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Linguistic Relativity and Multilingualism

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LINGUISTIC RELATIVITY AND MULTILINGUALISM

by

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ABSTRACT

Over the last decade, linguistic relativity has seen a resurgence in research and discourse on thought, language, and culture. One particular facet of this research, multilingualism, has been relatively sparse in comparison to the wealth of research available focusing on individual languages and monolingual speakers. This study represents a preliminary investigation that enters this arena by focusing specifically on how speakers of English as a second language use English basic color terms in respect to monolingual speakers. This is done by using a modified methodology from the World Color Survey as a comparative model of a speaker's division of colors. Participants in this study illicit responses for 160 color tiles taken from the Munsell color chart used as the basis of the World Color Survey.

The results of this study show that three of the ten multilingual participants division of the color space per English color terms falls outside of the normal range of variation between the monolingual English speakers who participated in this study. Though future research is needed to definitively posit the reasons for those participants color maps, this study provides a new window and inquiry into an under-researched area of linguistic relativity.

ACKNOWLEDGEMENTS

I would like to thank the multitude of people who made this possible and helped me along the way to creating this thesis. Thank you, Dr. Olga Bedoya for going above and beyond during your own busy schedule to seek out and find students to participate in my survey and taking a genuine interest in not only my study, but myself as a young researcher. I would like to also thank Denise Crisafi for assisting me throughout the process with any questions, queries, or mistakes I had made during the Honors in the Major process. My sincere gratitude is extended to my committee members, Dr. Ty Matejowsky and Dr. Valerie Sims for agreeing to be part of my study and dedicating their time. The office and staff of the Research and Mentoring Program also deserves equal praise for facilitating and mentoring me from an undergraduate student into an undergraduate student researcher. Their offices and resources were paramount in fostering me as a researcher. My parents, Lisa and John Casorio, also deserve gratitude for always believing in me and encouraging me to better myself each and every day and instilling in me the drive to work hard and not be discouraged by hurdles or speedbumps along the way. Thank you to Ashley Chatman for being supportive and present during each step of the way. I would also like to thank my sister, Jamie Casorio, for helping me assemble and organize parts of my study and for also encouraging me to strive for greatness in academia. None of this would have been possible, however, without the tutelage of Dr. Beatriz Reyes-Foster throughout the entire process. When I first arrived at the University of Central Florida, I had no idea how to enter the world of research, but Dr. Reyes-Foster fielded me and selflessly dedicated her time and energy to helping me turn an interest into a reality. Her patience, kindness, and direction have made an impact on me that will last a lifetime. To the dozens of friends, family, and instructors who have also helped me along the way, thank you as well.

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Introduction

Language provides us, as humans, the means to describe, categorize, and ponder everything around us. It is easy, however, to overlook the complicated factors involved in the production and performance of language as it is a natural, everyday part of our lives. The layers of complexity involved with language are too numerous to list and yet with relative ease any number of people speaking the same language can in effortless conversation discuss a plethora of abstract concepts. This never becomes more apparent as when one undertakes the daunting task of learning another language, when we are forced to critically think about not only the grammatical structure of a language, but the numerous contextual and semantic complexities that are expressed by any given language. If, like me, someone attempts to learn a language later in life, it seems at first almost impossible to understand how anyone could fluently speak and understand more than one language.

The phenomenon of multilingualism is the crux of my research and this thesis. Several academic disciplines provide insight into the nuances of language as a medium of thought, but research in regards to multilingualism and thought are surprisingly sparse. This project aims to enter that specific arena by exploring a particular realm of language, color terms, in multilingual individuals. By coupling empirical data with individual experience, I attempt to understand multilingualism, which I define as speaking two or more languages for the purpose of this study, and its implications from a holistic and interdisciplinary perspective. Furthermore, by using methodology detailed in this thesis, I attempt to answer a fundamental question of whether or not

speaking English as a second language impacts the perception and categorization of colors as modeled within English.

Literature Review

The relationship between language, thought, and culture presents a highly debated topic across the academic landscape composed of many disciplines including psychologists, linguists, and anthropologists. Anthropologists, or more specifically, linguistic anthropologists, posit that an axiomatic relationship exists between language, thought, and culture; a concept given the popular misnomer[1], "Sapir-Whorf Hypothesis" (Ahearn, 2012, p. 69). Within this field of thought, researchers primarily focus on cross-linguistic and cross-cultural differences between languages that may or may not have non-linguistic cognitive effects. Surprisingly, there has been a scant amount of research done with linguistic relativity in respect to multilingualism despite the prevalence of multilingualism in the rapidly globalizing world (Groot & Kroll, 2005).

Linguistic Relativity

Linguistic relativity, or the "Sapir-Whorf Hypothesis," is a complicated, and often contorted, concept that has waned in and out of discourse since the nineteen-fifties. Simply stated, linguistic relativity suggests that the wide array of languages influence the thought of those who use them (Lucy, 1992). Often linguistic relativity is given a "hard," deterministic interpretation, or a "soft," relative interpretation (Cameron, 1999). The hard interpretation pigeon-holes Whorf's axiom into two inflexible concepts;

[1] Ahearn states that outside of linguistic anthropology, the "Sapir-Whorf Hypothesis" has been used by other disciplines "as shorthand for a simplistic and easily dismissible "strong" version of Sapir and Whorf's beliefs, which purportedly (and mistakenly) states that language *determines* thought."

1. “Structural differences between language systems will, in general, be paralleled by non-linguistic cognitive differences, of an unspecified sort, in the native speakers of the two languages.

2. The structure of anyone’s native language strongly influences or fully determines the world-view he will acquire as he learns the language” (Kay, 1984, p. 66).

These hard interpretations easily create a “straw Whorf,” that the primary language becomes the single modality of thought; an absolute interpretation that is open and vulnerable to refute in the academic community (Cameron, 1999). A soft interpretation more appropriately defines linguistic relativity and is far less refutable than the Sapir-Whorf hypothesis, in part due to its flexibility. Linguistic relativity, in this soft interpretation, insists that language influences and is influenced by thought and culture and together affect how reality is perceived by an individual.

Boroditsky (2003) argues that research in linguistic relativity has had a resurgence across many disciplines and that ample evidence of a soft interpretation of the Sapir-Whorf hypothesis is shining new insight into the complex relationship between language and thought. Any given language has unique structures, apparent to anyone who has attempted to learn another language, which transcends beyond the simple translation of terms and grammatical units. This structural diversity separates each language and “each language embodies a particular interpretation of reality and these language interpretations can influence thought about that reality” (Jourdan & Tuite, 2006, p. 54). These effects, colloquially referred to as Whorfian effects, can be found across a plethora of cognitive functions. One such nuance is explored in an experiment by John A. Lucy (1997) with English and Yucatec speakers highlighting a cognitive contrast with shape

versus material when selecting similar objects. The experiment explored a grammatical mechanic within the Yucatec language that numerates objects with accordance to its material composition as opposed to English which as no such mandatory grammatical mechanic. In Lucy's experiment he presents children at various ages three combs that vary in either material or shape. In one version of the experiment, two of the combs are similar in shape and two are similar in material composition. What Lucy (1997) found is Yucatec speaking children after the age of nine favor the material composition of an object as opposed to English speaking children favoring shape of an object with regard to grouping, but children younger than nine, regardless of language, favored shape.

Another study provides evidence of a difference in spatial orientation between languages. A study noted in Ahearn's (2012) "Language, Thought, and Culture" shows a stark contrast in English's relative spatial orientation as compared to many languages fixed spatial orientation. The study referenced is by Levinson, where he "conducted various experiments testing the spatial memory and reasoning abilities of speakers of Tzeltal, Guugu Yimithirr, and other languages" (Ahearn, 2012, p. 88). To summarize, Levinson found that languages, such as those mentioned, that do not possess the relative spatial terms similar to the English "right" and "left," orient themselves and objects in their environment in a much different way. In one of the experiments, Levinson had subjects sit at a table with a row of stuffed animals. After a short period, he removed the stuffed animals and asked the subjects to replace the stuffed animals on the original table and then on another table facing the opposite direction. The order of the stuffed animals on the second table was dependent upon the relative or fixed spatial terminology of their language.

These are just a few studies that highlight cognitive impacts that extend beyond the vocal expression of language. The implication of this research is that language can have a profound cognitive impact on the way an individual perceives and classifies their environment. Though not determinant, there is a strong argument that can be made for the axiomatic relationship between thought, language, and culture as suggested by the theoretical frameworks of linguistic relativity.

Research on Multilingualism and Cognition

Where this corpus of research falls short is in the application of linguistic relativity in the realm of multilingualism. If indeed the influence of a single language is so profound on the perception of reality how then is this affected by the acquisition and fluency in two or more languages? This query is emphasized in a number of scholarly studies within the cognitive sciences (Boroditsky, 2011). In order to accomplish a more complete understanding of language and linguistic relativity it is paramount to study the cognitive effects of multilingualism, especially given the environment of the rapidly globalizing world. It is at the crossroads in research, however, where less and less data and analysis exist.

Of the research that exists there are peculiar effects that highlight a cognitive diversity between monolingual and multilingual speakers. One set of studies posits that multilingual speakers change their interpretation of reality depending on the language they are speaking at that time (Boroditsky, 2011). The acquisition of language might also have a cognitive impact on individuals during the acquisition process. Research on second language acquisition (SLA) in the past claimed that one's original language, or mother tongue, exerted a unidirectional influence on the second language that is being acquired (Boroditsky, 2011). More recently however, research

is starting to show that SLA actually has a bidirectional relationship; that the second language will influence an individual's original language (Brown & Gullberg, 2008). These recent studies of multilingualism's effect on the mind imply the influence language, or languages, has on the mind and its perception of reality. This study expounds upon existing studies in this vein by comparing the cognitive space dedicated to color as defined by English basic color terms in multilingual ESL speakers.

Research on Color Terms

For the purposes of this particular study, division of the color space will be the primary focal point. The World Color Survey (WCS), conducted by Paul Kay (1999), sought to establish a broad analysis of how different languages divide their color space by their most Basic Color Terms (BCT) and where the BCT aligns on a universal color map. BCT is defined by Kay (1999) as such; a word that most basically describes a color and meets four criteria;

1. It is monolexemic.[2]

2. Its signification is not included in that of any other color term.

3. Its application must not be restricted to a narrow class of objects

4. It must be psychologically salient for informants.[3]

The WCS provides a compendium of BCT's and their respective color maps for over 180 languages across the globe. In doing so, Kay has provided a method of comparison for the

[2] In other words, consisted of only one lexeme or word.
[3] In the context of this study, psychologically salient means that the term must be effective in presence of a stimulus.

division of color space of a wide variety of languages. The overwhelming consensus that the preliminary WCS, and its predecessor (Berlin & Kay, 1967), have found is that linguistic color categories across languages are not the same. In the WCS and Berlin & Kay studies, the research has centered on developing an evolutionary and universal development of color terms in languages.

These findings, however, have not been accepted in the academic community without due skepticism from peers. Some of the strongest criticism of Kay's findings come from noted linguistic relativist John Lucy (2005, 1997), who argues that in many languages, words that denote color properties also denote non-color properties. Lucy (1997) references a study by Harold C. Conklin on the Hanunóo language color categories. Hanunóo provide evidence of a language that identifies certain colors with not only the appearance of the color in the English sense, but also as properties of materials. For example, Lucy (1997, p. 324) quotes Conklin (1986, p. 190), "a shiny, wet, brown-colored section of newly-cut bamboo is *malatuy* not *marara÷*," whereas "*malatuy*" describes colors that are "light green and mixtures of green, yellow, and light brown" and "*marara÷*" describes colors that are "maroon, red, orange, yellow and mixtures in which these qualities are seen to predominate." The crux of Lucy's (1997, p. 326) argument lies in that the word "*malatuy*" is used not to indicate color but a "sense of wetness or freshness." However, in a 2006 publication, Kay counters Lucy's critique, suggesting that in English "green" means both the color and the quality of being "unripe or mature," yet this does not create a conflict with "green" being a basic color term within English.

Lucy makes a second criticism of Kay's work, noting that in many or all languages, words that serve to express color properties do not constitute a morpho-syntactic class. A word

that belongs to a morpho-syntactic class can be best be summarized as a word that displays a related morphological form with its syntactical function. In the case of English color terms, the property of colors as descriptive features of phenomena may place it into a morpho-syntactic class. Kay engages Lucy's second point by acknowledging that is a strong and legitimate criticism of color mapping studies. Kay (2006) takes Lucy's concerns of the morpho-syntactic classes of terms on a methodological level as a valuable contribution to research of this type. On a theoretical level, however, Kay (2006) accuses Lucy of adopting a view of language that is "one-one mapping between grammatical and semantical categories" (p. 16) that is without any accompanying support for this opinion. Regardless of these arguments and possible shortcomings, portions of the WCS methodology provide a workable way – especially in the case of English color terms - to analyze the distribution of BCT's throughout a color space with respect to languages that adjectivally use color terms.

A diverse distribution of colors and the cognitive effects of memorization of colors have been further researched without the purpose of making the broad and universal strokes of the WCS and Berlin & Kay study. One such study focuses on semantic differences in color identification between speakers of different languages, English and Ndonga, by Michael Pilling and Ian R. L. Davies (2004). Results of these experiments showed while there were some general similarities in color naming tasks for both languages, "there were significant differences between the two groups consistent with the differences in [color] language on all tasks including the search task and thus consistent with the predictions of [linguistic relativity]" (Pilling & Davies, 2004, pg. 452). This research supports the claim that color terms, regardless of whether there are

universal structures for them within language, are expressed and perceived different in respect to the language defining it.

Multilingualism

A short survey of academic publishing will show that color term research, as with many other sub-topics within linguistic relativity, dwindles once it enters the arena of multilingualism. In short, according to Groot and Kroll (2005, p. 531-532), there are a few main factors that contribute to this lack of research in multilingualism: a reluctance to acknowledge the high percentage of multilingual peoples in the world; a lack of understanding in general about multilingualism; and the idea that second languages do not affect one's native language if acquired after the critical period. Figures of the world's population that speak 2 or more language fluctuate between 50% and 70% with the generally accepted figure sitting at approximately 65% (Grosjean, 2014). This proportion of multilinguals would suggest that monolingualism, despite its mentioned bias in research, is the exception rather than the rule. It is important moving forward with research in linguistic anthropology, the cognitive sciences, and especially on linguistic relativity, to incorporate multilingualism into the broader discourse. Color is one such area that could greatly benefit from an exploration of multilingualism and the division of color. From the minute and dispersed studies, "researchers [have] found that the boundaries for non-overlapping color terms had shifted in the process of [second language] socialization and were no longer comparable to the areas mapped by monolingual speakers of these languages" (Groot & Kroll, 2005, pg. 439). Recently, Panos Athanasapoulos (2009 & 2011) has conducted research on English-Greek speakers and English-Japanese speakers, specifically on the perception of the "blue's." Both Greek and Japanese have a BCT that would be most closely translated as "light

blue" in English, but in those respective languages is a unique color. Athanasapoulos' (2009 & 2011) found that the ability to identify the Japanese and Greek hue among Japanese-English and Greek-English bilinguals increases or decreases according to which language a participant was habitually using rather than which language was their native tongue. According to Athanasapoulos, "empirical evidence is accruing to suggest that bilingual speakers with languages that differ in their lexical or grammatical concepts and categories differ from monolingual speakers of their [first language], and shift towards monolingual speakers of their [second language], in their cognitive representation of those categories" (Athanasapoulos, 2009, pg. 91). Athanasapoulos further elaborates on this concept in his Japanese-English bilingual experiment, "suggesting that knowledge of two languages with contrasting ways of parsing reality has profound consequences for cognition" (Athanasapoulos, 2011, pg. 14).

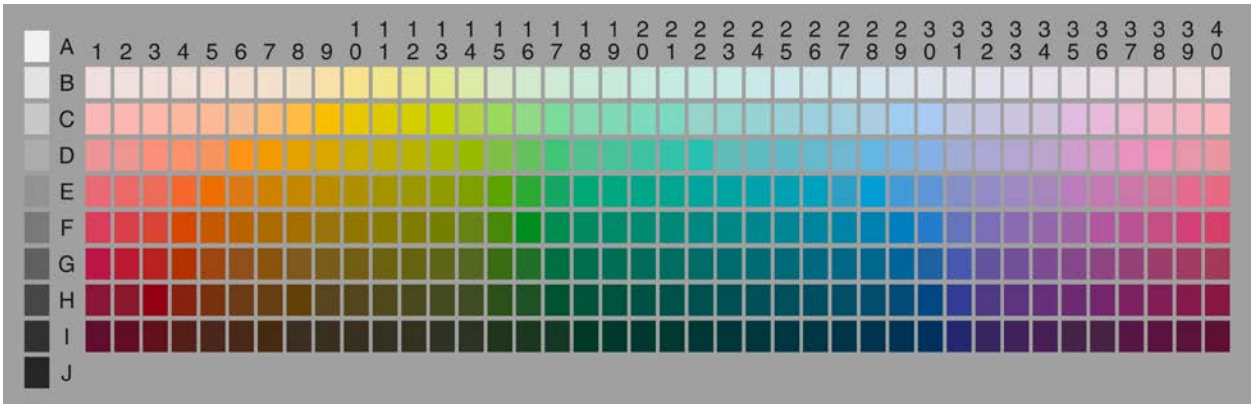
Athanasapoulos' research represents the intersecting crossroads of cognitive sciences, linguistic relativity, and multilingualism. More research that follows this vein of interdisciplinary thought could elucidate multilingualism and linguistic relativity in the future. This study is one of the only studies that surfaced through the literature review for this thesis that focused specifically on multilingualism, color, and linguistic relativity. This sparsity of research is one of the main motivating factors that inspired this study. There is a wealth of literature that addresses separately linguistic relativity and multilingualism, yet very little that is attempting to synthesize the two. This study breaks that mold and ventures into this new and largely unexplored area of research.

Research Design and Methodology

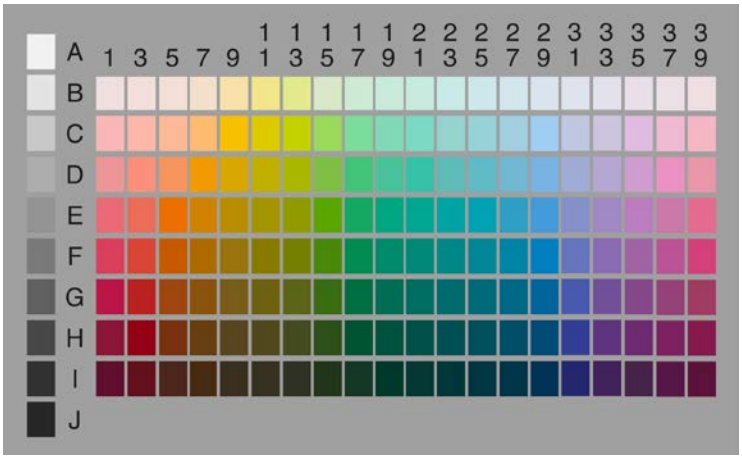
This research project uses a modified form of the World Color Survey to compare the division of color space in relation to the basic color terms in English by both monolingual and multilingual speakers of English. In the original World Color Survey, participants are given an array of 330 divided color chips which are presented individually in a pre-shuffled order and told to produce the most Basic Color Term (BCT) for each color chip. These results are recorded and then reorganized into a map that provides a map of terms and their respective locations within the Munsell color chart. Originally this was done by seeking monolingual speakers of over 180 various languages spanning the globe, hence the title World Color Survey (WCS).

World Color Survey Modifications

This survey is a modified and shortened version of the original WCS, shown below. Every other chip and the black/white scale has been removed from the Munsell color chart to produce a 160 color chip array that is still representative of the continuum of visible color. This has been done to shorten the duration of the survey in order to keep participants from becoming exhausted, a noted issue in the original WCS. Another notable variation is the omission of the focal colors test that prompts the participant to provide the best representative chip for a particular BCT. This omission is necessary for same reasons as the reduced color map - duration.



Example 1, Original Munsell Color Chart



Example 2, Modified Munsell Color Chart

Participant Selection and Recruiting

Participants were selected based on criteria outlined within the IRB proposal been approved for exemption status. Eligible participants were currently enrolled in an accredited degree program at UCF. In addition, non-degree seeking students at UCF with English proficiency test scores of at least 6.5 on the iELTS or 80 iBT on the TOEFL[4], which are

[4] The iELTS (International English Language Testing System) and TOEFL (Test of English as a Foreign Language) are standardized English proficiency tests employed by many Universities.

minimum entrance requirements for the University, were also included in the study. The status of being enrolled in an accredited degree program, or having the requisite English test scores, ensures that English as a Second Language (ESL) speakers have enough a high enough level of English proficiency to be placed in English speaking classes. The scores of 6.5 on the iELTS and an 80 iBT on the TOEFL are both the minimum proficiency level of ESL speakers for the University of Central Florida as well as my study. Participants were recruited primarily through cooperation with various departments and organizations, namingly the English Language Institute and Global UCF, within the University.

Survey Design

Prior to the modified BCT survey, each participant was given a verbal survey that provided a brief history of their linguistic background. This information included the number of spoken languages, approximate age of English acquisition, class standing at UCF, and age of the participant. The survey, in its entirety, can be found in Appendix C. Coupled with this survey is a HRP-508 form, found in Appendix B, that provided an informative summary of the research project for the participant as well as their rights as a human participant. This form was kept by the participant for their own records. This initial survey provides a linguistic background for each participant to accompany their unique color map.

After the linguistic profile was completed the BCT survey began. Each color chip was presented as a slideshow via a computer tablet. The participant moved at their own pace by

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The TOEFL iBT is a common internet based TOEFL exam. IELTS is graded on a score of 0-9 and the TOEFL is scored on a scale of 0 – 120.

swiping the tablet screen to view each chip. Each participant was asked to provide a BCT for each chip that was shown. The administrator then made a note of each response on a packet that coincided with each participant. Each chip was presented in a randomized order known only to the administrator. Afterwards, the data was re-configured into the correct order of the Munsell chart resulting in the participant's unique color map.

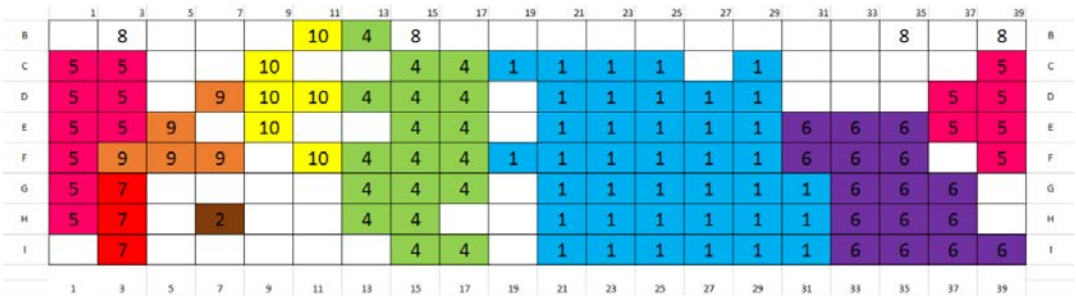
Two separate pools of completed BCT surveys are used for comparison. In order to compare the data with monolingual English speakers, eight participants were monolingual English speakers with little to no proficiency in other languages. The other ten participants were multilingual ESL speakers. By comparing the multilingual ESL speakers to the native English speakers, the survey was able to compare cognitive differences or similarities in the perception of colors of both groups.

Comparative Methods

With the two pools of BCT surveys successfully converted to their color maps, comparison of the regions of individual BCT's for speakers within and without their original pool is relatively simple. The converted data contains corresponding Munsell color chart values similar to a coordinate chart with a horizontal and vertical axis. With the converted data in color map form, analysis of BCT color regions is possible by row and column.

The English speaker's color maps were formatted into English Agreement Maps, see *example 1* below, with varying degrees of agreement. Four maps were formed that are discussed in detail in the data section of this thesis. These maps provide a baseline for the distribution of

English BCT's as defined by monolingual speakers against the distribution of English BCT's by ESL speakers.



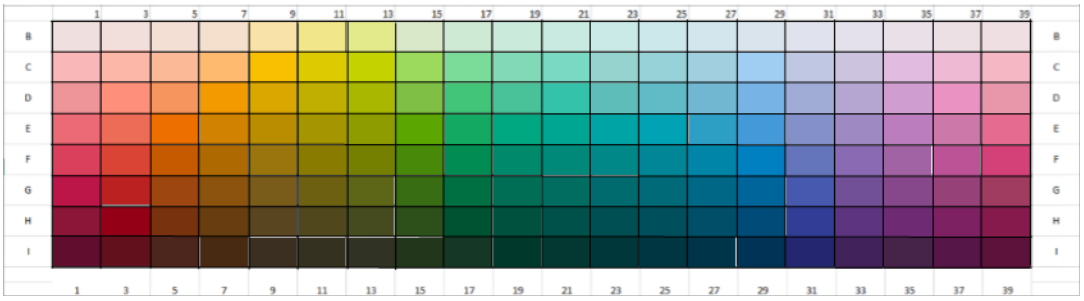
Example 3, EAM C

Another method of comparison for this study is the frequency that a BCT is used throughout the study. This was completed by counting both the total terms used and how often those terms were used. A maximum of eleven BCT's, were used by participants over the course of this study, although many did not use all eleven in their surveys. The eleven BCT's used were; blue, brown, gray, green, pink, purple, red, white, orange, yellow, and black.

Data

Original Color Map

This figure represents the modified Munsell color chart that is shuffled and used for this study. In this figure are the original colors that are isolated and shown to participants.



Modifed Munsell Chart 1

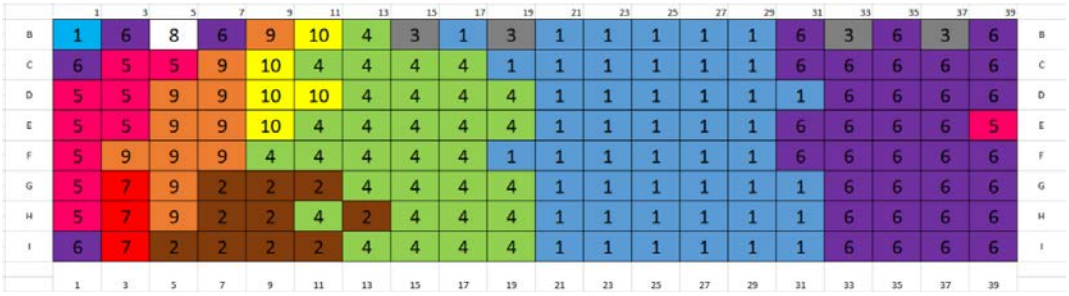
Color Map Key

To better organize the responses of the individuals, I use both a numerical code and a related and arbitrary color to distinguish between the responses. These numbers and patterns are represented spanning from 0 to 10 and are shown in the figure, *Key 1*.

Key 1

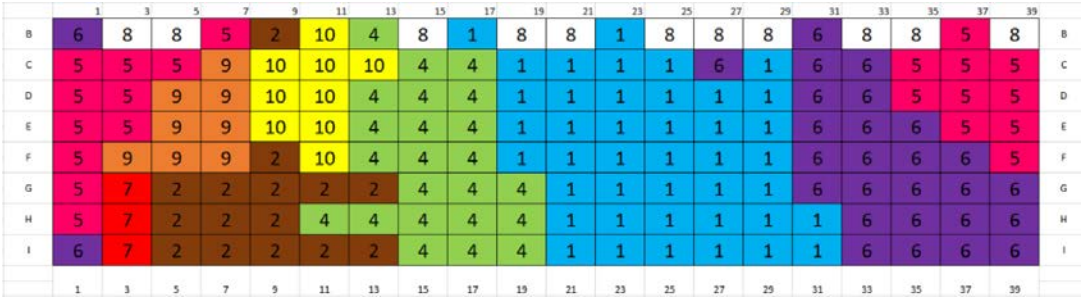
Individual Color Map Results

The following maps are the results of each individual with their accompanying age, gender, and first language. These will be referenced and discussed further in the analysis and discussion sections of this paper.



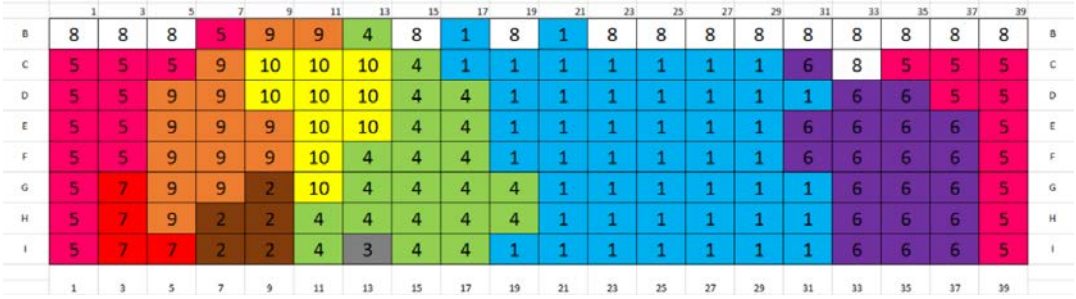
Subject 1

Subject 1, 27 years old male, native English speaker.



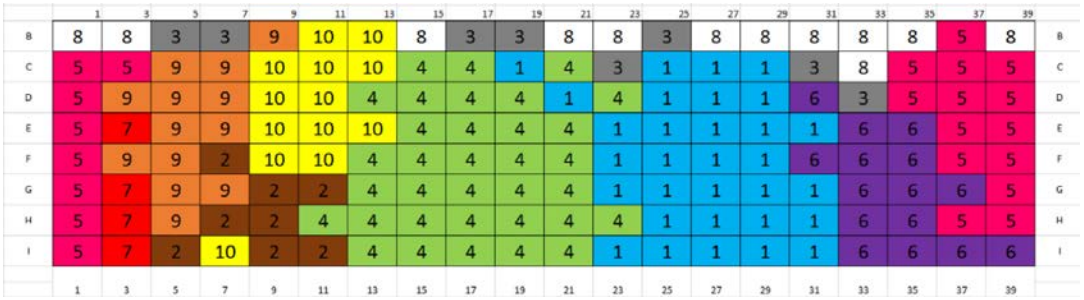
Subject 2

Subject 2, 27 years old male, native English Speaker.



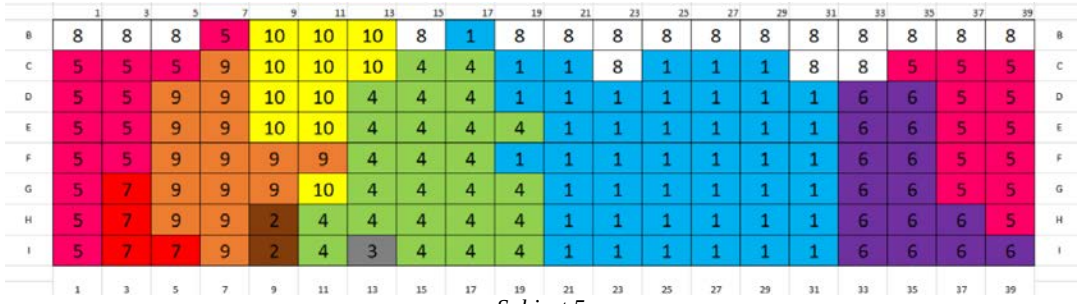
Subject 3

Subject 3, 21 years old female, native Korean speaker. Proficient Languages; English, Korean. English Acquisition: Pre-K ESOL program.



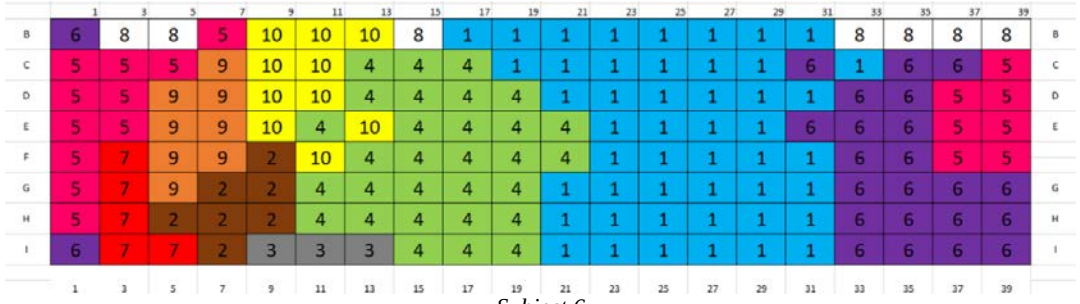
Subject 4

Subject 4, 22 years old female, native English speaker.



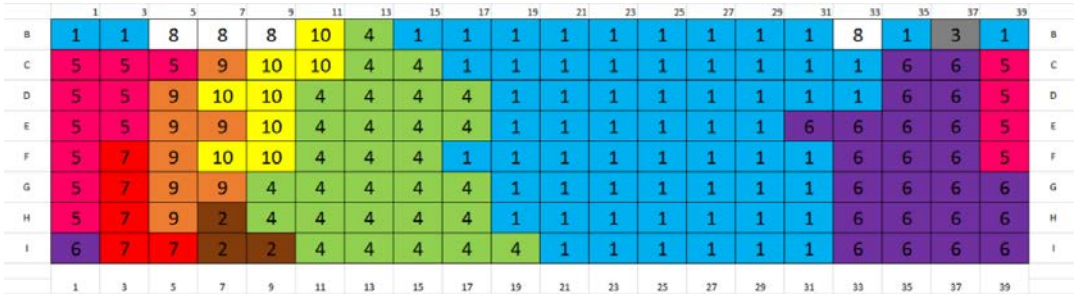
Subject 5

Subject 5, 23 years old female, native Spanish speaker. Proficient Languages; English, Spanish. English Acquisition: Pre-K ESOL program.



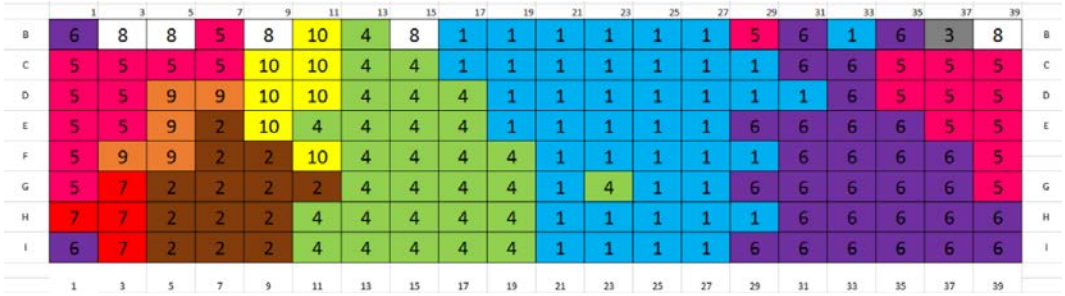
Subject 6

Subject 6, 19 years old female, native English speaker.



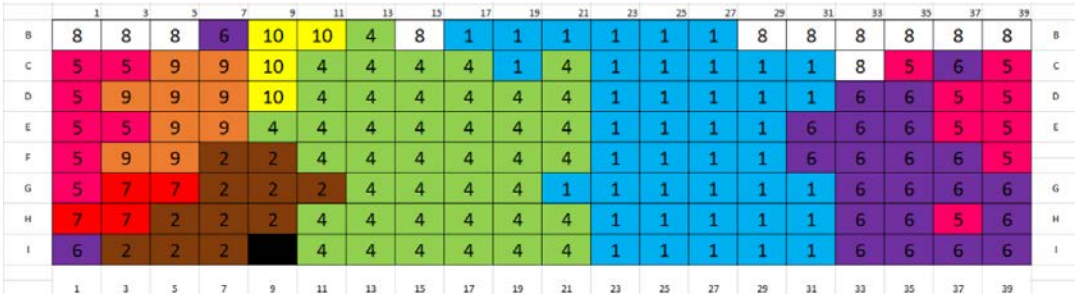
Subject 7

Subject 7, 23 years old female, native Thai speaker. Proficient Languages; English, Thai, Spanish. English Acquisition: Pre-K ESOL program.



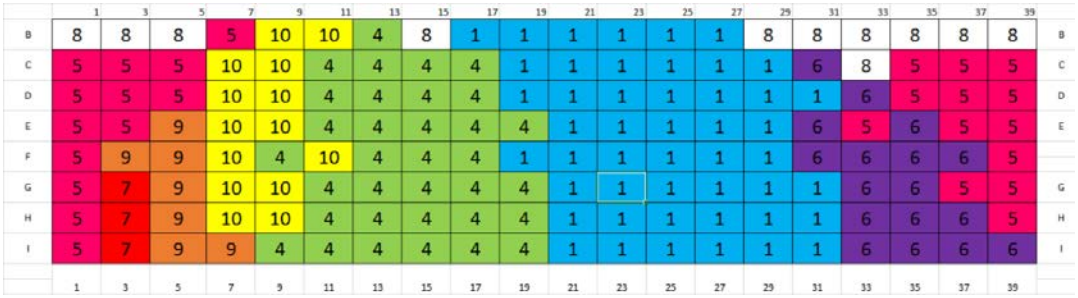
Subject 8

Subject 8, 20 years old female, native Spanish speaker. Proficient Languages; English, Spanish. English Acquisition: Two years in bilingual program followed by private lessons and tutoring.



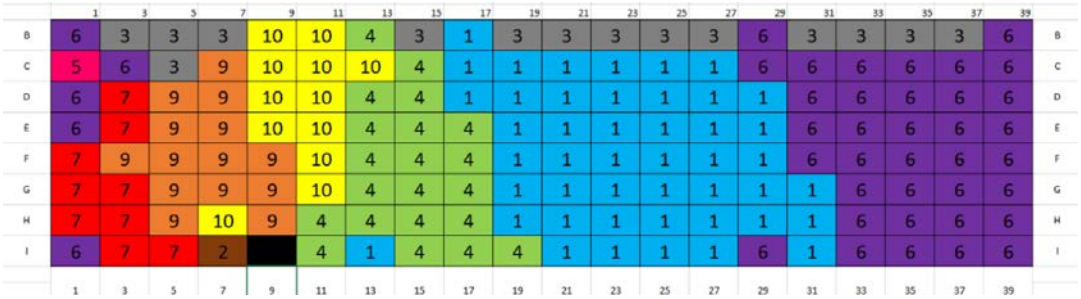
Subject 9

Subject 9, 18 years old female, native Portuguese speaker. Proficient Languages; English, Spanish, Portuguese. English Acquisition: English Schooling Institute since 10 years old.



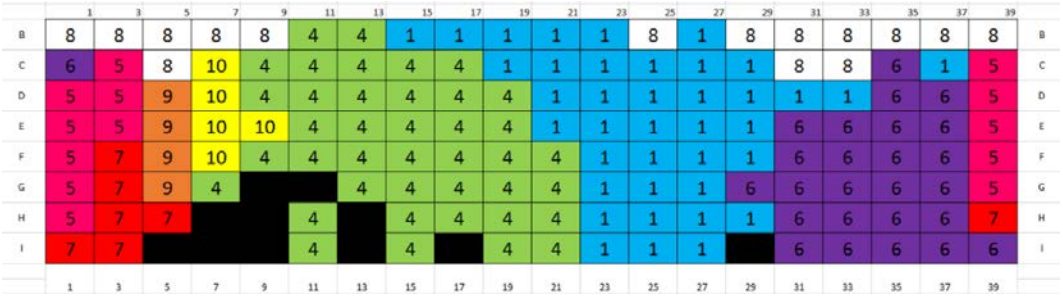
Subject 10

Subject 10, 40+ year old female, native English speaker.



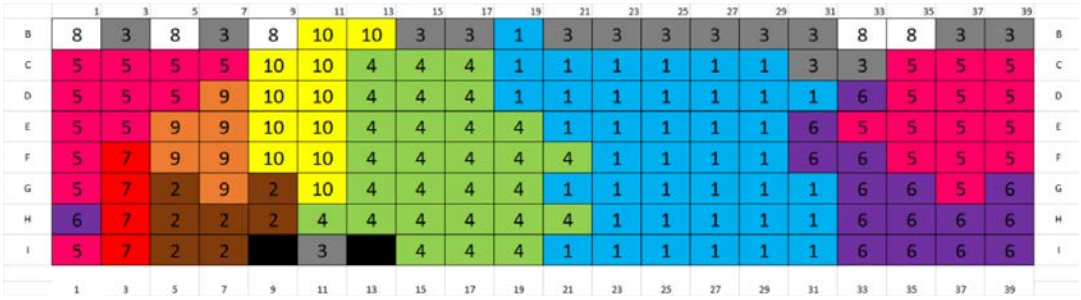
Subject 11

Subject 11, 40 year old male, native Ngambay speaker. Proficient Languages; English, French, Italian, Ngambay, Masana, Fulani. English Acquisition: Elementary school equivalent English Programs.



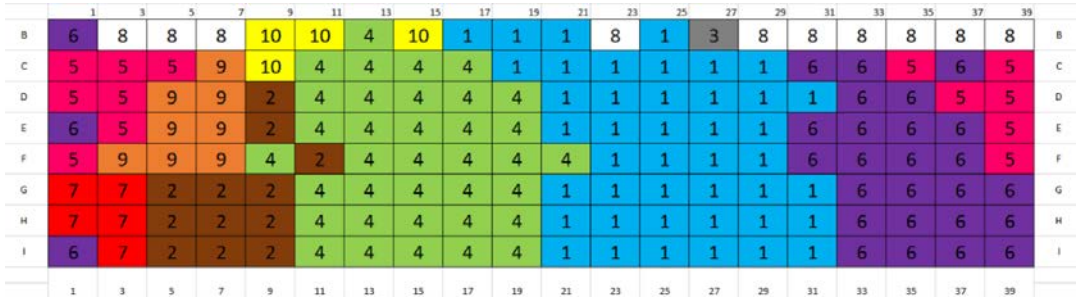
Subject 12

Subject 12, 19 year old male, native Twi speaker. Proficient Languages; English, Twi. English Acquisition: Official language taught in schools.



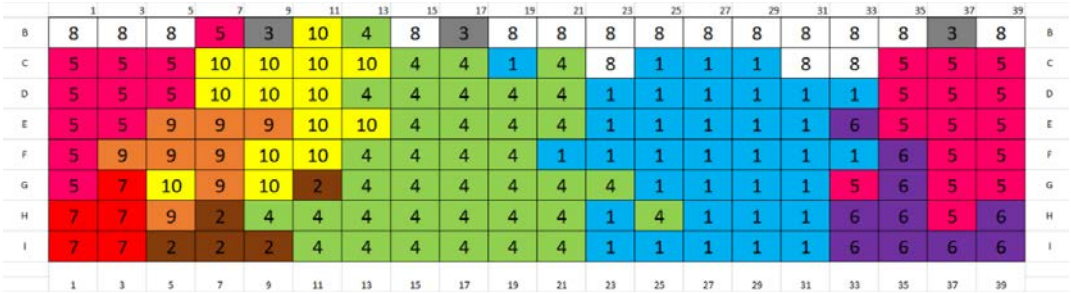
Subject 13

Subject 13, 22 year old male, native Portuguese speaker. Proficient Languages; English, Portuguese. English Acquisition: English language program beginning in junior high school.



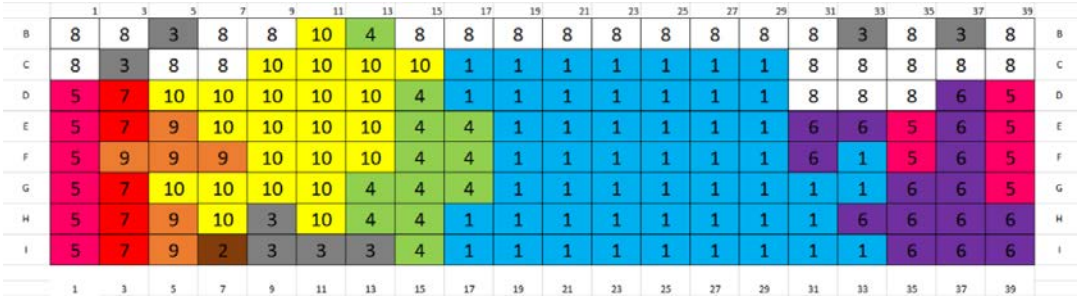
Subject 14

Subject 14, 18 year old female, native Ukrainian/Russian speaker. Proficient Languages; English, Russian, Ukrainian. English Acquisition: English lessons in Elementary school followed by personal lessons and immersion program in the United Kingdom for two years.



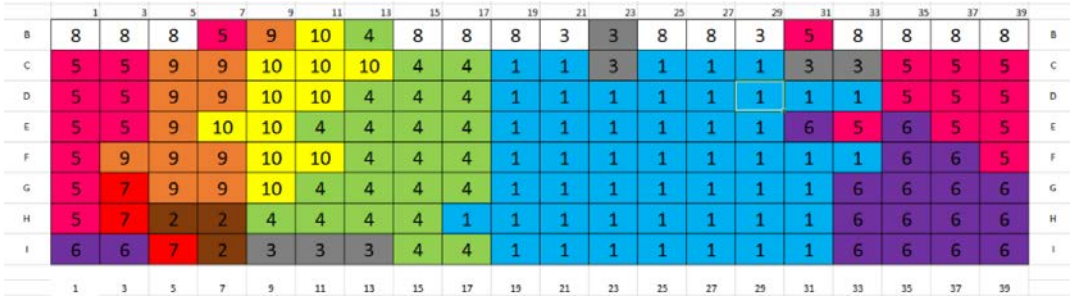
Subject 15

Subject 15, 18 year old male, native Telegu Speaker. Proficient Languages; English, Telegu, Hindi. English Acquisition: Tri-lingual education program.



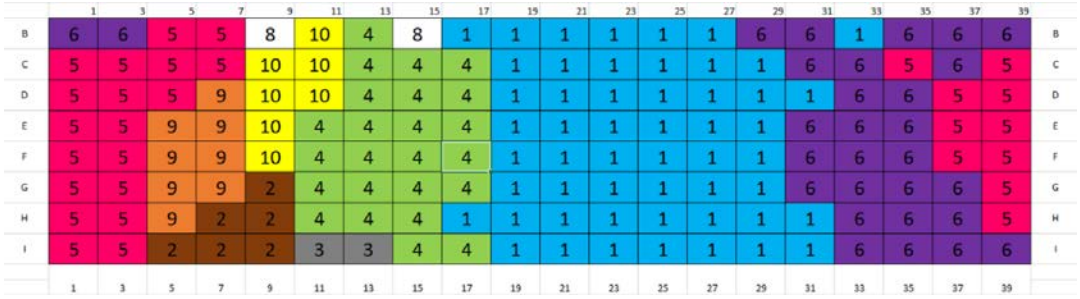
Subject 16

Subject 16, 24 year old male, native English speaker.



Subject 17

Subject 17, 25 year old female, native English Speaker.

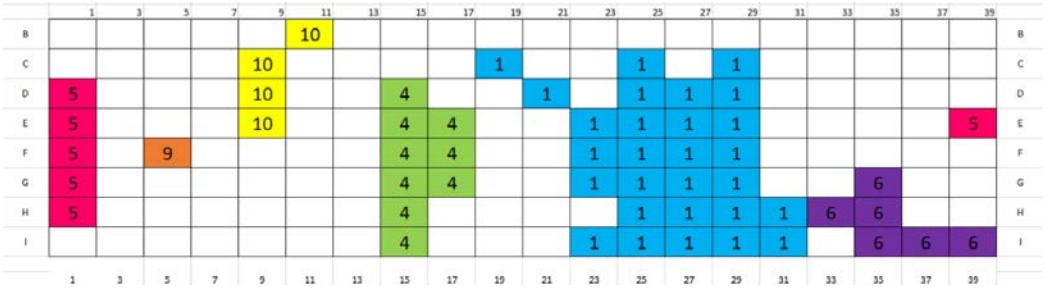


Subject 18

Subject 18, 22 year old female, native English speaker.

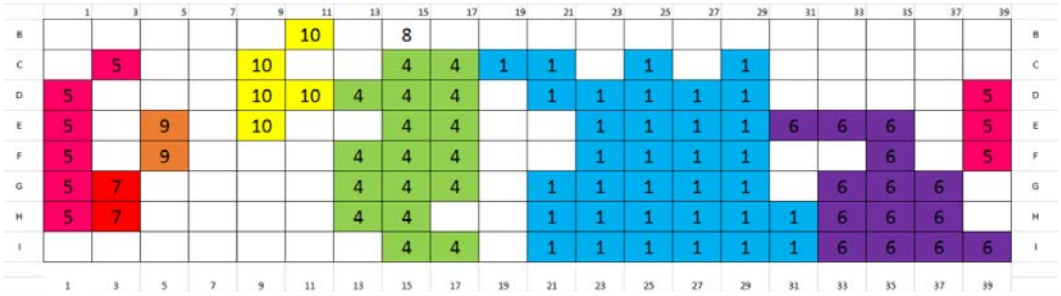
English Agreement Maps

The following figures are referred to as “English Agreement Maps,” and are the primary medium for comparison among the monolingual English speakers and the multilingual individuals who speak English as a second language. These maps are constructed by comparing each individual tile and the response given for that tile. The first map, ‘English Agreement Map A,” represents the individual color tiles that all monolingual English participants labeled as the same BCT. The second map, ‘English Agreement Map B,’ represents the individual color tiles that 87.5% of the monolingual English participants labeled identically. “English Agreement Map C” and “English Agreement Map D” represent the individual color tiles that 75% and 62.5% of the monolingual English participants respectively labeled identically. These maps provide agreed regions of specific BCT’s that provide comparative models for the multilingual color maps.



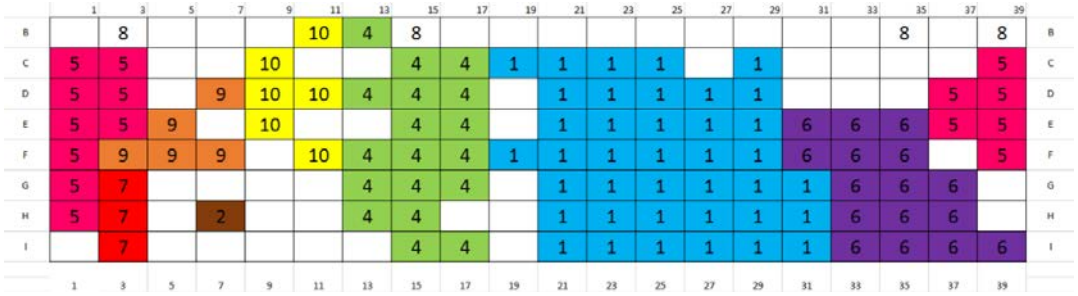
English Agreement Map A

English Agreement Map A, 100% Agreement



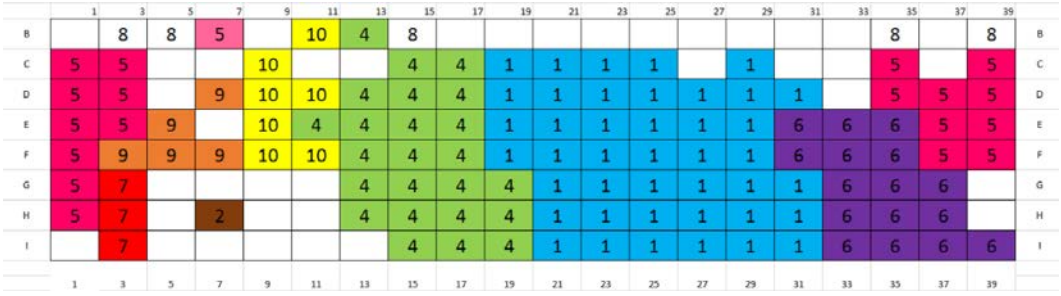
English Agreement Map B

English Agreement Map B, 87.5% Agreement



English Agreement Map C

English Agreement Map C, 75% Agreement



English Agreement Map D

English Agreement Map D, 62.5% Agreement

Proficient Languages and Language Families

This study uses 18 participants to explore the cognitive space that divides color among multilingual and monolingual English speakers. Of those 18 participants, eight are monolingual English speakers and ten are multilingual speakers who speak English as a second language. Of those ten multilingual speakers, five are bilingual and five speak three or more languages. The most languages spoken by a single participant is six, which is attributed to Subject 11. The number of languages spoken by a participant will be used as a metric for comparison within the discussion.

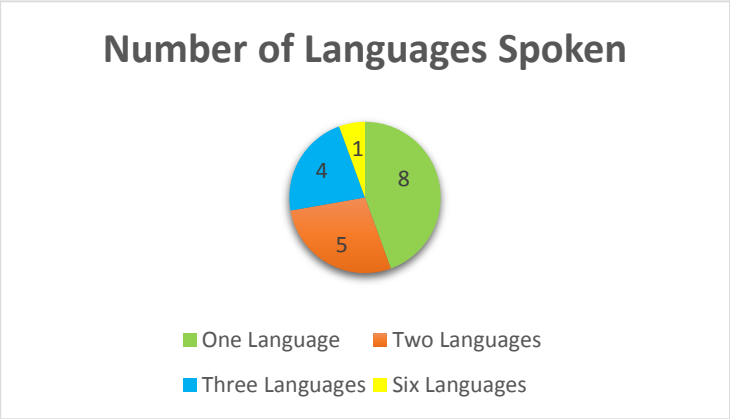


Figure 1

Across all the participants, 15 languages are represented in either the native or secondary capacity. Those languages are; English, French, Spanish, Italian, Portuguese, Russian, Ukrainian, Hindi, Telegu, Ngambay, Masana, Fulani, Twi, Korean, and Thai. The native languages list is much smaller, however, and are as follows; English, Korean, Thai, Ngambay, Telegu, Russian, Ukrainian, Spanish, Twi, and Portuguese. The full list represents six language families which are; Nilo-Saharan, Niger-Congo, Indo-European, Koreanic, Tai-Kadai, and Dravidian. Of those 15 languages, however, eight belong to the Indo-European language family which is also the most widely distributed of the represented language families. Language families are another metric that will be considered in the discussion.

Multilingual Speakers English Acquisition

The age and mode of acquisition varies across the ten multilingual participants. Kindergarten and Pre-Kindergarten programs dominate the landscape representing 70% of the participant's introduction to and acquisition of English. The remaining 30% of the participants began their acquisition of English after the age of 10 in school programs and private tutoring lessons.

Analysis

Basic Color Term Frequency

The following sections are accompanied with chart graphs that illustrate the frequency of select BCTs with each participant. Monolingual participants are easily identified in these maps by their red color in contrast to the blue multilingual bars. The frequency charts not mentioned in this section are available in the appendices.

With the exception of subjects 9 and 12, the BCT "blue" represents the greatest frequency of color tiles attributed to this term. There is great amount of variation between how many color tiles are named blue, ranging from 31 to 64, but it is easily noted that the same core regions are often attributed to blue. This core region stretches from the 23rd to 29th columns and the rows "E" to "G" (see *figure 2*). From the sample sizes taken, there is little contention to this core of "blueness" as almost all of the participants agree to the BCT blue being attached to this region.

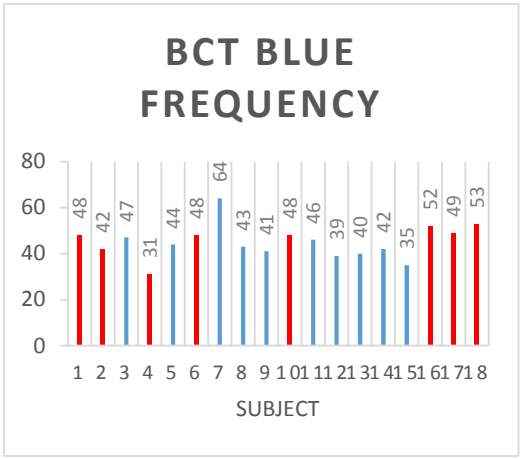


Figure 3

Extending to either the left or right is when discrepancies begin to develop not only within multilingual and monolingual English speakers, but within the monolingual English speakers themselves. These colors were often

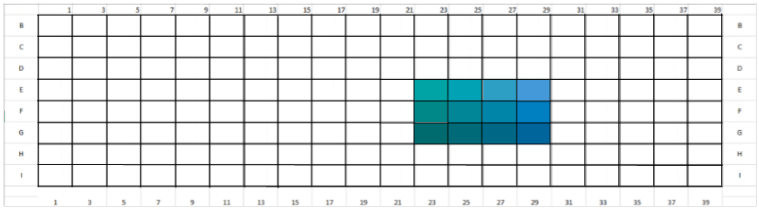


Figure 2

referred to as “uncomfortable” to participants because they straddle the muddy regions between two ideologically distinct terms, especially between blue and green. Outside of the constraints of the mono-lexemic terminology, a more common color term such as “teal” would be a more comfortable term to use when describing these colors that lie in the tertiary zone between blue and green according to participants.

The BCT term “gray” has an interesting frequency distribution as illustrated by *figure 2*. The use of this term to describe color tiles was, for the most part, minimal except into two cases. Subjects 11 and 13 attributed a majority of the lightest colors belonging to the “B” row on the modified Munsell color chart.

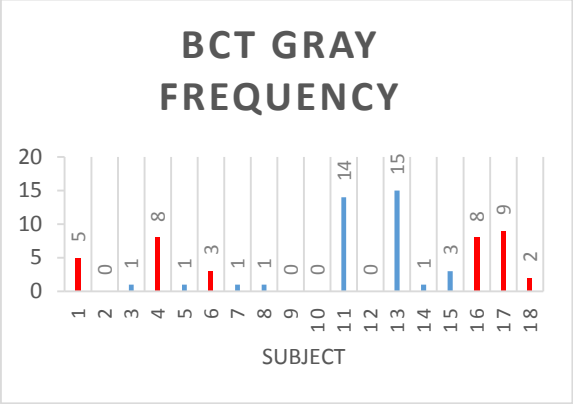


Figure 4

These three particular charts representing the frequency of the BCT’s pink, red, and purple are interesting when reviewing subject 11’s data. Though variation is expected between the frequencies of colors regardless of the participant’s language, subject 11 labeled an extremely low number of tiles “pink” in relation to

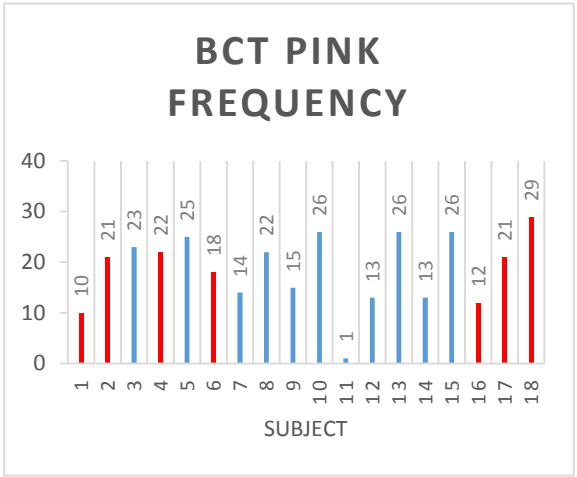


Figure 5

other subjects. Upon further review, subject 11 also attributes the most tiles to the BCTs purple and red.

Subject 11's native language, Ngambay, is a unique language family represented in this study. According to the subject, his native language does not use color in the same capacity as most of the other languages represented in this study do. In his own words, the subject said that the color of objects is described not by an individual term but rather by comparing one object to another familiar object in the environment. For example, he told me that in English I may refer to a bird as being red, but in his language he would refer to the parrot as being "like blood."

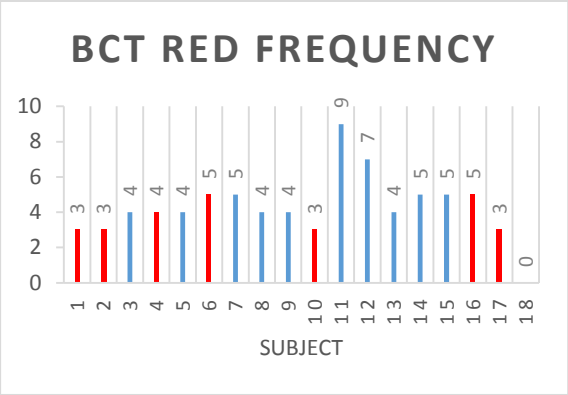


Figure 7

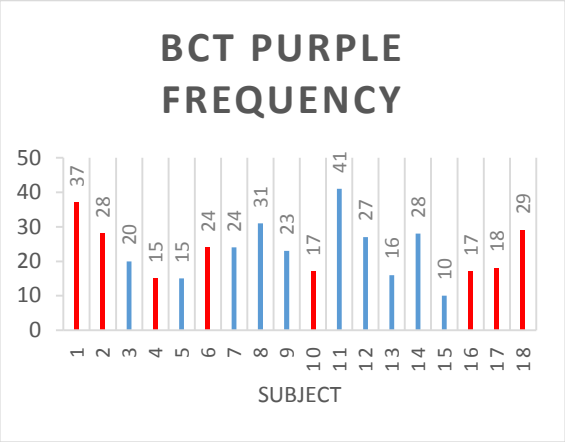


Figure 6

Color Map Comparison

In order to maintain both accuracy and a wealth of comparable data I have chosen English Agreement Map (EAM) C as the best representative model of English BCTs to use for cross-comparison. This map, as visualized previously, represents 67% of the color tiles with 75% agreement across all monolingual English speakers. EAM D represents 76% of the color tiles in the survey, but only offers 62.5% agreement among the monolingual English speakers.

Using EAM C, a comparison for control was conducted across all of the monolingual English speakers. The average agreement with this map was 91.6%, with individual agreements ranging from 85%-98.1%. EAM D using the same method resulted in an 88.3% average agreement, but ranged from 77.8%-95.9%.

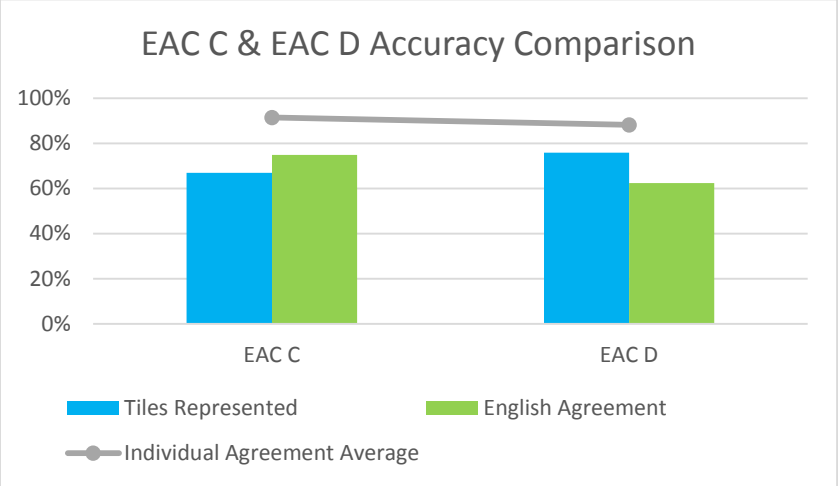
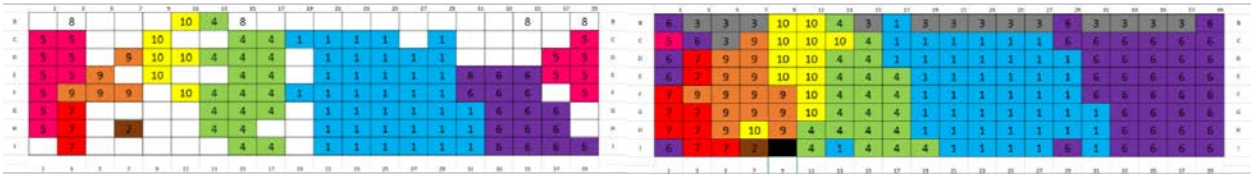


Figure 8

The comparison of all ten multilinguals provides a percentage agreement with EAM C which is listed in *figure 10*. The range of variation within EAM C was 85% - 98.1%, as mentioned previously, and any color maps that fall below this agreement are further analyzed.

Subject	EAM C Agreement Percentage
Subject 3	94.3%
Subject 7	93.4%
Subject 8	87.8%
Subject 9	85.9%
Subject 11	76.6%
Subject 12	75.7%
Subject 13	88.7%
Subject 14	88.7%
Subject 15	81.3%

Figure 9



Comparison 1, EAM C left, Subject 11 right

Three outliers stand out from this comparison analysis as illustrated in *figure 9* – subjects 11, 12, and 15. These three subjects fall outside of the variable range of monolingual English speaker's agreements and well below the averaged monolingual English agreement with EAM C. A review of all three subjects' areas of conflict with EAM C shows little similarity between the conflicted regions of all three subjects.

Subject 11, as discussed earlier in the frequencies section of this analysis, has a great deal of conflict with not only EAM C, but also with most other participants in his distribution of the "pink" and "red" BCTs across his color map. This greatly expanded use of the pink term across the columns 1 and 3 of the color map are where the most profound conflict exists.

Comparison 2, EAM C left, Subject 12 right

Subject 12's conflicting regions are not concentrated specifically in any area. In regions commonly identified as the BCT "yellow" according to EAM C, Subject 12 identifies 85.7% these tiles as green. There is the possibility that this subject was colorblind, however, the subject claimed that he had normal color vision. Another interesting feature of Subject 12's color map is that he used the term "black" ten times, the most of any other participant with the next closest

individual reporting two black tiles. No monolingual English speakers reported any tiles as black, thus this causes 4 conflicts with EAM C.

Comparison 3, EAM C left, Subject 15 right

Subject 15's conflicting regions are concentrated primarily in the right and left borders of the common blue region per EAM C. Subject 15 extends the tiles he identifies as green into columns 21, 23, and 25 where there are no tiles identified as green according to EAM C accounting for 45% of the conflicts. On the left borders of the EAM C's blue regions, he identifies three tiles in columns 31 and 33 as blue in conflict with the purple attributed to those tiles by EAM C.

Discussion

For the purposes of this project, the division of the color space by English BCT's by both monolingual English speakers and multilingual speakers whom speak English as a second language were assessed. The premise was underlined by the studies referenced in the literature review that elucidate the differences in the number of BCTs in different languages and the varied hues that those terms describe. Visible light, without the categorical language that divides it, is a continuum with no clearly defined regions. When we begin to learn a language as a child we learn words that divide this continuum into regions that are identified by those words. Thus, our concepts of color are shaped not just by the experienced stimuli of wavelengths of light, but also by the terms which we identify these wavelengths by.

Certainly, variation exists within a language between what exact hues are considered to be a specific term. Fuzzy regions between colors are often up for debate as popularized by complex color terms such as teal, which according to the individual can be a blue-ish green or a green-ish blue. However, there are core regions that are less disputable than these tertiary regions which I have attempted to identify using the EAM with varied agreement levels. By identifying core regions with comparative methods such as the EAM, we find the common hues that are associated with English BCTs – the truest blues, greens, reds, purples, pinks, yellows, oranges, and browns. The identification of these common regions gives us a mode to investigate how the cognitive concepts of English are incorporated in multilingual individuals who speak English as a second language.

The results of this study, though small in scope, show a varied cognitive impact of multilingualism across the multilingual individuals. The greatest disparity between the English color spaces, as put forth in this study, occurs in three participants whose languages fall outside the Indo-European language families that make up the majority of the landscape. These language families are the Nilo-Saharan, Niger-Congo, and Dravidian. What is interesting, however, is that two other participants whose language families, Tai-Kadai and Koreanic, fall outside of the Indo-European language families do not show the same degree of disparity and in fact possess the highest agreement with EAM C than any other multilingual participant by 4.7 percentage points. A larger data set with individuals who speak those languages and other speakers of languages within those language families could provide a clearer picture on this anomaly. With the data present in this study, however, the disparity between these three subjects, the monolinguals, and the other multilinguals merits discussion.

Subject 11 speaks Ngambay as a native language in addition to five other languages; English, French, Italian, Masana, and Fulani. Ngambay, Subject 11's native language, is a language indigenous to central Cameroon and southwestern Chad and is spoken by an estimated 953,000 people ("Ngambay," n.d.). As mentioned earlier, Subject 11 explained to me that his language did not use color like his other languages did. This particular feature of Ngambay, is a common critique of the World Color Survey, which this research borrows some of its methodology from. Specifically, Lucy indexes languages that do this as a way to espouse the inability of color terms to be a sophisticated universal concept to explore languages via the intellectual framework linguistic relativity. I agree with Lucy that color terms are not universal concepts, but when studying multilingualism, especially when the target language is English, I

would argue that instances such as this offer sophisticated insight into language via linguistic relativity. In this instance, it is intriguing to look at how Subject 11's native language interacts with English given this stark contrast in terminology and use. Subject 11 stated that he began to learn English before the critical period of eight to nine years old, so why does this disparity between EAC C and his color map exist? Subjects' 12 and 15 also exhibit this disparity, yet they also learned English prior to the critical period.

A possible answer to this question could be that these subjects native languages do not belong to the same language family as English and thus the cognitive interactions between the two cause a type of interference with the concepts. Subjects 3 and 7, however, also speak native languages outside of the Indo-European family and there agreement percentages were some of the highest among multilinguals. Further research could explore this quandary by specifically seeking out ESL speakers of not just the specific languages of Subjects 3, 7, 11, 12, and 15, but other ESL speakers of other languages within those language families.

Conclusion

This study serves as a preliminary exploration into the specific realm of color terms as perceived by multilingual individuals. While this study shows some interesting data, the small sample size warrants further research. Additional work should be done with select populations to garner more definitive evidence about the impact of multilingualism on thought. Despite the widespread prevalence of research dedicated to understanding the relationships between language, culture, and thought there is very little research that aims to explore the implications of multilingualism within this perspective. New approaches must be forged to better understand the cognitive framework of language acquisition. Within our rapidly globalizing world, the application of the theoretical framework provided through linguistic relativity could play a vital role in understanding language acquisition and learning. I believe this project can forge the way to future vital research in a variety of fields interested in understanding the unique expression of human language.

This study set's data show that some ESL speakers display a variation of the English color space outside the normal variation of monolingual English speakers. The precise reasons for this may be a direct impact of their native or other proficient languages. It could be argued that further research is warranted to investigate the findings in this study to better understand the complex interactions between languages in a single cognitive space.

Linguistic relativity has enjoyed a revival across many disciplines looking to understand language in a more complete and holistic way. Multilingualism as an area of research can benefit from the explorations of linguistic relativity, offering valuable and fresh insight alongside the

cutting edge research of individuals such as Athanasapoulos into the cognitive implications of speaking multiple languages. This project exemplifies a preliminary study into ways that we can begin to explore how multilingualism affects our worldview and categorization of stimuli. Furthermore, the anthropological considerations afforded in the framework of linguistic relativity is another avenue to explore how language, culture, and thought are adapting in an increasingly globalized world, especially when an estimated 65% of the world population speaks two or more languages (Grosjean, 2014).

Appendix A: IRB Outcome Letter

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Exempt Human Research

From: **UCF Institutional Review Board #1**
FWA00000351, IRB00001138

To: **Beatriz Mireya Reyes-Foster** and Co-PI: **Nicholas M. Casorio**

Date: **August 12, 2015**

Dear Researcher:

On 08/12/2015, the IRB approved the following minor modifications to human participant research that is exempt from regulation:

Type of Review:	Exempt Determination
Modification Type:	Included students that are enrolled in non-degree or unaccredited programs at UCF that have ToEFL scores of 80 iBT or IELTS scores of 6.5. A revised protocol has been uploaded in iRIS and a revised Informed Consent document has been approved for use.
Project Title:	Multilingualism and Linguistic Relativity
Investigator:	Beatriz Mireya Reyes-Foster
IRB Number:	SBE-14-10447
Funding Agency:	
Grant Title:	
Research ID:	N/A

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these changes affect the exempt status of the human research, please contact the IRB. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

Kanille Chay

IRB Coordinator

Appendix B: HRP-508

Summary Explanation for Exempt Research

EXPLANATION OF RESEARCH

Title of Project: *Multingualism and Linguistic Relativity*

Principal Investigator: *Dr. Beatriz Reyes-Foster*

Other Investigators: Nicholas Casorio

You are being invited to take part in a research study. Whether you take part is up to you.

Research related to linguistic relativity and its cognitive effects have been primarily limited to a monolingual context. This project aims to explore the cognitive effects of multilingualism by reproducing past methodologies, specifically the division of color space.

As a participant you will be asked information about your linguistic background; languages spoken, age of acquisition, etc. After a basic linguistic profile has been established an array of colors will be presented to you and you will provide the most basic color term for the given color.

This survey will take between ten and twenty minutes.

You must be 18 years of age or older and currently enrolled in an accredited program at the University of Central Florida or have a valid TOEFL score of 80 iBT or an iELTS score of 6.5 at the University of Central Florida to take part in this research study to take part in this research study.

Study contact for questions about the study or to report a problem: If you have questions, concerns, or complaints *[Insert language similar to this]: Nicholas Casorio Undergraduate Student Researcher, Department of Anthropology, College of Sciences, nmcasorio@knights.ucf.edu or Dr.Beatriz Reyes-Foster, Assistant Professor, Principal Investigator, Department of Anthropology at (407) 823-2206 or by email at Beatriz.Reyes-Foster@ucf.edu.*

IRB contact about your rights in the study or to report a complaint: Research at the University of Central Florida involving human participants is carried out under the oversight of the Institutional Review Board (UCF IRB). This research has been reviewed and approved by the IRB. For information about the rights of people who take part in research, please contact: Institutional Review Board, University of Central Florida, Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246 or by telephone at (407) 823-2901.

Appendix C: Participant Survey

Subject Number

Age

Sex

Freshman	Sophomore	Junior	Senior+

Proficient Languages

First Language

Acquisition of English

Chip #	Color Term	Chip #	Color Term
1		33	
2		34	
3		35	
4		36	
5		37	
6		38	
7		39	
8		40	
9		41	
10		42	
11		43	
12		44	
13		45	
14		46	
15		47	
16		48	
17		49	
18		50	
19		51	
20		52	
21		53	
22		54	
23		55	
24		56	
25		57	
26		58	
27		59	
28		60	
29		61	
30		62	
31		63	
32		64	

Chip #	Color Term	Chip #	Color Term
65		98	
66		99	
67		100	
68		101	
69		102	
70		103	
71		104	
72		105	
73		106	
74		107	
75		108	
76		109	
77		110	
78		111	
79		112	
80		113	
81		114	
82		115	
83		116	
84		117	
85		118	
86		119	
87		120	
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90		123	
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92		125	
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94		127	
95		128	
96		129	
97		130	

Chip #	Color Term
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Appendix D: Participant Responses

	Responses							
Tile	Subject 1	Subject 2	Subject 3	Subject 4	Subject 5	Subject 6	Subject 7	Subject 7
1	GRAY	PINK	WHITE	PINK	WHITE	WHITE	GRAY	GRAY
2	GREEN	GREEN	GREEN	YELLOW	YELLOW	YELLOW	GREEN	GREEN
3	PURPLE	PURPLE	PURPLE	PINK	PINK	PINK	PURPLE	PURPLE
4	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
5	BROWN	BROWN	ORANGE	ORANGE	ORANGE	BROWN	ORANGE	BROWN
6	GRAY	WHITE	WHITE	WHITE	WHITE	WHITE	WHITE	BLUE
7	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
8	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
9	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
10	RED	RED	RED	RED	RED	RED	RED	RED
11	YELLOW	YELLOW	ORANGE	YELLOW	YELLOW	YELLOW	YELLOW	YELLOW
12	PINK	PINK	PINK	PINK	PINK	PINK	PINK	PINK
13	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE
14	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	PURPLE
15	WHITE	WHITE	WHITE	GRAY	WHITE	WHITE	WHITE	WHITE
16	BROWN	BROWN	GREEN	BROWN	GREEN	GRAY	GREEN	GREEN
17	GRAY	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
18	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE
19	BLUE	WHITE	WHITE	WHITE	WHITE	BLUE	BLUE	BLUE
20	YELLOW	YELLOW	YELLOW	YELLOW	YELLOW	YELLOW	YELLOW	YELLOW
21	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	PURPLE
22	GRAY	WHITE	WHITE	GRAY	WHITE	BLUE	BLUE	BLUE
23	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
24	PINK	PINK	PINK	PINK	PINK	PINK	PINK	RED
25	PINK	PINK	PINK	PINK	PINK	PINK	PINK	PINK
26	GREEN	GREEN	BLUE	GREEN	GREEN	GREEN	GREEN	GREEN
27	GRAY	WHITE	WHITE	WHITE	WHITE	WHITE	BLUE	WHITE
28	PINK	PINK	PINK	PINK	PINK	PINK	PINK	PINK
29	GREEN	BLUE	BLUE	GREEN	GREEN	GREEN	BLUE	BLUE
30	PURPLE	PURPLE	PURPLE	PURPLE	PINK	PURPLE	PURPLE	PURPLE
31	PINK	PINK	PINK	PINK	PINK	PINK	PINK	PINK
32	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE
33	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
34	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE
35	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	GREEN
36	PURPLE	PURPLE	PINK	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE
37	ORANGE	ORANGE	PINK	ORANGE	PINK	RED	RED	ORANGE
38	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
39	PURPLE	PINK	PINK	PINK	PINK	PINK	PINK	PINK
40	GREEN	BROWN	GRAY	GRAY	GRAY	GRAY	GREEN	GREEN
41	PINK	PINK	PINK	ORANGE	PINK	PINK	PINK	PINK
42	GREEN	GREEN	YELLOW	GREEN	GREEN	GREEN	GREEN	GREEN

	Responses							
Tile	Subject 1	Subject 2	Subject 3	Subject 4	Subject 5	Subject 6	Subject 7	Subject 7
43	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
44	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
45	ORANGE	ORANGE	ORANGE	BROWN	ORANGE	ORANGE	YELLOW	BROWN
46	GREEN	YELLOW	YELLOW	YELLOW	YELLOW	GREEN	GREEN	GREEN
47	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
48	GREEN	BROWN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
49	PINK	PINK	PINK	RED	PINK	PINK	PINK	PINK
50	BLUE	PURPLE	WHITE	WHITE	WHITE	PURPLE	BLUE	PURPLE
51	GREEN	BROWN	ORANGE	YELLOW	ORANGE	BROWN	YELLOW	BROWN
52	BLUE	BLUE	BLUE	GREEN	BLUE	BLUE	BLUE	BLUE
53	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE
54	BROWN	BROWN	BROWN	BROWN	ORANGE	BROWN	BROWN	BROWN
55	BLUE	PURPLE	BLUE	BLUE	BLUE	BLUE	BLUE	PURPLE
56	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE
57	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
58	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
59	PURPLE	PINK	PURPLE	PINK	PURPLE	PURPLE	PURPLE	PINK
60	PURPLE	WHITE	WHITE	WHITE	WHITE	WHITE	BLUE	PURPLE
61	BROWN	BROWN	BROWN	BROWN	BROWN	GRAY	BROWN	BROWN
62	BLUE	BLUE	BLUE	GREEN	BLUE	BLUE	BLUE	BLUE
63	PINK	PINK	PINK	ORANGE	PINK	PINK	PINK	PINK
64	PURPLE	PURPLE	PINK	PINK	PINK	PURPLE	PURPLE	PINK
65	BLUE	WHITE	WHITE	WHITE	WHITE	BLUE	BLUE	PINK
66	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
67	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
68	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE
69	PURPLE	PURPLE	WHITE	WHITE	WHITE	BLUE	BLUE	PURPLE
70	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
71	RED	RED	RED	RED	RED	RED	RED	RED
72	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE
73	YELLOW	YELLOW	YELLOW	YELLOW	YELLOW	YELLOW	YELLOW	YELLOW
74	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
75	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE	PINK
76	PURPLE	PURPLE	PINK	PINK	PINK	PURPLE	PURPLE	PURPLE
77	RED	RED	RED	RED	RED	RED	RED	RED
78	PURPLE	WHITE	WHITE	WHITE	WHITE	WHITE	BLUE	WHITE
79	PURPLE	PURPLE	PURPLE	GRAY	PURPLE	PURPLE	BLUE	PURPLE
80	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
81	PURPLE	WHITE	WHITE	WHITE	WHITE	WHITE	BLUE	WHITE
82	GREEN	GREEN	BLUE	GREEN	GREEN	GREEN	BLUE	BLUE
83	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE	YELLOW	ORANGE
84	ORANGE	BROWN	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE	BROWN
85	YELLOW	YELLOW	ORANGE	YELLOW	YELLOW	YELLOW	YELLOW	YELLOW
86	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE

	Responses							
Tile	Subject 1	Subject 2	Subject 3	Subject 4	Subject 5	Subject 6	Subject 7	Subject 7
87	PURPLE	PURPLE	PINK	PINK	PINK	PURPLE	PURPLE	PURPLE
88	BLUE	BLUE	WHITE	WHITE	WHITE	BLUE	BLUE	BLUE
89	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE
90	GREEN	YELLOW	YELLOW	YELLOW	YELLOW	YELLOW	YELLOW	YELLOW
91	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
92	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
93	GREEN	YELLOW	YELLOW	YELLOW	YELLOW	GREEN	GREEN	GREEN
94	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE
95	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE	BROWN
96	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
97	PURPLE	PURPLE	WHITE	WHITE	WHITE	BLUE	BLUE	PURPLE
98	ORANGE	BROWN	ORANGE	ORANGE	YELLOW	YELLOW	WHITE	WHITE
99	BLUE	BLUE	BLUE	GREEN	BLUE	BLUE	BLUE	BLUE
100	GREEN	BLUE	BLUE	GREEN	BLUE	GREEN	BLUE	BLUE
101	PURPLE	PINK	PINK	GRAY	PINK	PINK	WHITE	PINK
102	BLUE	PURPLE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
103	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
104	PURPLE	PINK	PURPLE	PINK	PINK	PINK	PURPLE	PINK
105	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
106	BLUE	BLUE	BLUE	GREEN	BLUE	GREEN	BLUE	BLUE
107	ORANGE	BROWN	ORANGE	ORANGE	ORANGE	BROWN	ORANGE	BROWN
108	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE
109	PINK	PINK	PINK	PINK	PINK	PINK	PINK	PINK
110	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
111	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
112	PURPLE	PINK	PINK	PINK	PINK	PURPLE	PURPLE	PINK
113	BLUE	PURPLE	BLUE	PURPLE	BLUE	BLUE	BLUE	BLUE
114	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
115	PURPLE	PINK	PINK	PINK	PINK	PINK	PINK	PINK
116	BLUE	BLUE	BLUE	GREEN	BLUE	BLUE	BLUE	BLUE
117	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	BLUE	GREEN
118	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE
119	PURPLE	PURPLE	PURPLE	GRAY	WHITE	PURPLE	BLUE	PURPLE
120	BROWN	BROWN	BROWN	BROWN	BROWN	BROWN	GREEN	BROWN
121	BLUE	WHITE	BLUE	WHITE	WHITE	BLUE	BLUE	BLUE
122	PINK	PINK	PINK	PINK	PINK	PINK	PINK	PINK
123	YELLOW	YELLOW	YELLOW	YELLOW	YELLOW	YELLOW	GREEN	YELLOW
124	BLUE	BLUE	BLUE	GREEN	BLUE	BLUE	BLUE	BLUE
125	BLUE	BLUE	BLUE	GREEN	BLUE	GREEN	BLUE	GREEN
126	PURPLE	PINK	PINK	PINK	PINK	PINK	PINK	PINK
127	BROWN	BROWN	BROWN	BROWN	ORANGE	BROWN	GREEN	BROWN
128	BROWN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
129	PURPLE	PURPLE	PURPLE	PINK	PURPLE	PURPLE	PURPLE	PURPLE
130	PURPLE	PINK	PINK	PINK	PINK	PINK	PURPLE	PINK

	Responses							
Tile	Subject 1	Subject 2	Subject 3	Subject 4	Subject 5	Subject 6	Subject 7	Subject 7
131	BLUE	WHITE	WHITE	GRAY	WHITE	BLUE	BLUE	BLUE
132	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
133	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
134	BLUE	BLUE	BLUE	GREEN	BLUE	BLUE	BLUE	BLUE
135	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
136	BROWN	BROWN	RED	BROWN	RED	RED	RED	BROWN
137	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	PURPLE
138	BLUE	BLUE	BLUE	GREEN	BLUE	GREEN	BLUE	BLUE
139	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
140	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
141	BLUE	BLUE	BLUE	GRAY	WHITE	BLUE	BLUE	BLUE
142	PURPLE	PINK	PINK	PINK	PINK	PURPLE	PURPLE	PINK
143	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
144	BROWN	BROWN	YELLOW	BROWN	YELLOW	GREEN	GREEN	BROWN
145	PURPLE	PURPLE	PURPLE	PURPLE	BLUE	BLUE	BLUE	PURPLE
146	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	BLUE	GREEN
147	PURPLE	PURPLE	PURPLE	BLUE	BLUE	PURPLE	PURPLE	PURPLE
148	BROWN	BROWN	BROWN	YELLOW	ORANGE	BROWN	BROWN	BROWN
149	GREEN	GREEN	YELLOW	YELLOW	GREEN	YELLOW	GREEN	GREEN
150	BLUE	BLUE	BLUE	GREEN	BLUE	BLUE	BLUE	BLUE
151	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE
152	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	PURPLE
153	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
154	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
155	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	BLUE	GREEN
156	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
157	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	PURPLE
158	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE
159	GREEN	YELLOW	YELLOW	YELLOW	ORANGE	YELLOW	GREEN	YELLOW
160	PURPLE	PINK	PINK	PINK	PINK	PINK	PINK	PINK

	Responses							
Tile	Subject 8	Subject 9	Subject 10	Subject 11	Subject 12	Subject 13	Subject 14	Subject 15
1	GRAY	WHITE	WHITE	GRAY	WHITE	GRAY	WHITE	GRAY
2	GREEN	GREEN	GREEN	GREEN	GREEN	YELLOW	GREEN	GREEN
3	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PINK	PURPLE	PINK
4	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
5	BROWN	BROWN	YELLOW	ORANGE	GREEN	ORANGE	BROWN	ORANGE
6	BLUE	WHITE	WHITE	GRAY	WHITE	WHITE	WHITE	WHITE
7	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
8	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
9	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
10	RED	RED	RED	RED	RED	RED	RED	RED
11	YELLOW	YELLOW	YELLOW	YELLOW	GREEN	YELLOW	YELLOW	YELLOW
12	PINK	PINK	PINK	PURPLE	PINK	PINK	PINK	PINK
13	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	BLUE
14	PURPLE	BLUE	BLUE	BLUE	PURPLE	BLUE	BLUE	BLUE
15	WHITE	WHITE	WHITE	GRAY	WHITE	WHITE	WHITE	WHITE
16	GREEN	GREEN	GREEN	GREEN	GREEN	GRAY	GREEN	GREEN
17	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
18	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE
19	BLUE	BLUE	BLUE	GRAY	BLUE	GRAY	GRAY	WHITE
20	YELLOW	YELLOW	YELLOW	YELLOW	GREEN	YELLOW	BROWN	YELLOW
21	PURPLE	BLUE	BLUE	BLUE	PURPLE	BLUE	BLUE	BLUE
22	BLUE	BLUE	BLUE	GRAY	BLUE	BLUE	BLUE	WHITE
23	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
24	RED	RED	PINK	RED	PINK	PURPLE	RED	RED
25	PINK	PINK	PINK	RED	PINK	PINK	PINK	PINK
26	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
27	WHITE	WHITE	WHITE	GRAY	BLUE	GRAY	YELLOW	WHITE
28	PINK	PINK	PINK	RED	PINK	PINK	RED	PINK
29	BLUE	GREEN	GREEN	BLUE	GREEN	GREEN	GREEN	GREEN
30	PURPLE	PURPLE	PINK	PURPLE	PURPLE	PINK	PURPLE	PINK
31	PINK	PINK	PINK	PURPLE	PINK	PINK	PINK	PINK
32	ORANGE	ORANGE	PINK	ORANGE	ORANGE	PINK	ORANGE	PINK
33	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
34	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE
35	GREEN	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	GREEN
36	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE
37	ORANGE	ORANGE	ORANGE	ORANGE	RED	RED	ORANGE	ORANGE
38	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
39	PINK	PINK	PINK	PINK	PURPLE	PINK	PINK	PINK
40	GREEN	GREEN	GREEN	BLUE	BLACK	BLACK	GREEN	GREEN
41	PINK	ORANGE	PINK	GRAY	WHITE	PINK	PINK	PINK
42	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN

	Responses							
Tile	Subject 8	Subject 9	Subject 10	Subject 11	Subject 12	Subject 13	Subject 14	Subject 15
43	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
44	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
45	BROWN	BROWN	YELLOW	ORANGE	YELLOW	ORANGE	ORANGE	ORANGE
46	GREEN	GREEN	GREEN	YELLOW	GREEN	GREEN	GREEN	YELLOW
47	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
48	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
49	PINK	PINK	PINK	RED	PINK	PINK	PINK	PINK
50	PURPLE	WHITE	WHITE	PURPLE	WHITE	WHITE	PURPLE	WHITE
51	BROWN	BROWN	GREEN	ORANGE	GREEN	YELLOW	GREEN	YELLOW
52	BLUE	GREEN	BLUE	BLUE	GREEN	BLUE	BLUE	GREEN
53	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE	ORANGE
54	BROWN	BROWN	YELLOW	YELLOW	BLACK	BROWN	BROWN	BROWN
55	PURPLE	BLUE	BLUE	BLUE	PURPLE	BLUE	BLUE	BLUE
56	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE
57	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
58	BLUE	GREEN	BLUE	BLUE	BLUE	BLUE	BLUE	GREEN
59	PINK	PURPLE	PINK	PURPLE	PURPLE	PINK	PURPLE	PINK
60	PURPLE	WHITE	WHITE	GRAY	WHITE	WHITE	WHITE	WHITE
61	BROWN	BLACK	GREEN	BLACK	BLACK	BLACK	BROWN	BROWN
62	BLUE	BLUE	BLUE	BLUE	GREEN	BLUE	BLUE	GREEN
63	PINK	ORANGE	PINK	RED	PINK	PINK	PINK	PINK
64	PINK	PURPLE	PINK	PURPLE	PINK	PURPLE	PURPLE	PINK
65	PINK	WHITE	WHITE	PURPLE	WHITE	GRAY	WHITE	WHITE
66	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	GREEN
67	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
68	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PINK	PURPLE	PURPLE
69	PURPLE	WHITE	WHITE	PURPLE	WHITE	GRAY	PURPLE	WHITE
70	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
71	RED	BROWN	RED	RED	RED	RED	RED	RED
72	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE
73	YELLOW	YELLOW	YELLOW	YELLOW	GREEN	YELLOW	YELLOW	YELLOW
74	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
75	PINK	ORANGE	YELLOW	ORANGE	YELLOW	PINK	ORANGE	YELLOW
76	PURPLE	PURPLE	PINK	PURPLE	RED	PINK	PURPLE	RED
77	RED	RED	RED	RED	RED	RED	RED	RED
78	WHITE	WHITE	WHITE	PURPLE	WHITE	GRAY	WHITE	WHITE
79	PURPLE	PURPLE	PURPLE	PURPLE	BLUE	PURPLE	PURPLE	BLUE
80	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
81	WHITE	WHITE	WHITE	GRAY	WHITE	GRAY	WHITE	WHITE
82	BLUE	GREEN	GREEN	BLUE	GREEN	GREEN	GREEN	GREEN
83	ORANGE	ORANGE	YELLOW	ORANGE	YELLOW	ORANGE	ORANGE	YELLOW
84	BROWN	RED	ORANGE	ORANGE	ORANGE	BROWN	BROWN	YELLOW
85	YELLOW	GREEN	YELLOW	YELLOW	YELLOW	YELLOW	BROWN	ORANGE
86	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE

	Responses							
Tile	Subject 8	Subject 9	Subject 10	Subject 11	Subject 12	Subject 13	Subject 14	Subject 15
87	PURPLE	PURPLE	PINK	PURPLE	RED	PURPLE	PURPLE	PURPLE
88	BLUE	BLUE	BLUE	GRAY	BLUE	GRAY	WHITE	WHITE
89	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PINK	PURPLE	PINK
90	YELLOW	GREEN	GREEN	YELLOW	GREEN	YELLOW	GREEN	YELLOW
91	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
92	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
93	GREEN	GREEN	GREEN	YELLOW	GREEN	YELLOW	GREEN	YELLOW
94	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PINK
95	BROWN	ORANGE	YELLOW	ORANGE	YELLOW	ORANGE	ORANGE	ORANGE
96	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
97	PURPLE	WHITE	WHITE	GRAY	WHITE	GRAY	WHITE	WHITE
98	WHITE	YELLOW	YELLOW	YELLOW	WHITE	WHITE	YELLOW	GRAY
99	BLUE	BLUE	BLUE	BLUE	BLUE	GRAY	BLUE	GRAY
100	BLUE	GREEN	BLUE	BLUE	GREEN	BLUE	GREEN	GREEN
101	PINK	PURPLE	PINK	GRAY	WHITE	GRAY	WHITE	PINK
102	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
103	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
104	PINK	PINK	PINK	PURPLE	PURPLE	PINK	PURPLE	PINK
105	BLUE	BLUE	BLUE	PURPLE	BLUE	BLUE	BLUE	BLUE
106	BLUE	GREEN	BLUE	BLUE	GREEN	GREEN	GREEN	BLUE
107	BROWN	BROWN	ORANGE	ORANGE	RED	BROWN	BROWN	ORANGE
108	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE
109	PINK	PINK	PINK	PURPLE	PINK	PINK	PINK	PINK
110	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
111	GREEN	GREEN	GREEN	BLUE	GREEN	GREEN	GREEN	GREEN
112	PINK	PURPLE	PINK	PURPLE	BLUE	PINK	PURPLE	PINK
113	BLUE	BLUE	BLUE	PURPLE	BLUE	BLUE	BLUE	BLUE
114	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
115	PINK	PINK	PINK	PURPLE	PINK	PINK	PINK	PINK
116	BLUE	GREEN	BLUE	BLUE	GREEN	GREEN	BLUE	GREEN
117	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
118	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE
119	PURPLE	BLUE	PURPLE	PURPLE	WHITE	GRAY	PURPLE	WHITE
120	BROWN	BROWN	YELLOW	ORANGE	BLACK	BROWN	BROWN	GREEN
121	BLUE	BLUE	BLUE	GRAY	BLUE	GRAY	BLUE	WHITE
122	PINK	PINK	PINK	PURPLE	PINK	PINK	PURPLE	PINK
123	YELLOW	GREEN	GREEN	YELLOW	GREEN	YELLOW	GREEN	YELLOW
124	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
125	GREEN	GREEN	BLUE	BLUE	GREEN	GREEN	GREEN	GREEN
126	PINK	PINK	PINK	PURPLE	PINK	PINK	PINK	PINK
127	BROWN	BROWN	YELLOW	ORANGE	BLACK	BROWN	BROWN	YELLOW
128	GREEN	GREEN	GREEN	GREEN	BLACK	GREEN	GREEN	GREEN
129	PURPLE	PINK	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PINK
130	PINK	PINK	PINK	PURPLE	PURPLE	PINK	PINK	PINK

	Responses							
Tile	Subject 8	Subject 9	Subject 10	Subject 11	Subject 12	Subject 13	Subject 14	Subject 15
131	BLUE	BLUE	BLUE	GRAY	WHITE	GRAY	BLUE	WHITE
132	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
133	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
134	BLUE	GREEN	BLUE	BLUE	BLUE	BLUE	BLUE	GREEN
135	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
136	BROWN	BROWN	ORANGE	RED	BLACK	BROWN	BROWN	BROWN
137	PURPLE	BLUE	BLUE	PURPLE	PURPLE	BLUE	BLUE	BLUE
138	BLUE	GREEN	BLUE	BLUE	BLUE	BLUE	BLUE	GREEN
139	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	bLUE	BLUE
140	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
141	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	WHITE
142	PINK	PINK	PINK	PURPLE	PURPLE	PINK	PINK	PINK
143	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
144	BROWN	BROWN	GREEN	YELLOW	BLACK	YELLOW	GREEN	BROWN
145	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	BLUE
146	GREEN	GREEN	GREEN	BLUE	GREEN	GREEN	GREEN	GREEN
147	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	BLUE
148	BROWN	BROWN	ORANGE	BROWN	BLACK	BROWN	BROWN	BROWN
149	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	YELLOW
150	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
151	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE	PURPLE
152	PURPLE	BLUE	BLUE	BLUE	PURPLE	BLUE	BLUE	BLUE
153	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
154	GREEN	GREEN	GREEN	GREEN	BLACK	GREEN	GREEN	GREEN
155	GREEN	GREEN	GREEN	BLUE	GREEN	GREEN	GREEN	GREEN
156	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	GREEN	BLUE
157	PURPLE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE	BLUE
158	PURPLE	PURPLE	PINK	PURPLE	PURPLE	PINK	PURPLE	PURPLE
159	YELLOW	GREEN	YELLOW	YELLOW	GREEN	YELLOW	BROWN	YELLOW
160	PINK	PINK	PINK	PURPLE	PINK	PINK	PINK	PINK

Responses								
Tile	Subject 16	Subject 17	Subject 18					
1	GRAY	WHITE	PURPLE					
2	GREEN	GREEN	GREEN					
3	PURPLE	PURPLE	PINK					
4	BLUE	BLUE	BLUE					
5	YELLOW	ORANGE	ORANGE					
6	GRAY	WHITE	BLUE					
7	BLUE	BLUE	BLUE					
8	BLUE	BLUE	BLUE					
9	GREEN	GREEN	GREEN					
10	RED	RED	PINK					
11	YELLOW	YELLOW	YELLOW					
12	PINK	PINK	PINK					
13	BLUE	BLUE	PURPLE					
14	BLUE	BLUE	BLUE					
15	GRAY	WHITE	PINK					
16	GRAY	GRAY	GRAY					
17	GREEN	GREEN	GREEN					
18	ORANGE	ORANGE	ORANGE					
19	WHITE	WHITE	BLUE					
20	YELLOW	YELLOW	YELLOW					
21	BLUE	BLUE	BLUE					
22	WHITE	WHITE	BLUE					
23	GREEN	GREEN	GREEN					
24	PINK	PINK	PINK					
25	PINK	PINK	PINK					
26	BLUE	BLUE	BLUE					
27	WHITE	WHITE	WHITE					
28	PINK	PINK	PINK					
29	BLUE	BLUE	BLUE					
30	PURPLE	PURPLE	PURPLE					
31	GRAY	PINK	PINK					
32	YELLOW	ORANGE	PINK					
33	BLUE	BLUE	BLUE					
34	PURPLE	PURPLE	PURPLE					
35	BLUE	BLUE	BLUE					
36	PURPLE	PURPLE	PURPLE					
37	ORANGE	ORANGE	PINK					
38	YELLOW	GREEN	GREEN					
39	WHITE	PINK	PINK					
40	GRAY	GRAY	GRAY					
41	WHITE	ORANGE	PINK					
42	YELLOW	GREEN	GREEN					

Responses								
Tile	Subject 16	Subject 17	Subject 18					
43	BLUE	BLUE	BLUE					
44	BLUE	BLUE	BLUE					
45	ORANGE	ORANGE	ORANGE					
46	YELLOW	YELLOW	GREEN					
47	BLUE	BLUE	BLUE					
48	GREEN	GREEN	GREEN					
49	RED	PINK	PINK					
50	WHITE	WHITE	PURPLE					
51	YELLOW	YELLOW	YELLOW					
52	BLUE	BLUE	BLUE					
53	ORANGE	ORANGE	ORANGE					
54	YELLOW	BROWN	BROWN					
55	BLUE	BLUE	PURPLE					
56	PURPLE	PURPLE	PURPLE					
57	BLUE	BLUE	BLUE					
58	BLUE	BLUE	BLUE					
59	WHITE	PINK	PURPLE					
60	WHITE	ORANGE	PURPLE					
61	GRAY	GRAY	BROWN					
62	BLUE	BLUE	BLUE					
63	RED	PINK	PINK					
64	PINK	PURPLE	PINK					
65	WHITE	GRAY	PURPLE					
66	BLUE	BLUE	BLUE					
67	GREEN	GREEN	GREEN					
68	PINK	PURPLE	PURPLE					
69	WHITE	green	PURPLE					
70	BLUE	BLUE	BLUE					
71	RED	PURPLE	PINK					
72	BLUE	PURPLE	PURPLE					
73	YELLOW	YELLOW	YELLOW					
74	GREEN	GREEN	GREEN					
75	PINK	ORANGE	PINK					
76	PINK	PURPLE	PINK					
77	RED	RED	PINK					
78	WHITE	WHITE	PURPLE					
79	WHITE	BLUE	PURPLE					
80	YELLOW	GRay	GREEN					
81	WHITE	WHITE	PURPLE					
82	BLUE	GREEN	GREEN					
83	YELLOW	ORANGE	ORANGE					
84	YELLOW	ORANGE	ORANGE					
85	YELLOW	YELLOW	YELLOW					
86	BLUE	BLUE	BLUE					

Responses								
Tile	Subject 16	Subject 17	Subject 18					
87	PURPLE	PURPLE	PINK					
88	WHITE	GRAY	BLUE					
89	PURPLE	PURPLE	PURPLE					
90	BLUE	YELLOW	YELLOW					
91	YELLOW	GREEN	GREEN					
92	PURPLE	BLUE	BLUE					
93	YELLOW	GREEN	GREEN					
94	BLUE	PURPLE	PURPLE					
95	YELLOW	YELLOW	ORANGE					
96	BLUE	BLUE	BLUE					
97	WHITE	PINK	PURPLE					
98	WHITE	ORANGE	WHITE					
99	WHITE	WHITE	BLUE					
100	BLUE	BLUE	BLUE					
101	WHITE	PINK	PINK					
102	BLUE	BLUE	BLUE					
103	GREEN	GREEN	GREEN					
104	PURPLE	PINK	PINK					
105	BLUE	BLUE	BLUE					
106	BLUE	BLUE	BLUE					
107	ORANGE	BROWN	ORANGE					
108	PURPLE	PURPLE	PURPLE					
109	PINK	PINK	PINK					
110	BLUE	BLUE	BLUE					
111	BLUE	GREEN	GREEN					
112	WHITE	PINK	PURPLE					
113	WHITE	BLUE	BLUE					
114	GREEN	GREEN	GREEN					
115	WHITE	PINK	PINK					
116	BLUE	BLUE	BLUE					
117	GREEN	GREEN	GREEN					
118	PURPLE	PURPLE	PURPLE					
119	WHITE	GRAY	PURPLE					
120	GRAY	GREEN	BROWN					
121	WHITE	GRAY	BLUE					
122	PINK	PINK	PINK					
123	YELLOW	YELLOW	YELLOW					
124	BLUE	BLUE	BLUE					
125	BLUE	BLUE	BLUE					
126	PINK	PINK	PINK					
127	YELLOW	YELLOW	BROWN					
128	GREEN	GREEN	GREEN					
129	PURPLE	PURPLE	PURPLE					
130	PURPLE	PINK	PINK					

Responses								
Tile	Subject 16	Subject 17	Subject 18					
131	WHITE	WHITE	BLUE					
132	BLUE	BLUE	BLUE					
133	BLUE	BLUE	BLUE					
134	BLUE	BLUE	BLUE					
135	BLUE	BLUE	BLUE					
136	GREEN	RED	BROWN					
137	BLUE	BLUE	BLUE					
138	BLUE	BLUE	BLUE					
139	BLUE	BLUE	BLUE					
140	GREEN	GREEN	GREEN					
141	BLUE	GRAY	BLUE					
142	WHITE	PINK	PINK					
143	BLUE	BLUE	BLUE					
144	YELLOW	GREEN	GREEN					
145	PURPLE	BLUE	PURPLE					
146	BLUE	BLUE	BLUE					
147	PURPLE	PURPLE	PURPLE					
148	BROWN	BROWN	BROWN					
149	YELLOW	GREEN	GREEN					
150	BLUE	BLUE	BLUE					
151	PURPLE	PURPLE	PURPLE					
152	BLUE	BLUE	BLUE					
153	BLUE	BLUE	BLUE					
154	BLUE	GREEN	GREEN					
155	BLUE	BLUE	BLUE					
156	BLUE	BLUE	BLUE					
157	BLUE	BLUE	BLUE					
158	PURPLE	PINK	PURPLE					
159	YELLOW	YELLOW	GREEN					
160	PINK	PINK	PINK					

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