bluish purple there was significantly more descriptors that modified purple. Theses two categories were combined

in making the final description. Therefore, 15, or 37.5%, of the descriptions were represented in the final stimulus description of 'Bluish Dark Purple.'

These final descriptions (Table 1) were termed the 'group labels' of each individual stimulus. They were the descriptions that were then used in the second session, the second task being to decode the labels, matching the descriptions to the stimuli.

Stimulus	Color	Texture	Scent
1	Darkest Purple	Soft and Textured	Scented Soap
2	Bright Light Purple	Roughest	Sweet Floral
3	Vibrant Medium Purple	Stiff and Smooth	Fruity and Sweet
4	Bluish Dark Purple	Thin and Smooth	Strong Soap or Lotion
5	Dull Dark Purple	Soft and Velvety	Weak Floral Soap
6	Pale Reddish Purple	Thin Silky Smooth	Sweet Perfume
7	Pinkish, Light Purple	Stretchy Silky Smooth	Woody or Musty

Table 1: Group Labels

Session Two - Decoding

The subjects were recalled for a second session two weeks after the first. They were presented with the sets of stimuli individually and in a newly randomized order. Each set was presented to them as a whole to refresh their memory of the stimuli range. The subjects were also given index cards with the group labels printed on them. The subjects were asked to match the descriptions to the stimuli. This was completed for all three sets. Scent and color were presented in the same manner as in the first session. The format of the fabric task was altered to accommodate the need to have the subjects read the index cards during the task. Rather than have blindfolds, a barrier of a non-stimuli fabric was placed between the subject and the stimuli suspended between two metal paper towel holders. They were asked to reach under the barrier to touch the fabrics and not to look at

the fabrics should they come into the field of vision by mistake. The researcher recorded the matches made by the subjects. The subjects were given a post-decoding questionnaire (Appendix G)

Analysis

The data received from the second session was entered into a table (Appendix H) in Microsoft Excel (2008). The columns contain the stimulus labels (C1 for Color 1, F1 for Fabric 1, etc.) headings. The rows are labeled by subject number. The boxes in the table have numbers 1 to 7 indicating which group label the subject chose for each stimulus. If the number of the stimulus matches the number of the answer, the answer is 'correct' or in agreement with the group label (i.e. C1=1, F4=4, etc.).

Using these data, frequency distribution tables (Tables 2, 3, and 4) were constructed to show the sample's distribution of answers. In the color table, the 'correct answer' was the most often selected for all of the stimuli. In the scent table, all but one scent was 'correct' modally. In the textures table, it is shown that there were three stimuli for which a particular 'wrong' answer was chosen more often than the 'correct' one and another stimulus had equal distribution between a 'correct' answer and a 'wrong' one. These patterns of 'correctness' are in agreement with the results of the statistics employed below.

	COLORS						
Descriptor#	C1	C2	C3	C4	C5	C6	C7
1	3	0	0	4	3	0	0
2	0	1	6	0	0	8	6
3	0	1	18	2	0	4	0
4	6	0	1	2	7	0	1
5	1	1	1	8	2	0	0
6	0	5	9	1	1	1	5
7	0	1	2	0	1	8	2

Table 2

	TEXTURES						
Descriptor#	F1	F2	F3	F4	F5	F6	F7
1	7	12	2	4	3	4	5
2	6	11	12	2	3	2	2
3	7	4	15	2	3	4	2
4	3	4	5	8	4	6	6
5	8	4	1	5	10	3	6
6	1	1	1	12	4	13	5
7	5	1	1	4	10	5	11

Table 3

	SCENTS						
Descriptor#	S1	S2	S3	S4	S5	S6	S7
1	9	2	0	7	11	3	5
2	6	13	1	2	3	8	4
3	1	3	27	0	0	6	0
4	11	2	3	14	6	1	0
5	4	6	0	3	13	5	6
6	2	8	6	6	2	11	2
7	4	3	0	5	2	3	20

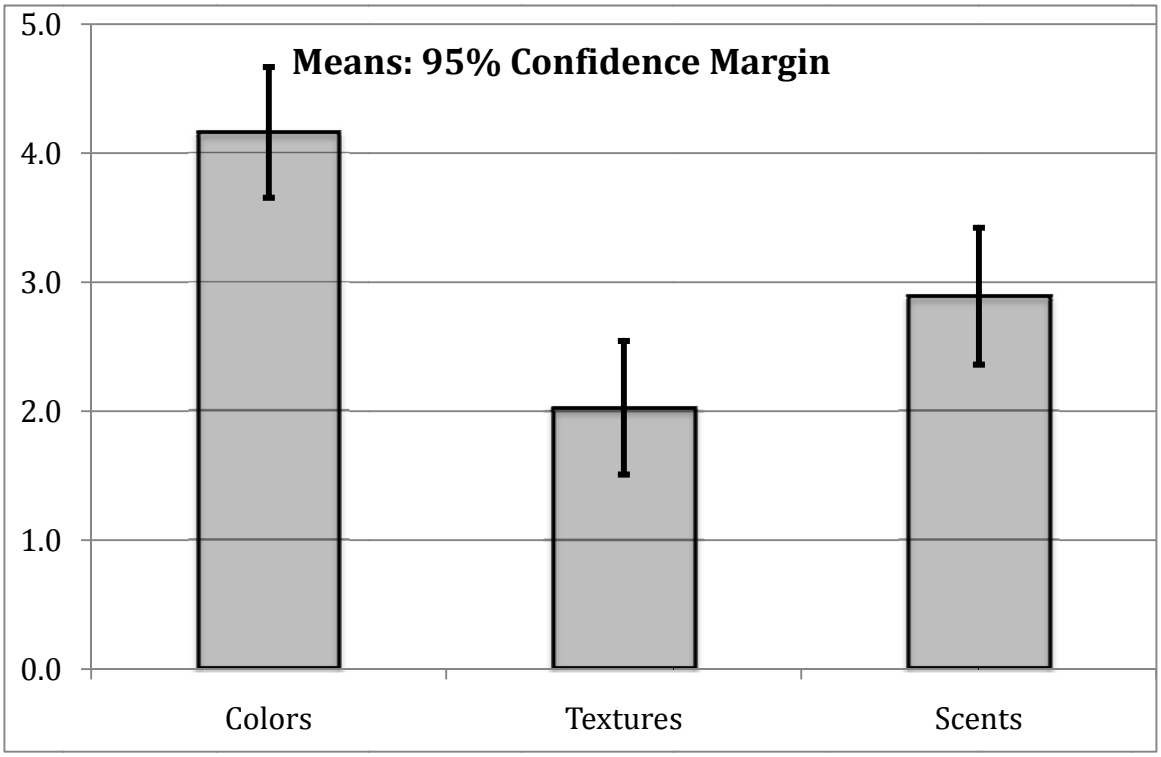
Table 4

Group Communication Accuracy (Means)			
	Colors	Textures	Scents
Raw Score	4.162	2.027	2.892
Percentage 'correct'	59.46%	28.96%	41.31%

Table 5

The original data table was dichotomized for 'correctness' (Excel 2008). The second table (Appendix I) shows an answer in agreement with the group label as a 1 and any other response as a 0. The dichotomized table was used to create another table (Appendix J) that shows how many stimuli of each sense were in agreement with the group label for each subject. These subject totals were averaged together to create group communication accuracy scores for each sense (Table 5, Appendix J).

Color clearly stands out has having a much higher (4.162) group accuracy than scent (2.892) and texture (2.027). Scent (2.892) has a considerably higher score than texture (2.027). These numbers were checked for significance using inferential statistics including One-Way ANOVA (Table 2) and t-tests.



Graph 4

The One-Way ANOVA analysis (Excel 2003) shows that the differences between the senses are very significant (p=0.000) [2]. The differences between the sense groups explain 23.4% of the total variance. This means that a little less than ¼ of all differences were

[2] This analysis was independently checked by Professor Christopher Burke, Dept. of Psychology, Lehigh University. He used multilevel logistic regressions comparing the independent variables of subject, sex, and domain as sources of variation concurrently with the dependent variable of correctness. The same pattern of significance of domains was confirmed, as was the non-significance of sex. Additionally, the analysis looked for variation of competence among the subjects. While there was found to be subjects who preformed better on the tasks overall, there was not evidence that some subjects preformed better in a domain-specific manner.

based on the subjects varying ability to communicate about the different senses. This is a very significant amount of explained variance.

Colors vs. Textures vs. Scents (three domains compared)
Anova: Single Factor
SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Colors	37	154	4.1622	2.4730
Textures	37	75	2.0270	2.5826
Scents	37	107	2.8919	2.7102

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*
Between Groups	85.3514	2	42.6757	16.4861	0.0000
Within Groups	279.5676	108	2.5886		
Total	364.9189	110			

Strength of association (between groups SS/total SS) = 23.4%

Table 5

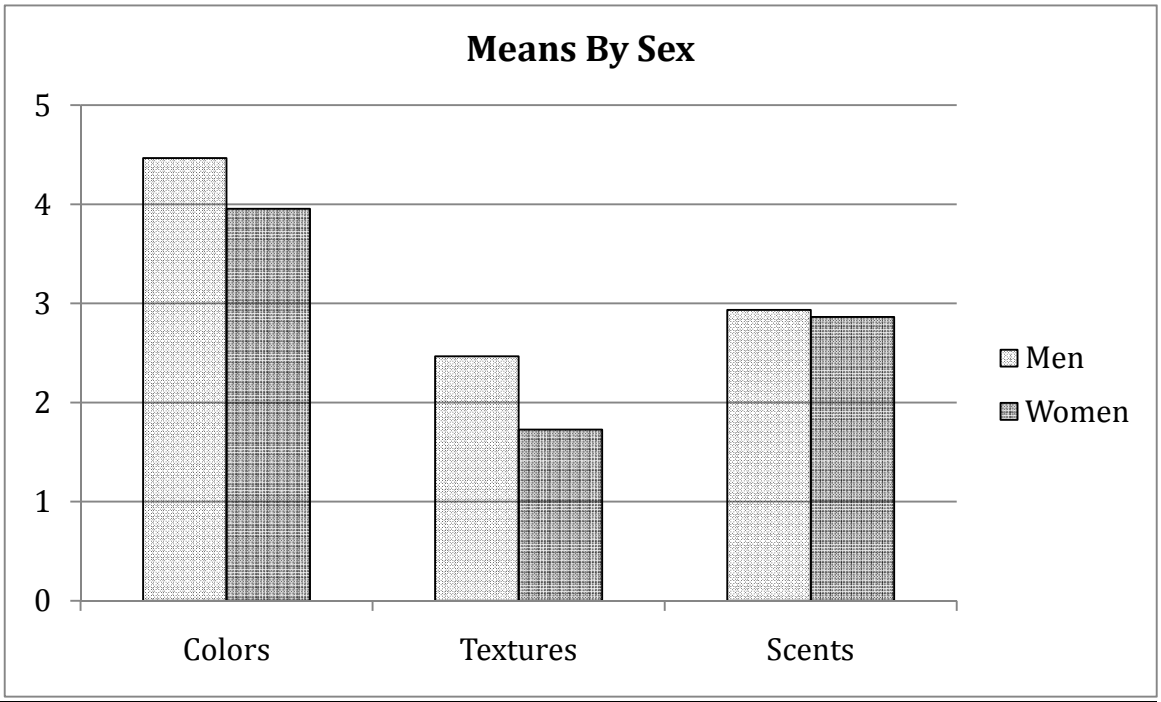
The data were also analyzed for variation based on sex by three t-tests[3] (Excel 2003), one for each of the sense domains. Men were 'correct' more often in all three domains (Table 6), but the difference did not prove to be significant for any domain (Color: t= 0.9718, df= 35, p 2-tail= 0.3378; Texture: t= 1.3918, df= 35, p 2-tail= 0.2173; Scent: t= 1.2564, df= 35, p 2-tail= 0.2173). This analysis shows that the men and women are justifiably considered to be one population in this experiment; any variation between the sexes could reasonably be due to sampling error.

Means by Sex

	Color		Textures		Scents	
	Men	Women	Men	Women	Men	Women
Raw Score	4.467	3.955	2.467	1.727	2.933	2.864
Percentages	63.81%	56.49%	35.24%	24.68%	41.90%	40.91%

Table 6

[3] The t-tests employed were two-sample assuming equal variances. The variances were checked for approximate equality of variance.



Graph 5

Section V: Discussion

The data clearly show that in this sample there is a very marked hierarchy of senses through comparative group communication accuracy. In approximate percentages, sight was understood correctly 60% of the time, smell 40% of the time and texture 30% of the time. This supports the claim that sight is the highest ranked of the senses in American English. It also seems to be indicating that smell is higher on the hierarchy for American English speakers than touch.

Discriminability Error

The findings should be cautioned with the information that the subjects found fabric to have the least amount of discriminable difference while they found scent to have the most. This data was collected in the pile-sort task and the encoding task, through rankings of discriminability given after manipulating and thinking about the stimuli throughout the tasks. 10% is a large difference but it could conceivably be entirely accounted for by the error in stimuli selection. As discussed previously, in any further study using this framework, more time should be given to selecting object sets that are equally discriminable to avoid this ambiguity.

Sight is the best communicated sense by these subjects. This finding is not in question because the stimuli in the color set were judged to be less discriminable than the stimuli in the scent set. This means that the subjects found more difference between the scents than between the colors and therefore should have been better able to communicate about scent if the two senses were equally easy to talk about in American English. If there was any significant error caused by the unequal discriminability, scent's communication

accuracy score would be higher than it should be in relation to sight. Sight having considerably more communication accuracy than scent overcomes this effect.

Metaphors

A more complex way of reading the data might not make the distinction between the senses so straightforward as simple percentages. The descriptions did not consist of only of words mainly associated with the sense described. Deviation from visual descriptions for the colors was along the lines of emotion words. Some examples are 'happy,' 'innocent' and 'gloomy.' These words have clear situational color meanings: 'happy' would be a bold, bright cartoon color; innocent would be lighter, pastel, something a little girl would wear on Easter; and 'gloomy' would be a dark shade, one that could be seen on a stormy night. While referring to emotional state, these words do not directly involve any other senses. For scent, there are some words that could be seen as visual such as 'ocean,' but it is rather common for us to have 'ocean' scented products around without seeing the ocean. Otherwise, the words are all clearly descriptions of the scents themselves. For touch, multiple subjects used descriptions such as 'shiny' and 'sheer,' which are visual descriptions, one for the reflection of light and the other for being able to see through the described object. Touch is a sense that we rarely use without also seeing the objects that we are touching. When something has a certain texture, a person can see that and have a preconceived notion of the feel before they touch it. The subjects came up with these words when talking about textures they could not see.

It is possible that the American English hierarchy is so dominated by the visuality of our culture that the language of touch is partially subsumed under sight. We often smell scents without seeing the object of origin such as perfume, air freshener, soap and other

cleaning products. This is not the case with touch. With the exception of the blind, who would probably perform very differently on these tasks, we usually see what we touch. While we can smell the ocean without being in front of it, we can't feel the ocean unless we are able to see it. The language of touch for the subjects was difficult. This could indicate there isn't a need for precise language about texture when the limited language can be supplemented with visual descriptions in most natural situations.

This tendency may not be unique to American visual-centric culture, however. It is possible that the dual proximity of the senses, what you can touch you can see and what you see you can touch, may be universally linked. The connection operates in the opposite direction. It makes perfect sense linguistically in English to say that an object looks sharp, rough, or smooth. Unless touch stimuli can be chosen that are not normally seen, this issue will be inherent in any touch task.

This linguistic overlap between the senses could be a complexity to be added to the analysis of the study. Visual descriptions were utilized for communication about touch rather than the reverse. They did not use touch descriptions for the colors though we just found some examples of how such an overlap could be understandable. In a society that values vision less dominantly, overlap might still occur but it could be more evenly divided between the senses rather than being mostly used in one direction.

Whorf writes of a similar metaphorical difference in terms of space between Standard American English (SAE) speakers and Hopi Native Americans.

> "Since physical bodies and their outlines in PERCEIVED SPACE are denoted by size and shape terms and reckoned by cardinal numbers and plurals, these patterns of denotation and reckoning extend to the symbols of nonspatial meanings, and so suggest an IMAGINARY SPACE. Physical shapes 'move, stop, rise, sink, approach,' etc. in perceived space; why not these other referents in their imaginary space? This has gone so far that we can hardly refer to the simplest nonspatial situation without

> constant resort to physical metaphors. I 'grasp' the 'thread' of another's arguments, but if its 'level' is 'over my head' my attention may 'wander' and 'lose touch' with the 'drift' of it, so that when he 'comes' to his 'point' we differ 'widely,' our 'views' being indeed so 'far apart' that the 'things' he says 'appear' 'much' too arbitrary, or even 'a lot' of nonsense!" (Whorf 1956:146-147, emphasis Whorf's)

SAE speakers use physical metaphors and objectify concepts as shown in Whorf's sentence about non-corporeal concepts above. This does not make sense in Hopi, they don't have an 'imaginary space.' Instead, they have words that are direct rather than metaphorical. This could be a visualization technique, but even if not directly related to sensation, Whorf provides evidence that metaphor systems reflect cultural modes of thinking, one of which could be hierarchies of the senses.

The domination of metaphors of one sense replacing direct descriptions for another sense would corroborate communication accuracy findings when done in languages beyond American English.

Sex Differences (or lack there of)

It was surprising that the men were able to decode the labels more correctly, even if the difference was not significant. It was pointed out to me that I chose rather 'girly' objects: purple colors, floral scents and smooth fabrics. These mainly fall within the American English conception of feminine objects. Why would men be even slightly more likely to get the decoding correct? I went back to the original encoding data along with my notes from collapsing the encodings into the group labels. I computed men's encodings as a percentage of all encodings that were collapsed into the decoding phrase (Appendix K). Men make up 40% of the subject pool and on average only produced ~36% of the encodings that contributed to the decoding phrases. These percentages mean they were slightly less likely to have helped create the group labels. This does not explain why they

may be slightly better at decoding. An alternate idea is that while men are not good at coming up with the descriptions, these being feminine objects, they are more likely to understand the description that a woman gives, rather than have their own idiosyncratic idea of how the object should be described.

Stimuli and Procedure

The stimuli types I chose to use were not perfectly suited to this study. Each stimuli set had some issues that are uncontrolled sources of error that could be avoided with careful, knowledgeable selection and more pilot-studies while developing an expanded research design.

The incense did not hold their scent evenly throughout the month. They were hand dipped in essential oils, which started to dry out towards the end of the experiment. Many of the scent encodings had strength of the scent as a distinguishing factor. Some of this trend was prevalent enough to be included in the group labels. While the exact manufacture process of the incense is unknown to me, the oils are unlikely to be exactly the same mixture each time. This meant replacing the incense was likely to change more than the strength of the scents so I left the originals in the experiment for both tasks. Additionally, the containers I chose were spice jars that rather than being completely clear (as most I found were) had paned insides and distorted the internal contents. Since the incense looked essentially the same, with the added distortion I considered this to eliminate visual distinctions. One of the incense degraded onto the jar, however, creating a distinct pattern making it visually differentiable. Finally, the subjects touched the jars. While the jars were identical, the use of the sense of touch could be eliminated for further sense isolation.

The color chips were very good stimuli for the most part. They were exactly the same from day one until the end of the experiment. I was working with paint chips attained from a hardware store. An additional consideration that I didn't take into account was the different techniques of paint chip creation by the different paint companies. Some paint chips were printed with a glossy coat. Others were painted and had a distinct texture to them that was visible if you attended to it. I was so focused on the colors I forgot to pay attention to the other dimensions of sight that the subjects could resort to. These different methods of creation also created different textures for the subject to feel if they had moved the chips for comparison purposes.

The fabrics I chose were too similar. This might be an inherent quality of the category smooth. Smooth seems to be a rather narrow category with rough being a considerably larger conceptual space. Some subjects could not differentiate the textures with touch. Others could perceive that they were different, just too similar to describe the difference. Isolating fabric from sight proved to be complicated. During the first session, subjects put on blindfolds. I did not think far enough ahead. During the second session, the blindfold needed to be eliminated because the subjects needed to see the group labels on the index cards while simultaneously touching the fabrics. I devised a fabric wall to serve as a barrier between the subject and the fabrics. This was a functional setup, but the movement of the subject's hand under the fabric could cause pieces of fabric to become visible if the researcher was inattentive.

Finding types of objects that are distinct in one single dimension, or have no extra categories of discriminability other than the one selected within, is a tricky thing. Perhaps investigation into the types of objects used by psychologists or by biologists in studies of

sensation and perception would reveal some object classes that would be particularly suited to this type of experimentation. One thing that must be kept in mind when choosing object types for a cross-culturally oriented research design is the transportability of stimuli or being able to acquire them locally throughout the world.

Basic Categories

Another issue with the study is the 'basic'-ness of the language categories the objects were selected from within. A basic color term is monolexemic (the meaning is not a sum of the parts of the word), is not a narrow range of another color, is generalizable across all objects that have color, and must be psychologically salient for speakers of the language (Berlin and Kay 1969:6). In English, there are eleven basic terms: white, black, red, green, yellow, blue, brown, purple, pink, orange, and grey (Berlin and Kay 1969:2). These basic terms divide up the conceptual space of color. The concept of 'basic-ness' could potentially be applied to other sense categories.

Berlin and Kay's (1969) research shows that in American English, purple is a basic term to describe color. There is no parallel work that I know of to support using floral for scent and smooth for texture. Doing this sort of work of discovering the basic terms and choosing one would add more reliability and credence to the equal discriminability of the senses. On the other hand, relying on categories of linguistic categories to choose the objects to be used in a study of language seems a bit circular. One of the root ideas of this study is that a basic term referring to a less privileged sense may have a wider range of referents than a basic term for a sense that is culturally important. Using basic categories is not sufficient in and of itself for establishing equal discriminability.

Being insufficient does not mean it is unimportant, however. In Kay and Kempton's (1984:73-74) research on boundaries between color term referents, the boundaries were shown to affect the discrimination of the objects. This effect should be avoided.

Section VI: Expansion to Cross-Cultural Research

In addition to the discussion of the pilot-study, additional issues that are going to become important when the research design is expanded and used cross-culturally need to be addressed. Testing these issues was beyond the scope of my pilot-study, but I can offer some idea of what the additional problems might be and some preliminary ideas of how to deal with them.

Number of Senses

One of the biggest issues for a cross-cultural version of this study is to decide how many and which senses to investigate. In English there are five senses: sight, hearing, smell, taste and touch. Other cultures recognize heat as separate from pressure, consider balance a sense or conceptualize kinesthesia, motion, a sense. Should color and perception of 3D objects be considered the same sense? Essentially, senses are classifications of perception into bounded categories. Should we work within each culture's different classification system or should we impose one culture's model on all other cultures?

I am going to advocate a third option. There is significant physiological evidence of what kinds of sensations we as humans are capable of collecting. Geurts claims that science recognizes 9 capabilities: "(1) visual apparatus, responding to luminous and chromatic impressions; (2) auditory apparatus, responding to tonal impressions; (3) olfactory apparatus; (4) gustatory apparatus; (5) tactile apparatus, responding to mechanical impressions; (6) tactile apparatus, responding to thermal impressions; (7) tactile apparatus, responding to kinesthetic impressions; (8) labyrinthine apparatus, governing balance; and (9) affective apparatus (pleasant and painful), responding to impressions of tickling, itching, voluptuousness, desiccation, burning, distention, pinching, pressure and so

forth" (Geurts 2002:8-9). This classification should be compared against accounts of sense categorizations from around the world to be sure it is complete. The full range of sensations should be investigated in each culture. That would produce comparable results without imposing our taxonomy on other cultures. The internal hierarchies could also be constructed by collapsing and averaging categories that a culture considers aspects of the same sense. The subjects could be asked to name the senses before the first task, and after each task they could be asked which sense the task was testing. This questioning would allow for any collapsing of categories to follow an internal logic of the culture.

Transfer of Design Cross-Culturally

The idea of being objective and not imposing the concepts and categorizations of one culture on another has another dimension for this research design. As discussed earlier, each culture has different basic categories for each sense. The basic color categories of English (Berlin and Kay 1969: 2) consist of eleven categories while the Jalé of New Guinea (Berlin and Kay 1969:23) have only two. This variation is likely to be the case in other sense categories. If the color stimuli were selected in the language of the Jalé, the discriminability for English speakers would be significantly different as it would be likely that the colors would cross between basic term boundaries. If all the sense stimuli sets were developed in English, the stimuli would be likely to not be as equally discriminable in other languages.

The stimuli need to be selected specifically for each language. To create sense categories representing the same abilities, the type of objects selected from should be the same (i.e. color chips, fabrics, incense). The stimuli will need to be equally discriminable in the language tested. A ramification of this necessary ground-up design is that the actual

communication accuracy scores of a particular sense will not be comparable cross-culturally. The order of the senses will be comparable, but without a way to ensure that the equal discriminability of the arrays from one culture are the same equal amounts of discriminability in other cultures the actual scores will not be related to each other.

Section VI: Conclusion

This pilot-study serves as an illustration of how hierarchies of the senses could possibly be compared. American English has a hierarchy. This hierarchy coincides with what we think it biologically should be so this pilot study does not tell us much conclusively about the original question. This research, when done cross-culturally, has the potential to bring understanding to the question of whether sensation is an innately equivalent, panhuman capability or whether it is modified and shaped by culture.

An answer to this question will have a number of uses. Within anthropology, having knowledge of a local hierarchy of the senses, in addition to the researchers' own hierarchies, will allow them to be aware of a potential bias. They will be know of the differing paradigms of experiencing the world and will be able to focus on trying to understand the local framework. The underlying structure will be available for them to build off of or to investigate ethnographically.

We will also understand the range of human variation and universalism just a little bit better. Western culture seems to often assume that all humans understand the world through sight first. We have such idioms as 'seeing is believing.' Some areas of academia seem to largely go along with this folk knowledge. Cognitive science, especially computationalist cognitive science, for example seems to assume that all people think the way Westerners think (Thagard 2005:10-12). They do tests based on logic and rationality as defined by Western philosophy. If people prove capable of different hierarchies of sense importance, then how far into our internal processes does culture reach? For the majority of a discipline to be working under the assumption that nature outweighs nurture when the debate is still a lively one seems questionable.

Outside of academia, this information would be useful in terms of intercultural understanding, particularly for politicians and business people. Diplomats would be able to understand fundamental differences about how the world is perceived by the person across the table from them. If Geurts (2002:18) is right in claiming that the senses and how we understand them are essential elements in our identity and personhood, countries with multicultural populations in conflict will have a new tool to promote understanding. Business is increasingly multi-national. Within businesses, there are employees from very different backgrounds that all respond to a centralized command structure. The people in charge having knowledge of more cultural assumptions of their employees will allow them to tailor working conditions and policies. Between companies, executives of different cultures need to find ways to understand each other and accommodate each other's values. Finally, understanding a culture's hierarchy of the senses would be of particular interest to advertisers who could use this understanding to market products in a way that matters to the consumer, whether this is corporate marketing or the marketing of non-profits trying to implement aid programs.

Do people actually experience senses differently? Do we learn to make distinctions, or learn not to bother making distinctions? This research can't tell us that. But it will give us information to know whether that elementary difference is possible, and will allow us to know whether the social experience of the senses is different in various cultures.

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Stimuli

Appendix A

Paint Chips: Lowes

Stimulus	Product Label
C1	Olympic Paints-Plush Purple B43-6
C2	Valspar-Rollick 4003-10c
C3	Valspar-Purple Royalty 4009-10
C4	Olympic Paints-Byzantine Purple A43-6
C5	Olympic Paints-Perfectly Purple B42-6
C6	Olympic Paints-Cleopatra's Gown A42-6
C7	Valspar-Sonic Plum 4002-10c

Incense: Incense Galore

Stimulus	Product Label
S1	Rose
S2	Strawberry
S3	Orchid
S4	Gardenia
S5	Tulip
S6	Blossom
S7	Passion Flower

Fabrics: Joann's

Stimulus	Product Label	Composition
F1	Crepe Back Satin-Peacock Crepe-Special Occasion	100% Polyester
F2	Simply Silky Prints-Gray-Blue Vine	100% Polyester
F3	Special Occasion-Green STN Taffeta	100% Polyester
F4	Bemberg Lining-Potting Soil Ambiance	100% Bemberg Rayon
F5	Silky Solids-Rio Red Baby Silk	100% Polyester
F6	Charmeuse Solids-Gold Charmeuse	100% Polyester
F7	Simply Silky Prints-Golden Leopard Stretch	96% Polyester 4% Spandex

Aggregate Proximity Matrix

	1 1C	2 2C	3 3C	4 4C	5 5C	6 6C	7 7C
1 1C	1.00	0.05	0.00	0.52	0.38	0.00	0.00
2 2C	0.05	1.00	0.60	0.08	0.13	0.20	0.33
3 3C	0.00	0.60	1.00	0.08	0.08	0.40	0.35
4 4C	0.52	0.08	0.08	1.00	0.28	0.00	0.00
5 5C	0.38	0.13	0.08	0.28	1.00	0.05	0.00
6 6C	0.00	0.20	0.40	0.00	0.05	1.00	0.70
7 7C	0.00	0.33	0.35	0.00	0.00	0.70	1.00

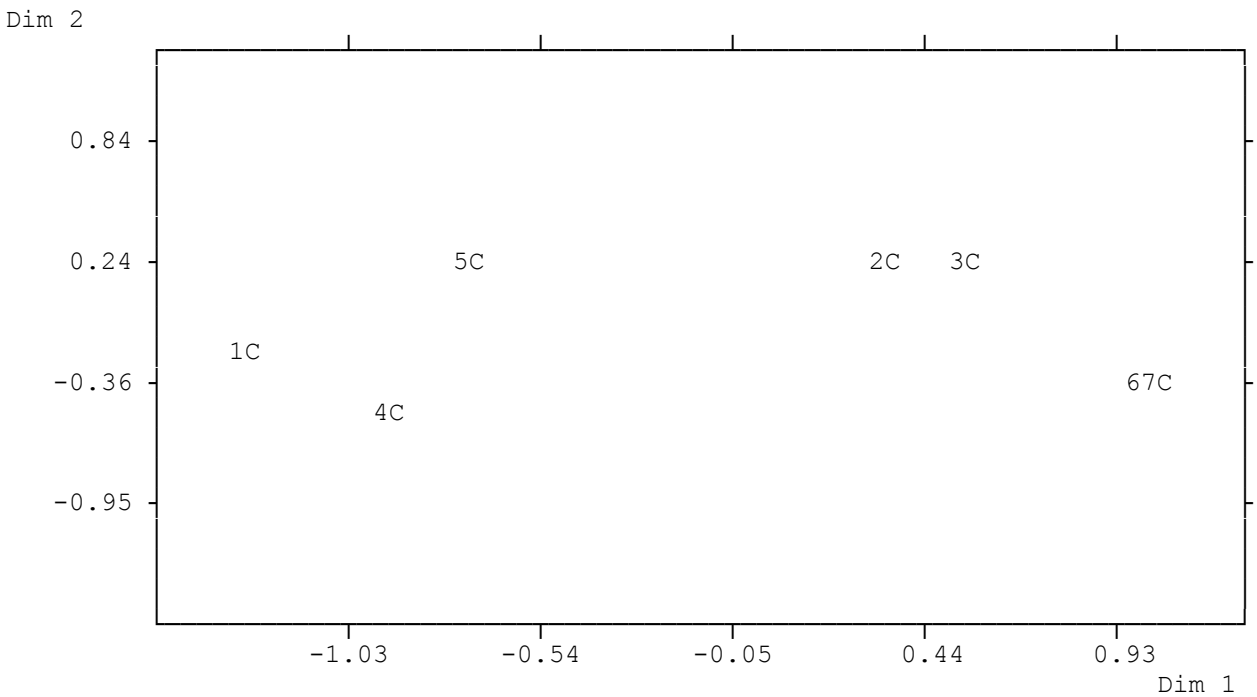
Elapsed time: 2 seconds. 2/2/2009 1:34 PM.
ANTHROPAC 4.983/X Copyright 1985-2002 by Analytic Technologies.

NON-METRIC MULTIDIMENSIONAL SCALING

Starting config: TORSCA
Type of Data: Similarities

	1	2
1 1C	-1.33	-0.21
2 2C	0.35	0.36
3 3C	0.56	0.46
4 4C	-0.95	-0.45
5 5C	-0.75	0.52
6 6C	1.04	-0.35
7 7C	1.08	-0.31

Stress 0.001 after 50 iterations.



Stress in 2 dimensions is 0.001
Elapsed time: 1 second. 2/2/2009 1:35 PM.
ANTHROPAC 4.983/X Copyright 1985-2002 by Analytic Technologies.

```
Method:                    AVERAGE
Type of Data:              Similarities

HIERARCHICAL CLUSTERING

         1 4 5 2 3 6 7
         C C C C C C C

 Level   1 4 5 2 3 6 7
------   - - - - - - -
0.7000   . . . . . XXX
0.6000   . . . XXX XXX
0.5250   XXX . XXX XXX
0.3389   XXX . XXXXXXX
0.3083   XXXXX XXXXXXX
0.0324   XXXXXXXXXXXXX


Partition-by-actor indicator matrix saved as dataset PART

Elapsed time:  1 second. 2/2/2009 1:36 PM.
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Aggregate Proximity Matrix

	1 AF	2 BF	3 CF	4 DF	5 EF	6 FF	7 GF
1 1F	1.00	0.30	0.40	0.15	0.15	0.15	0.15
2 2F	0.30	1.00	0.22	0.10	0.30	0.13	0.17
3 3F	0.40	0.22	1.00	0.20	0.03	0.40	0.23
4 4F	0.15	0.10	0.20	1.00	0.05	0.60	0.45
5 5F	0.15	0.30	0.03	0.05	1.00	0.13	0.23
6 6F	0.15	0.13	0.40	0.60	0.13	1.00	0.28
7 7F	0.15	0.17	0.23	0.45	0.23	0.28	1.00

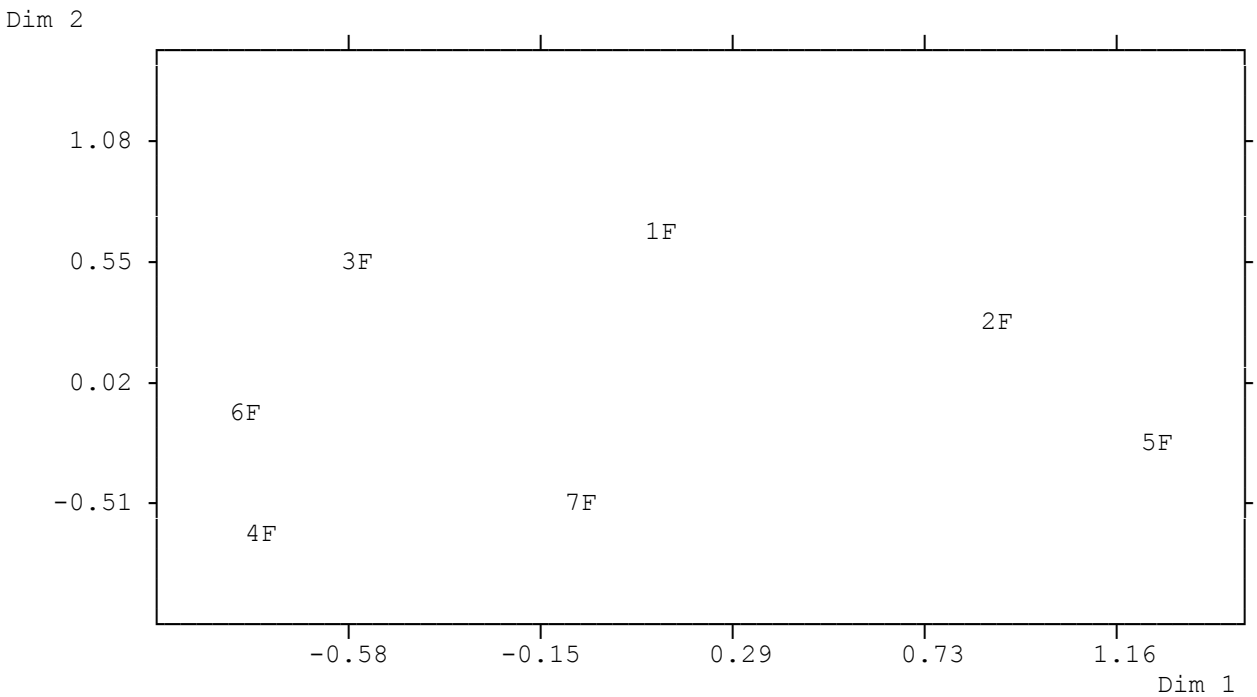
Elapsed time: 8 seconds. 2/2/2009 1:42 PM.
ANTHROPAC 4.983/X Copyright 1985-2002 by Analytic Technologies.

NON-METRIC MULTIDIMENSIONAL SCALING

Starting config: TORSCA
Type of Data: Similarities

	1	2
1 1F	0.12	0.91
2 2F	0.92	0.47
3 3F	-0.58	0.67
4 4F	-0.81	-0.80
5 5F	1.28	-0.38
6 6F	-0.87	-0.21
7 7F	-0.07	-0.66

Stress 0.005 after 42 iterations.



Stress in 2 dimensions is 0.005
Elapsed time: 1 second. 2/2/2009 1:42 PM.
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```
Method:                  AVERAGE
Type of Data:            Similarities

HIERARCHICAL CLUSTERING
         2 5 1 3 4 6 7
         F F F F F F F

 Level   2 5 1 3 4 6 7
------   - - - - - - -
0.6000   . . . . XXX .
0.4000   . . XXX XXX .
0.3333   . . XXX XXXXX
0.3000   XXX XXX XXXXX
0.2289   XXX XXXXXXXXX
0.1560   XXXXXXXXXXXXX

Partition-by-actor indicator matrix saved as dataset PART

Elapsed time:  1 second. 2/2/2009 1:43 PM.
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Aggregate Proximity Matrix

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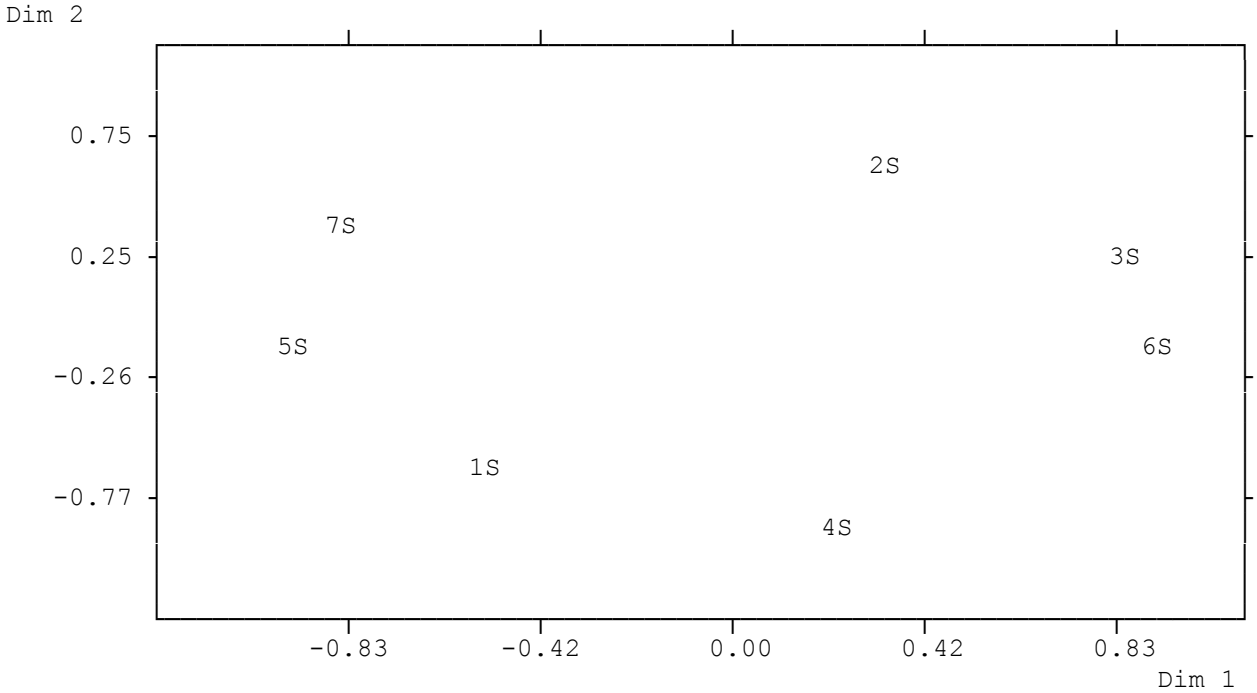
1 1S	1.00	0.17	0.17	0.38	0.30	0.10	0.23
2 2S	0.17	1.00	0.38	0.15	0.13	0.20	0.23
3 3S	0.17	0.38	1.00	0.13	0.20	0.58	0.13
4 4S	0.38	0.15	0.13	1.00	0.18	0.28	0.10
5 5S	0.30	0.13	0.20	0.18	1.00	0.17	0.33
6 6S	0.10	0.20	0.58	0.28	0.17	1.00	0.13
7 7S	0.23	0.23	0.13	0.10	0.33	0.13	1.00

Elapsed time: 4 seconds. 2/2/2009 1:45 PM.
ANTHROPAC 4.983/X Copyright 1985-2002 by Analytic Technologies.
NON-METRIC MULTIDIMENSIONAL SCALING

Starting config: TORSCA
Type of Data: Similarities

	1	2
1 1S	-0.55	-0.73
2 2S	0.33	0.92
3 3S	0.87	0.50
4 4S	0.24	-1.09
5 5S	-1.00	-0.09
6 6S	0.96	-0.05
7 7S	-0.86	0.55

Stress 0.071 after 16 iterations.



Stress in 2 dimensions is 0.071

Elapsed time: 1 second. 2/2/2009 1:45 PM.
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```
Method:                    AVERAGE
Type of Data:              Similarities

HIERARCHICAL CLUSTERING

         1 4 2 3 6 5 7
         S S S S S S S

 Level   1 4 2 3 6 5 7
------   - - - - - - -
0.5750   . . . XXX . .
0.3750   XXX . XXX . .
0.3250   XXX . XXX XXX
0.2583   XXX XXXXX XXX
0.1833   XXXXXXXXX XXX
0.1592   XXXXXXXXXXXXX


Partition-by-actor indicator matrix saved as dataset PART

Elapsed time:  1 second. 2/2/2009 1:46 PM.
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Appendix C

Informed Consent Form

This form is to gain your agreement to participate in the Sense Language Study conducted by Laura Kelly ('09 Anthropology) supervised by Professor John Gatewood (Soc/Anth dept.).

Purpose of Study: To examine the precision of language in describing the senses.

Procedures: You will be asked to interact with various objects and describe them. This will take approximately 45 minutes. You will be asked to come back in 3 weeks time for an additional session that will take approximately 30 minutes. In this second session, you will be asked to interact with and identify objects.

Possible Risks: There is minimal risk for you in this study. If you have any allergies that can result from interacting with paint chips, fabric or unlit incense please advise the investigator. If there proves to be any risk of reaction, you will be withdrawn from the study.

Benefits: The study is going to benefit our general knowledge of human capacity and cultural influences on sensory capacities. You should not expect any direct benefits other than compensation to result from this study.

Compensation: You will be reported to your professor of the class you were recruited from as having participated in the study after the second session. This will only happen with the your permission. The exact form of compensation is between the professor and the students.

If you would like to be reported as having participated to your professor please write your Lehigh email here:_____

Confidentiality: Contact information will be retained by the investigator in order to arrange second sessions. The data will be coded rather than directly associated with participant identification. The code will be retained by the investigator and not be shared.

This study is strictly voluntary. You can withdraw from the study at any time. Withdrawal will not jeopardize your relationship with Lehigh University.

If you have any questions about the study, you can contact the primary investigator, Laura Kelly at LJK209@lehigh.edu or the project advisor Dr. John Gatewood at JBG1@lehigh.edu.

You may report problems that may result from your participation or direct questions in regard to your rights as a subject in this study to the Office of Research and Sponsored Programs, Lehigh University, (610)758-3021. All reports or correspondence will be kept confidential.

To confirm that you have read and understand the foregoing information, that you have received answers to any questions you asked, and to consent to participate in the study, please sign below.

_____ _____

Date Signature

Appendix D

Post – Encoding Task Questions

1. What is your first language? (circle)

American English Other English Other_____

2. Were there any objects that you were not sure were different? (i.e. the first color and the sixth were so similar that you suspect they were the same.) If so, which objects?

3. How difficult was the color task?

Easy						Difficult
1	2	3	4	5	6	7

How difficult was the scent task?

Easy						Difficult
1	2	3	4	5	6	7

How difficult was the fabric task?

Easy						Difficult
1	2	3	4	5	6	7

4. Rank the difficulty of the sets: (Hardest is #1)

1.
2.
3.

5. "Discrimability" is the perceptual difference between the objects in a set. A measure of this concept would be how easy/difficult it was to identify the objects in a set as different from each other.

How easy/difficult was it to see the difference between the colors?

Easy						Difficult
1	2	3	4	5	6	7

How easy/difficult was it to smell the difference between the scents?

Easy						Difficult
1	2	3	4	5	6	7

How easy/difficult was it to feel the difference is between the fabrics?

Easy						Difficult
1	2	3	4	5	6	7

6. Rank order the sets in order of the amount of difference among the stimuli in a set. (Least Difference is #1)

1.
2.
3.

7. Do you have any reason to believe that you would be particularly good or bad at any or all of the tasks? If so, explain.

8. Do you have any thoughts or concerns you would like to share?

Encoding Task: Descriptors of Stimuli

Subj	Sex	Stimuli	Encoding	Subj	Sex	Stim	Encoding	Subj	Sex	Stim	Encoding
1	W	C2	Purple	3	W	F2	not that silky/soft	5	W	C6	purple
1	W	C4	Violet	3	W	F1	slightly satin	5	W	C7	light purple
1	W	C1	eggplant	3	W	F5	smooth	5	W	C4	dark purple
1	W	C7	pinker purple	3	W	F6	thin	5	W	C3	purple
1	W	C3	purple	3	W	F4	very thing	5	W	C5	dark purple
1	W	C5	amesthyst	3	W	F3	very satiny/silky	5	W	C2	purple
1	W	C6	pale purple	3	W	F7	moderately silky	5	W	C1	dark purple
1	W	S6	very light	3	W	S6	sweet, girly perfume	5	W	F2	smooth
1	W	S4	soap	3	W	S3	sweet	5	W	F7	silky
1	W	S3	flowery	3	W	S1	soap	5	W	F3	hard silky
1	W	S1	floor cleaner	3	W	S4	sunscreen, lotion	5	W	F1	soft, smooth
1	W	S7	plants	3	W	S5	bland	5	W	F5	matted
1	W	S2	baby oil	3	W	S2	bland	5	W	F4	silky
1	W	S5	strong perfume	3	W	S7	bland with a hint of fragrance	5	W	F6	silky smooth
1	W	F4	fine and smooth	3	W	C7	reddish purple	5	W	S3	bubblicious, bubble gum
1	W	F6	silky	3	W	C4	dark deep and solid	5	W	S5	flowers
1	W	F3	smooth with bigger fibers	3	W	C2	medium purple	5	W	S7	faint bad smell
1	W	F1	(sports) jersey	3	W	C6	ugly purple with brown	5	W	S4	strong like perfume
1	W	F2	stockings	3	W	C3	barney purple, little kid purple	5	W	S2	sweet flower
1	W	F5	t-shirt	3	W	C1	really dark, blackish purple	5	W	S6	perfume
1	W	F7	polyester swimsuit	3	W	C5	dark purple with brown	5	W	S1	jasmine or lavender
2	W	S4	potporri	4	W	S5	Fresh	6	W	F7	satin-like smooth
2	W	S3	fruity	4	W	S1	citrusy	6	W	F1	more rough, thicker
2	W	S5	musky	4	W	S2	really sweet	6	W	F2	more textured, more bumby, thicker
2	W	S7	rain	4	W	S4	Fruity	6	W	F6	very smooth, thin
2	W	S6	perfume	4	W	S3	like candy	6	W	F3	smooth, stiff
2	W	S1	soap	4	W	S6	clean	6	W	F4	very smooth, very thin, flimsy
2	W	S2	bubble gum	4	W	S7	natural	6	W	F5	very soft, very thin, flimsy-like
2	W	F2	screen	4	W	C4	basic purple	6	W	C7	very light almost pinkish tint purple
2	W	F5	smooth	4	W	C1	goth, dark	6	W	C3	standard purple of rainbow
2	W	F7	silk	4	W	C7	springy, summery	6	W	C4	darker shade of purple bluish tint
2	W	F4	silk	4	W	C5	plum	6	W	C2	little lighter (pinker) than rainbow
2	W	F3	smooth	4	W	C2	happy	6	W	C5	in between violet and blue
2	W	F6	resistant	4	W	C6	peaceful	6	W	C6	dark purple with red
2	W	F1	bumpy	4	W	C3	bright	6	W	C1	very dark purple a few shades from blue
2	W	C4	plum	4	W	F6	smooth	6	W	S1	clean, linen-like
2	W	C6	barney	4	W	F3	durable	6	W	S4	woodsy smell
2	W	C2	bright purple	4	W	F2	fuzzy	6	W	S3	victoria secret spray
2	W	C5	dull	4	W	F5	comfortable and soft	6	W	S5	soap
2	W	C7	vibrant	4	W	F4	rich, luxurious, high quality	6	W	S7	not very pleasant
2	W	C3	grape	4	W	F7	light weight	6	W	S2	combo of soap that is supposed to smell like linen
2	W	C1	dark purple	4	W	F1	thick, more cushiony	6	W	S6	baby powder

The objects are listed in the randomized order they were presented to the subjects.
There is a cycle of 6 orders of presenting the senses; each order was equally presented to the subjects
For Sex, W rather than F for Female because F was already being used for Fabric

Subj	Sex	Stimuli	Encoding	Subj	Sex	Stimuli	Encoding	Subj	Sex	Stimuli	Encoding
7	M	C7	ocher	9	M	F6	thin smooth fabric	11	M	C3	beautiful
7	M	C1	dark purple	9	M	F7	thin smooth fabric	11	M	C2	innocent
7	M	C2	grape	9	M	F4	thin smooth fabric	11	M	C1	gloomy
7	M	C6	flat purple	9	M	F5	thin smooth fabric	11	M	C4	plain
7	M	C5	violet	9	M	F1	thin smooth fabric	11	M	C5	sullen
7	M	C3	purple	9	M	F2	thin smooth fabric	11	M	C7	playful
7	M	C4	deep violet	9	M	F3	thin smooth fabric	11	M	C6	simple
7	M	S7	woody	9	M	S5	can't smell	11	M	F5	soft
7	M	S6	spring	9	M	S7	can't smell	11	M	F7	silky
7	M	S3	meadow	9	M	S4	potpourri	11	M	F1	thick
7	M	S1	beach	9	M	S3	candy	11	M	F3	artificial
7	M	S2	faint	9	M	S1	potpourri	11	M	F4	thin
7	M	S5	forest	9	M	S2	soap	11	M	F2	coarse
7	M	S4	ocean	9	M	S6	soap (can't smell well)	11	M	F6	silky smooth
7	M	F1	smooth	9	M	C4	in between purple	11	M	S5	clean
7	M	F7	slick	9	M	C6	very dark	11	M	S1	invasive
7	M	F4	sheer	9	M	C5	second lightest purple	11	M	S6	delicious
7	M	F5	heavy	9	M	C7	lightest purple	11	M	S3	car air freshener
7	M	F6	light	9	M	C2	light purple	11	M	S4	old people
7	M	F2	silky	9	M	C1	darkest purple	11	M	S7	fruity
7	M	F3	waxy	9	M	C3	light purple	11	M	S2	holiday/winter season
8	M	S4	bath soap	10	M	S3	watermelon	12	M	F2	thick elasticy
8	M	S2	fruity fragant	10	M	S2	apple	12	M	F6	not as thick, elasticy
8	M	S5	lavendar	10	M	S1	sour smell	12	M	F4	thin elasticy
8	M	S1	sour skittles	10	M	S7	soap, bad smelling	12	M	F3	thicker fabric
8	M	S3	sweet	10	M	S6	shampoo	12	M	F5	stretchy thin
8	M	S6	soapy	10	M	S5	weak smell	12	M	F7	thing stretchy
8	M	S7	ocean breeze	10	M	S4	potpourri	12	M	F1	soft stretchy
8	M	F5	fairly smooth	10	M	C7	violet	12	M	C5	second darkest
8	M	F6	smooth when stretched	10	M	C6	mauve	12	M	C4	third darkest
8	M	F1	rough, broken in denim	10	M	C3	purple	12	M	C1	darkest
8	M	F2	roughest	10	M	C1	dark purple	12	M	C3	fifth darkest
8	M	F7	synthetic, plasticy, latex	10	M	C5	flower purple	12	M	C6	seventh darkest
8	M	F4	smooth, glossy	10	M	C2	rainbow purple	12	M	C7	sixth darkest
8	M	F3	slippery	10	M	C4	barney purple	12	M	C2	fourth darkest
8	M	C4	medium purple	10	M	F7	vinyl	12	M	S4	suntan lotion
8	M	C3	shiniest purple	10	M	F1	corduroy-sort of	12	M	S1	almost nothing
8	M	C6	second lightest	10	M	F2	intersecting rays- in a grid	12	M	S5	stronger almost nothing
8	M	C5	dark, muted purple	10	M	F6	smooth	12	M	S7	incense
8	M	C7	lightest purple	10	M	F3	rough	12	M	S2	sugary, smarties
8	M	C2	magenta	10	M	F5	silk	12	M	S6	fabric softener
8	M	C1	darkest purple	10	M	F4	velvet	12	M	S3	vanilla candle

Subj	Sex	Stimuli	Encoding
13	W	C6	barney
13	W	C2	purple
13	W	C1	carpet
13	W	C7	flower
13	W	C4	old 70s bug
13	W	C5	mat
13	W	C3	groovy
13	W	S7	dorm room
13	W	S2	old person's house
13	W	S5	pinesol-cleaner
13	W	S4	beach
13	W	S1	candle store
13	W	S6	vanilla
13	W	S3	raspberries
13	W	F1	costume material
13	W	F5	costume material
13	W	F3	curtains
13	W	F4	lingerie
13	W	F7	like a bra
13	W	F2	rougher, couch
13	W	F6	soft, underwear
14	W	S1	very light, not strong
14	W	S3	potpourri
14	W	S6	gingery
14	W	S5	soap
14	W	S2	light flowers
14	W	S4	strong
14	W	S7	flowers
14	W	F6	slippery
14	W	F4	very thin
14	W	F3	smooth
14	W	F1	more texture
14	W	F2	clothy
14	W	F7	very fine, smooth
14	W	F5	peach fuzz
14	W	C3	light plum, light violet
14	W	C5	plumish brown
14	W	C1	dark plum
14	W	C2	eye catching
14	W	C4	duller, dark color
14	W	C6	reddish
14	W	C7	smoother

Subj	Sex	Stim	Encoding
15	W	F5	softest, most loosely woven
15	W	F6	fifth most soft
15	W	F2	third most soft
15	W	F3	firm
15	W	F1	second most soft
15	W	F7	fourth most soft
15	W	F4	sixth most soft
15	W	S2	citrus gum
15	W	S4	johnsons and jonhsons baby soap
15	W	S3	fruit flavored candy, gobbstoppers, fruity bubble gum
15	W	S6	air fresheners, nice but not
15	W	S5	floral bath soap
15	W	S1	roses
15	W	S7	unpleasant, fish, sweat, vomit
15	W	C6	second brightest, second warmest, second most reddish undertones
15	W	C2	flattest color without other hues
15	W	C7	brightest, warmest, most red
15	W	C3	bright with red hues but deeper
15	W	C4	darker undertones, second darkest
15	W	C5	deepest, dark, red hues
15	W	C1	darkest with most gray
16	W	S7	cinnamon
16	W	S3	strawberry
16	W	S1	cotton candle
16	W	S6	sweet
16	W	S2	flowers
16	W	S4	fabric softener
16	W	S5	roses
16	W	C6	purple
16	W	C7	mauve
16	W	C2	royal purple
16	W	C4	deep purple
16	W	C3	lighter purple
16	W	C5	grayish purple
16	W	C1	dark purple
16	W	F6	silk
16	W	F2	polyester
16	W	F1	cotton
16	W	F4	silk
16	W	F7	cashmere-like
16	W	F3	pleather
16	W	F5	cotton

Su	Sex	Stimuli	Encoding
17	W	C1	indigo
17	W	C3	normal purple
17	W	C7	golden tint, golden purple
17	W	C4	violet
17	W	C6	plum
17	W	C2	synthetic
17	W	C5	maroonish
17	W	F4	synthetic, plasticy
17	W	F2	rougher
17	W	F7	stretchable
17	W	F5	softer
17	W	F1	smooth or slippery
17	W	F3	ridged, tightly packed/woven
17	W	F6	thin
17	W	S3	sweet
17	W	S5	rustic, woodsy
17	W	S6	floral
17	W	S2	fruity
17	W	S1	wood
17	W	S7	musty, supple
17	W	S4	pungent
18	W	F4	silky
18	W	F7	thick-satiny
18	W	F3	really thick satiny
18	W	F2	lighter, silky, softer
18	W	F5	lighter, silky, softer
18	W	F6	flimsy, slippery
18	W	F1	silky surface, slippery
18	W	C5	soft purple
18	W	C1	dark purple
18	W	C7	lavender
18	W	C4	plum
18	W	C3	purple purple
18	W	C6	medium color purple
18	W	C2	sheer purple
18	W	S5	flowery - lavender
18	W	S1	flowery type
18	W	S3	strawberries
18	W	S2	flower
18	W	S6	flower
18	W	S4	soap
18	W	S7	plant

Subj	Sex	Stim	Encoding	Sub	Sex	Stim	Encoding	Subj	Sex	Stim	Encoding

19	M	C4	third darkest
19	M	C6	sixth darkest
19	M	C1	darkest
19	M	C5	second darkest
19	M	C3	fifth darkest
19	M	C2	fourth darkest
19	M	C7	seventh darkest
19	M	S3	sweet and heavy
19	M	S2	sour
19	M	S7	marijuana
19	M	S5	musky and lighter
19	M	S1	musky and heavier
19	M	S6	sweet and light
19	M	S4	musky heaviest
19	M	F5	book sock, less stretchy
19	M	F7	book sock
19	M	F6	almost silky
19	M	F2	slightly textured, not stretchy
19	M	F3	thicker almost silky
19	M	F4	thin and not very textured
19	M	F1	slightly furry
20	M	S2	hand soap, dish soap
20	M	S5	faint smell, soap
20	M	S7	spice
20	M	S4	old sponge -once had good smell but is starting to smell bad
20	M	S6	scented candle
20	M	S3	scratch and sniff or bubble gum, grape flavor
20	M	S1	hand wash
20	M	F2	more coarse, not very elastic
20	M	F4	fingers are sliding, not as coarse, delicate, thinner
20	M	F6	rough if napkin (would be rough against face) like material for glasses
20	M	F3	smoother like table cloth, not too rough
20	M	F1	more coarse, like a pair of jeans
20	M	F5	velvety
20	M	F7	clothing material
20	M	C2	light purple crayon
20	M	C5	least purple, reddish-brown, grape juice
20	M	C6	girl-drapes
20	M	C4	grape jolly rancher
20	M	C3	reflects light the best--if in window would give a glare
20	M	C7	brightest
	M	C1	dark purple crayon, reflects least amount of light
21	M	F6	mix between silky and rough,
21	M	F7	horizontal ridges
21	M	F3	smooth, silky very small ridges
21	M	F2	more rough
21	M	F5	thicker
21	M	F1	nylon, small ridges, not rough
21	M	F4	very thin, smooth
21	M	S4	lever 2000, soap-cheap
21	M	S1	bar of soap, less intense
21	M	S6	girl's berfume, most pleasant
21	M	S7	dog groomer
21	M	S2	fruity
21	M	S5	car freshener-cherry
21	M	S3	potpourri
21	M	C2	not lightest, not darkest, crayola purple
21	M	C3	fourth darkest
21	M	C5	third darkest
21	M	C7	lightest purple
21	M	C6	tad darker than lightest
21	M	C1	darkest
21	M	C4	barney purple
22	M	S5	don't smell anything
22	M	S1	minty
22	M	S7	clean, air freshener
22	M	S6	oranges
22	M	S2	air freshener
22	M	S3	bubble gum but not as sweet
22	M	S4	lemon pinesol
22	M	C2	purple
22	M	C6	reddish purple
22	M	C4	grape
22	M	C7	more reddish purple
22	M	C1	night sky, end of dusk
22	M	C3	grape jelly
22	M	C5	mouve (sic)
22	M	F3	heavier than rest, a little less smooth
22	M	F5	really soft and light
22	M	F2	curtain fabric
22	M	F7	flag material
22	M	F1	like a dress
22	M	F6	old fashioned lampshade
22	M	F4	light jacket
23	M	C7	dark pink
23	M	C5	darker purple
23	M	C4	dark purple
23	M	C2	light purple
23	M	C6	flat purple
23	M	C3	dark flat purple
23	M	C1	darkest purple
23	M	F5	most fuzzy
23	M	F1	less fuzzy
23	M	F6	smooth lines
23	M	F2	least fuzzy
23	M	F4	smooth
23	M	F3	stiff and smooth
23	M	F7	stretchy and smooth
23	M	S7	earthy
23	M	S6	flowers
23	M	S4	laundry
23	M	S1	ocean
23	M	S5	handsoap
23	M	S2	sweet
23	M	S3	sweet apple
24	M	F4	slippery
24	M	F2	ridged-y-er
24	M	F5	smooth
24	M	F7	stretchy
24	M	F3	tight
24	M	F1	not tight but not stretchy
24	M	F6	soft
24	M	C5	normal purple
24	M	C7	bright
24	M	C1	duller
24	M	C6	more romantic
24	M	C4	deep
24	M	C2	more defined
24	M	C3	clearer
24	M	S7	cinnamon
24	M	S1	soap
24	M	S6	pepper
24	M	S3	gum
24	M	S5	soap
24	M	S4	soap
24	M	S2	potpourri

Appendix E

Subj	Sex	Stim	Encoding	Subj	Sex	Stim	Encoding	Subj	Sex	Stim	Encoding
25	W	C6	barney purple	27	W	F3	smooth and homogeneous	29	W	C5	closest to burgandy
25	W	C7	magenta	27	W	F7	smooth	29	W	C2	most vibrant purple

25	W	C4	dark purple
25	W	C1	really dark purple
25	W	C5	mauve
25	W	C3	american apparel purple
25	W	C2	medium shade of purple
25	W	S2	potpourri
25	W	S4	air freshener
25	W	S6	pine cones
25	W	S1	soap
25	W	S5	soap
25	W	S7	air freshener
25	W	S3	potpourri
25	W	F3	ribbon, smooth
25	W	F7	microfibery material
25	W	F2	linen-ish
25	W	F1	silky
25	W	F4	silky
25	W	F6	silky
25	W	F5	ribbon
26	W	S5	floral
26	W	S6	sweet
26	W	S4	lotion
26	W	S7	bad
26	W	S3	candy
26	W	S2	lotion
26	W	S1	floral
26	W	F3	silky
26	W	F5	smooth
26	W	F4	synthetic
26	W	F2	soft
26	W	F7	silky
26	W	F6	thin
26	W	F1	satin
26	W	C3	vibrant purple
26	W	C1	muted/dull purple
26	W	C7	almost pastel purple
26	W	C6	standard purple
26	W	C5	dark purple
26	W	C2	vibrant purple
26	W	C4	vibrant darker purple

27	W	F6	very smooth, silky
27	W	F2	rough
27	W	F1	very smooth
27	W	F5	neutral
27	W	F4	flat
27	W	S1	baby oil
27	W	S2	piney
27	W	S7	evergreen
27	W	S4	lilac
27	W	S6	sweet
27	W	S3	gummy bears
27	W	S5	regular incense
27	W	C1	grape
27	W	C2	grape popsicle
27	W	C6	mood ring grape
27	W	C5	sultry purple
27	W	C7	fushia
27	W	C4	alternate lifestyle purple
27	W	C3	vibrant purple
28	W	S6	a little spicy, kind of sweet, not as potent
28	W	S5	strong, pine-ish
28	W	S1	Soapy smell, relatively strong
28	W	S7	little sweet, a little more piney
28	W	S2	not very strong, new car smell
28	W	S3	very sweet, strawberries, fruits
28	W	S4	really strong, spicy-pine
28	W	C6	light violet
28	W	C1	black and blue bruise
28	W	C3	sunset violet
28	W	C2	washed out violet-more white
28	W	C5	teletubbie- tinky-winky
28	W	C4	rainbow purple
28	W	C7	barney purple
28	W	F1	soft and glides on fingers
28	W	F7	feels shiny, smooth
28	W	F5	velvety, soft
28	W	F4	smooth but rough
28	W	F3	smooth, can't feel stitching of fabric
28	W	F2	very soft, velvety but more percise -can't feel ridges
28	W	F6	very smooth, stringent, cohesive

29	W	C7	closest to magenta
29	W	C3	middle shade
29	W	C1	darkest purple
29	W	C6	second closest to magenta
29	W	C4	third darkest shade
29	W	F5	softest
29	W	F3	feels striped with ridges
29	W	F4	most plasticy feel
29	W	F2	roughest
29	W	F6	feels like touching leather
29	W	F7	most stretchy
29	W	F1	non-stretchy rayon
29	W	S7	most musky
29	W	S3	most fruity
29	W	S6	sweetest
29	W	S4	strongest scent
29	W	S1	soap
29	W	S5	softest scent
29	W	S2	something you would smell
30	W	F1	mesh shorts, basketball shorts
30	W	F5	softer, suede
30	W	F7	basketball shorts
30	W	F2	coarser
30	W	F3	tougher to feel and bend
30	W	F4	silkier, softer
30	W	F6	basketball shorts
30	W	C6	medium, in between light and dark
30	W	C2	bolder purple
30	W	C5	dull, darker purple
30	W	C3	medium purple
30	W	C1	really dark purple
30	W	C7	light one
30	W	C4	dull & dark
30	W	S5	soap
30	W	S6	piney/woody
30	W	S2	tropical
30	W	S3	tropical-like berry
30	W	S4	lemony-lime
30	W	S1	pine-ish
30	W	S7	soap

Appendix E

Subj	Sex	Stim	Encoding
31	M	C3	purple
31	M	C5	dark purple

Subj	Sex	Stim	Encoding
33	M	F3	leathery
33	M	F4	cotton

Sub	Sex	Stim	Encoding
37	W	C4	plum
37	W	C7	pinkish

31	M	C4	bluish purple
31	M	C7	violety purple
31	M	C2	navy purple
31	M	C1	lavender
31	M	C6	faint purple
31	M	S4	typical bathroom spray
31	M	S7	faint bathroom spray
31	M	S3	cherry
31	M	S2	cheap bathroom fragrance-public place
31	M	S6	perfume
31	M	S1	chlorinated
31	M	S5	older woman's perfume
31	M	F2	regular fabric
31	M	F5	softer fabric
31	M	F7	cheaply made fabric
31	M	F3	coarser fabric
31	M	F4	thin
31	M	F1	more pleasant fabric
31	M	F6	thin but smooth fabric
32	M	S2	flowery
32	M	S7	sweet
32	M	S5	spicy
32	M	S4	plant-like, flower-like
32	M	S1	sharp
32	M	S3	sweet
32	M	S6	fruit
32	M	F7	silky
32	M	F4	stretchy
32	M	F1	soft
32	M	F2	rough
32	M	F5	soft
32	M	F6	thin
32	M	F3	not elastic
32	M	C2	true
32	M	C7	light or bright
32	M	C5	dull
32	M	C4	dull
32	M	C1	dark
32	M	C3	vibrant
32	M	C6	Light
33	M	F5	velvety
33	M	F2	silky
33	M	F1	plasticy
33	M	F7	nylon
33	M	F6	spandexy
33	M	S1	piney
33	M	S6	vanilla-ish
33	M	S4	flowery
33	M	S5	cotton
33	M	S3	strawberry
33	M	S2	rainy
33	M	S7	regular incense
33	M	C3	purple
33	M	C5	deep purple
33	M	C6	purple
33	M	C1	plum
33	M	C2	purple
33	M	C4	royal purple
33	M	C7	violet
35	M	C1	very dark purple
35	M	C7	barney the dinosaur purple
35	M	C2	lighter purple
35	M	C3	lighter purple with a little bit of red
35	M	C4	lighter purple, plain
35	M	C6	light purple with a little red
35	M	C5	somewhat of a dark purple
35	M	F5	normal fabric, not too thick
35	M	F2	little rough, kinda sticks together
35	M	F1	little rough, sticks a little bit
35	M	F6	very smooth
35	M	F7	feels normal
35	M	F4	lighter, thinner
35	M	F3	coarse
35	M	S2	faint, not very strong but noticeable
35	M	S7	reminds of something fresh
35	M	S5	something recently cleaned
35	M	S3	cherry or strawberry lip
35	M	S4	sunscreen, suntan lotion
35	M	S1	very faint
35	M	S6	fruity candy
37	W	C3	eggplant
37	W	C6	fuzzy
37	W	C2	bright purple
37	W	C5	maroonish
37	W	C1	dark purple
37	W	S5	fresh soap
37	W	S7	baby powder
37	W	S2	cucumber
37	W	S4	really strong hand soap
37	W	S3	bath bubbles
37	W	S6	fruity
37	W	S1	shampoo
37	W	F6	vinylly
37	W	F1	satiny
37	W	F2	kind of like denim - but not
37	W	F3	plasticy smooth
37	W	F5	softer
37	W	F4	polyester
37	W	F7	really smooth
38	W	S1	soapy
38	W	S2	sweet
38	W	S3	perfume
38	W	S6	bathroom-shampoo-bathroom
38	W	S7	musty
38	W	S4	sunscreen
38	W	S5	lotiony
38	W	F5	velvety
38	W	F6	waxy
38	W	F7	smooth
38	W	F3	lined
38	W	F4	tissuey
38	W	F1	slippery
38	W	F2	rough
38	W	C4	bright
38	W	C5	dull
38	W	C2	babyish
38	W	C6	brownish
38	W	C1	navyish
38	W	C7	vivid
38	W	C3	lighter blue

* The templates for Subject # 34 and 36 were not completed

Appendix E

Subj	Sex	Stimuli	Encoding	Subj	Sex	Stimuli	Encoding
39	W	F5	stretchy	41	W	C2	bright purple

39	W	F7	thin
39	W	F6	light
39	W	F4	sheer
39	W	F1	sturdy
39	W	F2	medium
39	W	F3	less smooth
39	W	S2	neutral
39	W	S6	lavender
39	W	S3	sweet
39	W	S7	plain
39	W	S4	strong
39	W	S1	mild
39	W	S5	soap-like
39	W	C7	light
39	W	C1	dark
39	W	C5	purple
39	W	C6	pink-ish purple
39	W	C3	reddish purple
39	W	C2	lighter purple
39	W	C4	bluish purple
40	W	S1	musty, from a forest
40	W	S4	like a chemical
40	W	S5	subtle
40	W	S3	floral
40	W	S6	baby powder
40	W	S2	subtle
40	W	S7	musty and subtle
40	W	C3	Violet
40	W	C6	purple
40	W	C7	light purple
40	W	C2	purple
40	W	C1	dark purple
40	W	C4	darkish purple
40	W	C5	purple
40	W	F7	silky
40	W	F2	rougher
40	W	F3	silky
40	W	F4	smooth
40	W	F1	silky
40	W	F5	rough
40	W	F6	silky
41	W	C1	eggplant
41	W	C5	rusty purple
41	W	C6	pale purple
41	W	C7	light purple
41	W	C3	bold purple
41	W	C4	bluish purple
41	W	F5	skin
41	W	F6	plasticy
41	W	F7	plastic tablecloth
41	W	F3	snake-like
41	W	F4	satiny
41	W	F2	rough
41	W	F1	cottony
41	W	S1	nutty, coconuty
41	W	S5	flowery
41	W	S7	musty
41	W	S4	bug spray
41	W	S2	sweet
41	W	S3	cherry
41	W	S6	vanilla
42	W	F3	silky
42	W	F6	silky
42	W	F1	soft, microfiber
42	W	F5	fluffy
42	W	F2	rougher thatn others
42	W	F7	grainy
42	W	F4	thinner than rest
42	W	C4	purple
42	W	C7	pinkish
42	W	C3	grape
42	W	C1	darkest
42	W	C6	earthy
42	W	C2	whimsical
42	W	C5	flat
42	W	S7	woody
42	W	S1	citrusy
42	W	S5	yankee candle, bayberry
42	W	S3	(apples) sweet
42	W	S6	food, spicy
42	W	S2	(delicious) flowery
42	W	S4	beach, soapy-clean

Latent Coding for Group Communications

C1 **Darkest Purple**	C2 **Bright Light Purple**	C3 **Vibrant Medium Purple**
Dark Purple (8) ** 31.3%	Purple (6)* * 30.8%	**Purple** (6) 35%
Darkest Purple (4) **	medium purple	standard purple of rainbow
Darkest (4) ***	rainbow purple*	normal purple
Eggplant (2)	flatest color without other hues	purple purple
really dark purple (2)	not lightest, not darkest, crayola purple*	middle shade
really dark, blackish purple	medium shade of purple	medium purple
goth, dark	True*	Grape (2)
dark plum	**Light Purple** (2) **	grape jelly*
darkest with most gray	lighter purple (2) *	**Vibrant Purple** (2)
indigo	little lighter (pinker) than rainbow purple	barney purple, little kid purple
dark purple crayon, reflects least amount- of light*	light purple crayon*	bright
very dark purple a few shades	washed out violet-more white	shiniest purple*
very dark purple*	**Bright Purple** (3)	bright with red hues but deeper
navyish	vibrant purple	reflects light the best--if in window would give a glare*
gloomy*	most vibrant purple	vibrant*
night sky, end of dusk	bolder purple	bold purple
black and blue bruise		Light Purple*
		light plum, light violet
		lighter purple
		lighter purple with a little bit of red*

*=Descriptions contributed by men
% in the right corner are the percentages that men contributed to the Group Labels.

C4 **Bluish Dark Purple**	C5 **Dull Dark Purple**	C6 **Pale Reddish Purple**
Plum (3) 13.3%	**Dark Purple** (3) 38.9%	Purple * 52.4%
Bluish Purple (3) *	second darkest (2) **	flat purple (2) **
Violet (2)	dark purple with brown	simple*
darker shade of purple bluish tint	dark, muted purple	medium color purple
Dark Purple (3) *	deepest, dark, red hues	standard purple
darker shade of purple bluish tint	darker purple*	medium, in between light and dark
dark deep and solid	dull, darker purple	Barney (2)
duller, dark color	somewhat of a dark purple*	barney purple
darker undertones, second darkest	**Dull** (3)	**Pale Purple** (2)
vibrant darker purple	dark, muted purple*	second lightest*
darkish purple	dull, darker purple	seventh darkest*
dull & dark	flat	sixth darkest*
Purple	grayish purple	tad darker than lightest*
basic purple	sullen*	light violet
medium purple*	mat	faint purple*
in between purple*	Purple (2)	light*
rainbow purple	normal purple*	light purple with a little red*
plain*		**Reddish Purple****
		light purple with a little red*
		dark purple with red
		reddish
		second brightest, second warmest, second- most reddish undertones
		pink-ish purple
		ugly purple with brown
		mauve*
		second closest to magenta
		brownish
		earthy

C7	**Pinkish, Light Purple**	
Lightest Purple (3) ***		34.8%
	light purple (3)	
	very light almost pinkish tint purple	
	sixth darkest*	
	seventh darkest*	
	almost pastel purple	
	light one	
	light or bright*	
	light	
Pinkish (2)		
	pinker purple	
	reddish purple	
	very light almost pinkish tint purple	
	brightest, warmest, most red	
	more reddish purple*	
	dark pink*	
	magenta	
	fushia	
	closest to magenta	

F1	**Soft and Textured**	
Silky (2)		47.1%
	silky surface	
	silky surface, slippery	
Satin		
	Slightly satin	
	satiny	
Soft*		
	soft, smooth	
	soft stretchy*	
	second most soft	
	soft and glides on fingers	
	soft, microfiber	
Smooth*		
	soft, smooth	
	smooth or slippery	
	very smooth	
	thin smooth fabric*	
Slippery		
	smooth or slippery	
More Texture		
	(sports) jersey	
	bumpy	
	more rough, thicker	
	rough, broken in denim*	
	corduroy-sort of*	
	slightly furry*	
	more coarse, like a pair of jeans*	
	nylon, small ridges, not rough*	
	mesh shorts, basketball shorts	
	little rough, sticks a little bit*	

F2	**Roughest**	
Rough = 4*		40%
	roughest (2) *	
	coarse*	
	rougher, couch	
	rougher (2)	
	more coarse, not very elastic*	
	more rough*	
	coarser	
	little rough, kinda sticks together*	
	rougher than others	
	stockings	
	screen	
	not that silky/soft	
	fuzzy	
	more textured, more bumby,	
	intersecting rays- in a grid*	
	slightly textured, not stretchy*	
	curtain fabric*	
	ridged-y-er*	
	kind of like denim - but not really	

F3	**Stiff and Smooth**	
Silky (3)		35.5%
	very satiny/silky	
	hard silky	
	smooth, silky very small ridges*	
	thicker almost silky*	
Smooth (2)		
	smooth with bigger fibers	
	smooth, stiff	
	thin smooth fabric*	
	smoother like table cloth, not too rough*	
	smooth, silky very small ridges*	
	stiff and smooth*	
	ribbon, smooth	
	smooth and homogeneous	
	smooth, can't feel stitching of fabric	
	plasticy smooth	
Firm (1)		
	ridged, tightly packed/woven	
	feels striped with ridges	
	coarser fabric*	
	coarse*	
	firm	
	hard silky	
	smooth, stiff	
	stiff and smooth*	
	tougher to feel and bend	
	heavier than rest, a little less smooth*	
	durable	leathery*
	waxy*	tight*
	thicker fabric*	plasticy smooth
	curtains	snake-like
	pleather	not elastic

F4	**Thin and Smooth**	
Silky (2)		54.5%
	silk (2)	
	silkier, softer	
Thin (2)* *		
	sheer (2) *	
	very thin (2)	
	very smooth, very thin, flimsy	
	thin smooth fabric*	
	thin	
	thin elasticy*	
	thin and not very textured*	
	fingers are sliding, not as coarse, delicate,- thinner*	
	very thin, smooth*	
	lighter, thinner*	
	tissuey	
	thinner than rest	
Smooth (2) *		
	fine and smooth	
	very smooth, very thin, flimsy	
	smooth, glossy*	
	thin smooth fabric*	
	fingers are sliding, not as coarse, delicate,- thinner*	
	very thin, smooth*	
	slippery*	
	smooth but rough	

F5	**Soft and Velvety**	
Smooth (4) *		35.3%
	fairly smooth*	
	thin smooth fabric*	
Velvety (3) **		
	peach fuzz	
	most fuzzy*	
	velvety, soft	
Soft (2) *		
	softer (2)	
	comfortable and soft	
	very soft, very thin, flimsy-like	
	softest, most loosely woven	
	lighter, silky, softer	
	really soft and light*	
	velvety, soft	
	softest	
	softer, suede	
	softer fabric*	

F6	**Thin Silky Smooth**	F7	**Stretchy Silky Smooth**	S1	**Scented Soap**
Silky (4)	53.8%	**Silky** (5)**	25%	**Soap**	27.3%
silky smooth*		silk		Hand Wash*	
silk		moderately silky		Bar of soap, less- intense*	
almost silky*		**Smooth** (2)		Soapy Smell	
mix between silky and rough, roughest*		satin-like smooth		Soapy	
very smooth, silky		thin smooth fabric*		Soapy smell, relatively- strong	
Thin (4) *		very fine, smooth		Floor Cleaner	
light (2) *		stretchy and smooth		Clean Linen-like	
very smooth, thin		feels shiny, smooth		Shampoo	
thin smooth fabric*		really smooth		**Floral**	
flimsy, slippery		*grainy*		Jasmine or lavender	
thin but smooth fabric		**Stretchy**		Potpourri*	
not as thick, elasticy*		thin stretchy*		Roses	
Smooth (2) *		stretchable		Flowery Type	
silky smooth (2) *		stretchy and smooth*		**Piney***	
very smooth, thin		most stretchy		wood	
smooth when stretched*		polyester swimsuit		pine-ish	
thin smooth fabric*				musty from a forest	
slippery				**Citrusy** (2)	
flimsy, slippery				Sour skittles*	
smooth lines*				Sour smell*	
very smooth, silky				Floor cleaner	
very smooth, stringent, cohesive					
very smooth*					
thin but smooth fabric*					

S2	Sweet Floral	
Sweet (3)*		26.7%
	really sweet	
	sweet flower	
	Sugary Smarties*	
Potpourri (2) *		
	old person's house	
	light flowers	
	flowers	
	flower	
	flowery*	
	flowery (delicious)	
	sweet flower	
Fruity (2) *		
	apple*	
	citrus gum	
	fruity fragrant*	
	tropical	

S3	Fruity and Sweet	
Sweet (5) **		41.4%
	candy (2) *	
	like candy	
	sweet and heavy*	
	sweet apple*	
	very sweet..-strawberry..fruits	
	(apples) sweet	
	bubblicious bubble gum	
	bubble gum but not as sweet*	
	gum*	
	gummy bears	
Potpourri (3) *		
	flowery	
	floral	
Fruity		
	strawberry (2) *	
	cherry (2) *	
	watermelon*	
	raspberries	
	fruit flavored candy…	
	strawberries	
	sweet apple	
	very sweet.-.strawberries…fruits	
	most fruity	
	tropical…like berry	
	cherry or strawberry- lipgloss/chapstick*	
	(apples) sweet	
	scratch and sniff or bubble- gum, grape-flavor*	

S4	Strong Soap or Lotion	
Soap (3) *		38.5%
	bath soap*	
	Johnsons & Johnsons baby- soap	
	Lever 2000, soap-cheap*	
	really strong hand soap	
	beach soapy-clean	
	fabric softener	
	lemon Pinesol*	
	laundry*	
	lemony-lime	
	typical bathroom spray*	
Strong		
	strong like perfume	
	pungent	
	musky heaviest*	
	really strong..spicy-pine	
	strongest scent	
	really strong hand soap	
Potpourri (3) **		
	lilac	
	plant-like flower-like*	
	flowery	
	old people*	
Sunscreen…Lotion*		
	ocean*	
	suntan lotion*	
	beach	
	lotion	
	sunscreen..suntain lotion	
	sunscreen	
	beach soapy-clean	

S5 **Weak Floral Soap**	S6 **Sweet Perfume**	S7 **Woody or Musty**
Soap (5) * 37.9%	**Sweet** 41.7%	**Woody** (2) * 11.8%
fresh	sweet…girly perfume	plants
clean*	sweet and light*	natural
floral bath soap	a little spicy, kind of sweet, not as potent	plant
faint smell..soap*	sweetest	earthy*
hand soap*	fruit*	evergreen
something recently cleaned*	fruity candy*	little sweet.. a little more piney
fresh soap	fruity	**Musty** (2)
soap-like	**Perfume** (3) *	faint bad smell
Pinesol-cleaner	sweet..girly perfume	rain
Flower	girl's perfume…most pleasant*	not very pleasant
lavender*	Baby Powder (2)	unpleasant..fish..sweat..vomit
floral bath soap	bathroom-shampoo-bathroom products	musty..subtle
roses	Vanilla (2)	musty and subtle
flowery…lavendar	vanilla-ish*	bad
floral	Soapy*	Cinnamon (2) *
flowery	soap, can't smell well*	spice*
Bland	shampoo*	Can't Smell*
can't smell*	fabric softener*	faint bad smell
weak smell*	clean	bland w/ a hint of- fragrance
stronger almost nothing*	bathroom..shampoo…bathroom products	faint bathroom spray*
musky and lighter*	air fresheners..nice but not anything	musty…subtle
faint smell…soap*		musty and subtle
don't smell		
softest scent		
subtle		
strong perfume		
strong..pine-ish		

Appendix G

Post Decoding Task Questions

1. How difficult was the color task?

Easy						Difficult
1	2	3	4	5	6	7

How difficult was the scent task?

Easy						Difficult
1	2	3	4	5	6	7

How difficult was the fabric task?

Easy						Difficult
1	2	3	4	5	6	7

2. Rank the tasks in order of difficulty: (Hardest is #1)

1.
2.
3.

3. Do you have any reason to believe that you would be particularly good or bad at any or all of the tasks? If so, explain.

4. Do you have any thoughts or concerns you would like to share?

Decodings: Matching the 7 Descriptors for Each Domain with the 7 Stimuli Appendix H

Subject	Sex	C1	C2	C3	C4	C5	C6	C7	F1	F2	F3	F4	F5	F6	F7	S1	S2	S3	S4	S5	S6	S7
1	W	1	2	3	4	5	6	7	3	4	2	1	5	6	7	1	6	3	4	7	2	5
2	W	1	3	2	4	5	7	6	3	6	4	1	2	7	5	4	6	3	1	5	2	7
3	W	1	3	2	4	5	6	7	7	1	2	5	6	3	4	4	7	3	6	1	2	5
4	W	1	3	6	4	5	2	7	5	1	2	3	7	4	6	2	6	3	4	1	5	7
5	W	1	6	2	4	5	3	7	1	3	2	4	6	7	5	1	2	3	4	5	6	7
6	W	4	2	3	1	5	6	7	2	1	3	6	7	5	4	4	7	2	1	5	3	6
7	M	1	6	3	5	4	2	7	7	5	3	6	2	1	4	5	2	3	1	4	6	7
8	M	1	2	3	4	5	6	7	5	3	2	6	7	4	1	3	2	6	4	5	7	1
9	M	subject did not do decoding																				
10	M	1	2	3	5	4	7	6	1	2	4	5	7	6	3	4	1	3	2	6	5	7
11	M	4	5	6	3	1	2	7	7	1	3	6	4	5	2	7	6	3	1	4	2	5
12	M	1	2	6	4	5	3	7	1	2	3	5	4	6	7	6	3	4	5	2	1	7
13	W	1	2	3	5	4	6	7	3	1	2	6	4	7	5	1	2	3	5	4	6	7
14	W	4	2	6	1	5	3	7	5	1	2	4	3	6	7	6	5	3	4	1	7	2
15	W	1	3	2	5	4	6	7	7	1	3	6	5	4	2	4	6	3	1	5	2	7
16	W	1	6	3	5	4	7	2	6	4	2	5	1	3	7	2	5	3	4	6	1	7
17	W	subject did not do decoding																				
18	W	1	2	3	4	5	7	6	5	4	3	6	1	2	7	4	6	3	7	1	5	2
19	M	1	3	6	4	5	2	7	1	2	4	3	5	6	7	7	2	3	4	5	6	1
20	M	1	3	2	4	5	6	7	2	1	5	7	3	6	4	4	3	6	7	5	2	1
21	M	1	3	6	4	5	2	7	2	1	3	5	4	6	7	2	4	6	1	5	3	7
22	M	1	3	7	4	5	6	2	5	1	2	6	7	3	4	1	6	3	7	4	5	2
23	M	1	3	7	4	5	6	2	1	2	3	6	5	7	4	1	2	3	4	7	6	5
24	M	1	6	3	4	5	2	7	4	5	3	2	6	1	7	4	1	6	5	2	3	7
25	W	5	2	3	1	7	6	4	3	2	4	7	5	6	1	2	6	4	7	1	3	5
26	W	4	2	5	6	1	3	7	7	1	2	4	5	3	6	2	5	3	6	4	1	7
27	W	1	2	3	4	5	6	7	3	5	2	1	7	4	6	1	2	3	4	5	6	7
28	W	1	3	6	5	4	2	7	2	5	3	4	7	6	1	7	2	3	4	1	5	6
29	W	1	3	2	4	5	6	7	1	2	3	4	5	6	7	4	2	3	7	5	6	1
30	W	1	6	3	4	6	2	7	5	1	3	4	7	2	6	5	2	4	6	1	3	7
31	M	1	2	3	4	5	6	7	4	3	2	1	5	6	7	5	2	3	4	1	6	7
32	M	1	2	3	4	5	6	7	5	2	3	4	7	1	6	1	4	3	6	5	2	7
33	M	1	2	3	5	4	6	7	2	4	3	7	5	6	1	1	5	3	2	4	6	7
35	M	4	2	3	1	5	7	6	1	2	3	7	6	4	5	7	2	3	4	1	6	5
37	W	1	3	6	4	5	7	2	3	2	7	6	5	4	1	1	3	6	4	5	7	2
38	W	1	3	6	4	5	7	2	5	2	6	2	1	7	3	2	7	6	4	5	3	1
39	W	4	2	3	5	1	7	6	3	2	4	6	7	1	5	4	5	3	6	1	2	7
40	W	1	7	3	4	5	6	2	4	3	1	6	2	5	7	4	5	3	1	2	6	7
41	W	1	2	4	3	5	6	7	2	7	1	4	3	6	5	5	2	3	6	1	4	7
42	W	subject did not do decoding task																				

Dichotomized Decodings (correct / incorrect):

Subject	Sex	C1	C2	C3	C4	C5	C6	C7	F1	F2	F3	F4	F5	F6	F7	S1	S2	S3	S4	S5	S6	S7
1	W	1	1	1	1	1	1	1	0	0	0	0	1	1	1	1	0	1	1	0	0	0
2	W	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1
3	W	1	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
4	W	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	1
5	W	1	0	0	1	1	0	1	1	0	0	1	0	0	0	1	1	1	1	1	1	1
6	W	0	1	1	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0
7	M	1	0	1	0	0	0	1	0	0	1	0	0	0	0	0	1	1	0	0	1	1
8	M	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	0	1	1	0	0
10	M	1	1	1	0	0	0	0	1	1	0	0	0	1	0	0	0	1	0	0	0	1
11	M	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0
12	M	1	1	0	1	1	0	1	1	1	1	0	0	1	1	0	0	0	0	0	0	1
13	W	1	1	1	0	0	1	1	0	0	0	0	0	0	0	1	1	1	0	0	1	1
14	W	0	1	0	0	1	0	1	0	0	0	1	0	1	1	0	0	1	1	0	0	0
15	W	1	0	0	0	0	1	1	0	0	1	0	1	0	0	0	0	1	0	1	0	1
16	W	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1
18	W	1	1	1	1	1	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0
19	M	1	0	0	1	1	0	1	1	1	0	0	1	1	1	0	1	1	1	1	1	0
20	M	1	0	0	1	1	1	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0
21	M	1	0	0	1	1	0	1	0	0	1	0	0	1	1	0	0	0	0	1	0	1
22	M	1	0	0	1	1	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
23	M	1	0	0	1	1	1	0	1	1	1	0	1	0	0	1	1	1	1	0	1	0
24	M	1	0	1	1	1	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	1
25	W	0	1	1	0	0	1	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0
26	W	0	1	0	0	0	0	1	0	0	0	1	1	0	0	0	0	1	0	0	0	1
27	W	1	1	1	1	1	1	1	0	0	0	0	0	0	0	1	1	1	1	1	1	1
28	W	1	0	0	0	0	0	1	0	0	1	1	0	1	0	0	1	1	1	0	0	0
29	W	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	0
30	W	1	0	1	1	0	0	1	0	0	1	1	0	0	0	0	1	0	0	0	0	1
31	M	1	1	1	1	1	1	1	0	0	0	0	1	1	1	0	1	1	1	0	1	1
32	M	1	1	1	1	1	1	1	0	1	1	1	0	0	0	1	0	1	0	1	0	1
33	M	1	1	1	0	0	1	1	0	0	1	0	1	1	0	1	0	1	0	0	1	1
35	M	0	1	1	0	1	0	0	1	1	1	0	0	0	0	0	1	1	1	0	1	0
37	W	1	0	0	1	1	0	0	0	1	0	0	1	0	0	1	0	0	1	1	0	0
38	W	1	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0
39	W	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1
40	W	1	0	1	1	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1	1
41	W	1	1	0	0	1	1	1	0	0	0	1	0	1	0	0	1	1	0	0	0	1

0:Incorrect
1:Correct Decoding

Subjects 9,17,42 did not complete the decoding task and were eliminated from this

Average by Stimulus

Colors	Average	Textures	Average	Scents	Average
C1	0.8108	F1	0.1892	S1	0.2432
C2	0.4595	F2	0.2973	S2	0.3514
C3	0.4865	F3	0.4054	S3	0.7297
C4	0.5946	F4	0.2162	S4	0.3784
C5	0.6757	F5	0.2703	S5	0.3514
C6	0.4595	F6	0.3514	S6	0.2973
C7	0.6757	F7	0.2973	S7	0.5405
Stimuli	0.594614286		0.2896		0.4131

Average by Subjects

Subject	Sex	Colors	Textures	Scents	
1	W	7	3	3	
2	W	3	0	3	
3	W	5	0	1	
4	W	4	0	3	
5	W	4	2	7	
6	W	5	1	1	
7	M	3	1	4	
8	M	7	0	3	
10	M	3	3	2	
11	M	1	1	1	
12	M	5	5	1	
13	W	5	0	5	
14	W	3	3	2	
15	W	3	2	3	
16	W	2	1	3	
18	W	5	2	1	
19	M	4	5	5	
20	M	5	1	1	
21	M	4	3	2	
22	M	4	0	2	
23	M	4	4	5	
24	M	5	2	1	
25	W	3	3	0	
26	W	2	2	2	
27	W	7	0	7	
28	W	2	3	3	
29	W	5	7	4	
30	W	4	2	2	
31	M	7	3	5	
32	M	7	3	4	
33	M	5	3	4	
35	M	3	3	4	
37	W	3	2	3	
38	W	3	1	2	
39	W	2	1	2	
40	W	5	1	3	
41	W	5	2	3	Communication Accuracy
Averages:		4.1622	2.0270	2.8919	<--Scores

Percents of Encodings Contributed by Men to Group Labels

Colors		Fabrics		Scents	
C1	31.3%	F1	47.1%	S1	27.3%
C2	30.8%	F2	40.0%	S2	26.7%
C3	35.0%	F3	35.5%	S3	41.4%
C4	13.3%	F4	54.5%	S4	38.5%
C5	38.9%	F5	35.3%	S5	37.9%
C6	52.4%	F6	53.8%	S6	41.7%
C7	34.8%	F7	25.0%	S7	11.8%
Averages:	33.8%		41.6%		32.2%

Total Average: 35.9%

The numbers in this table are taken from the latent coding lists in Appendix F.