

Report Documentation Page				Form Approved OMB No. 0704-0188	
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1. REPORT DATE 05 MAY 2010		2. REPORT TYPE		3. DATES COVERED	
4. TITLE AND SUBTITLE Interaction of Language, Culture and Cognition in Group Dynamics for Understanding the Adversary				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Marion Ceruti				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) SSC Pacific,53560 Hull Street,San Diego,CA,92152-5001				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited.					
13. SUPPLEMENTARY NOTES The original document contains color images.					
14. ABSTRACT This paper describes an analytical study of language, culture, cognition, and their contribution to concepts in an upper ontology to support asymmetric and irregular warfare for the U.S. Marine Corps. This ontology is designed to interact with decision-support applications for fighting the global war on terror. The long-term goal of this effort is to understand and predict the actions of terrorist individuals and groups from diverse cultures. The fusion of language and cultural factors, such as religion, and their contribution to cognition is explored vis-?is ingroup-outgroup perceptions that influence and reflect thought patterns and behavior. The interaction between natural language, culture and cognition provides a way to augment an integrated upper ontology with language-related and cross-cultural concepts that can support intelligence analysts. This paper introduces two models that provide an insight into topics relevant to cognitive-information operations. The hypothesis and suggested experimental approach are focused on methods and metrics to generate group profiles and to detect an individual?s group bias from selected word patterns.					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES 20	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

Interaction of Language, Culture, and Cognition in Group Dynamics for Understanding the Adversary

July 2010

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ABSTRACT

This paper describes an analytical study of language, culture, cognition, and their contribution to concepts in an upper ontology to support asymmetric and irregular warfare for the U.S. Marine Corps. This ontology is designed to interact with decision-support applications for fighting the global war on terror. The long-term goal of this effort is to understand and predict the actions of terrorist individuals and groups from diverse cultures. The fusion of language and cultural factors, such as religion, and their contribution to cognition is explored vis-à-vis ingroup-outgroup perceptions that influence and reflect thought patterns and behavior. The interaction between natural language, culture and cognition provides a way to augment an integrated upper ontology with language-related and cross-cultural concepts that can support intelligence analysts. This paper introduces two models that provide an insight into topics relevant to cognitive-information operations. The hypothesis and suggested experimental approach are focused on methods and metrics to generate group profiles and to detect an individual's group bias from selected word patterns.

Keywords: Cognition; Complexity and unpredictability of human adversaries; Counter insurgency; Culture; Grammar; Group dynamics; Ontology; Reasoning; Religion

1.0 Introduction

The U.S. Marine Corps needs a systematic way to understand and predict adversarial actions in asymmetric- and irregular-warfare environments. To support this requirement, we must understand how the adversary thinks, as thoughts, however brief, precede all actions. This paper explores the relationships between language, culture, cognition, and ontology in the global war on terror.

Geert Hofstede stated that culture is the collective programming of the mind, which distinguishes the members of one group from another [1]. Robert Kohls offers a definition of culture as an integrated system of learned behavior patterns characteristic of the members of any given society, to include its customs, language, and a shared systems of attitudes and feelings [1]. Taken together, these are particularly useful definitions of culture for the purposes of this paper because they capture the notion of group values, group behavior, and language, which imply key concepts in an ontology of cognition.

People from different cultures view time, space, [1], [26] and even color [30] in different ways. If these basic concepts differ from one culture to the next, perhaps many other concepts on which they depend also differ. Therefore, we cannot assume that adversaries and neutral parties from cultures different from ours will share our experiences, thoughts, perceptions, priorities, mental categories, values, and modes of reasoning. To provide the best technology to the war fighter, military decision-support systems constructed for cognitive-information operations should reflect the most comprehensive, accurate, and timely information regarding culture, language, and concepts.

This work is compared and contrasted with the Linguistic-Category Model (LCM) [43], which considers the interaction of general thought with broad language categories, such as transitive verbs, nouns and adjectives. Both the LCM and the Grammatical-Category Model (GCM) introduced here are based on the idea that cognition shapes and drives word selection, and that word selection provides a window into the thoughts of the speaker or writer.

The present paper describes a study of more specialized and fine-grained grammatical categories compared to LCM in relation to a very specific cognitive task. Here, we consider the interaction and possible influence of specific grammatical categories with cognition that promotes, encourages, and demands the selection of ingroup (This person belongs to “my” group.) vs. outgroup (This person is outside of my group. Is this person inferior or superior by virtue of membership in another group?).

Language can reveal a person’s group membership or group bias in the following ways:

- a. Absolute word choices – use of positive terms in reference to ingroup and less positive terms or negative terms for outgroup.
- b. Relative word choices, either subtle or explicit, when comparing and contrasting different groups.
- c. Jargon, slang, and accents
- d. Types of grammatical mistakes that originate from literal, word-for-word translations of one language into another

Traditional key-word searches in text or in transcribed speech alone can be insufficient to identify group bias because some words that are not normally accepted as having much explicit content may constitute cues about group identity when the implicit meaning is analyzed. Consider, for example, the statement, “Sikhs tie turbans like this, whereas the Muslims tie their turbans like that.” One can infer that the speaker either is a Sikh or identifies with Sikhs. One key cue is “the” which is used before “Muslims” but not before “Sikhs.” Another key cue is the use of “their” before “turbans” when referring to Muslim turbans but not in reference to Sikh turbans. Demonstrative pronouns, like “this” and “that,” show that the speaker first refers to something close (e.g. ingroup) and subsequently to something distant (e.g. outgroup). Words like “the,” “their,” “this,” and “that” traditionally are not considered to be key words. However, depending on the context, they can reveal group membership or group bias.

This paper considers the influence of grammar rules on word selection and how grammar rules force the selection of a group to be able to speak or write correctly about people, things and ideas. Selections must be grammatically correct for a listener to perceive that the speaker is “ingroup” with regard to language, and by extension, culture. For example, to select the grammatically correct first, second, or third-person pronoun in some languages, the speaker or writer first must consider the rank, social status, and specific circumstances of themselves in relation to the second or third person.

In this context, “group” means a set of people with at least one thing in common, regardless of group size, geographic and temporal distribution, and degree and type of organization. Any criteria can be used to define or characterize the group but some criteria are historically and culturally more significant. For example, a group can be united by a common language, religion, sect, family, tribe, race, philosophy, ideology, political party, or nationality. Other groups can be based on common interests, ancestry, physical and mental capabilities, experiences, achievements, or chronological age. The important characteristic of the group in the context of this study is that individuals form concepts about the degree to which they identify with one group or another. Similarly, individuals also mentally and sometimes unconsciously assign other people to group membership, either right or wrong.

This study is a step towards understanding the role of ingroup-outgroup thought in terrorist activities with a view toward identifying ingroup-outgroup identification of self. Ultimately, we would like to be able to predict future behavior from a multiplicity of factors in behavior, language being only one of them. Comprehensive intelligence models that support cognitive information operations will need to fuse data from multiple sources, including but not limited to cognitive models.

This paper is organized as follows. Section 2 describes the background. Section 3 explains the Grammatical-Category Model (GCM), which models durability and strength of language grammar. Section 4 describes the Concentric Group Theory (CGT), which is a model of ingroup-outgroup perception. Section 5 considers some aspects of culture, language and religion. Section 6 presents results and discussion, including language-based contributions to an upper ontology. Section 7 is focused on metrics and experimental hypothesis testing. Finally, section 8 concludes the paper with directions for future research. Appendix A introduces the notion of “strong domains” in language.

2.0 Background

Natural language, society, culture, and ontology are closely related to each other. (See, for example, [24].) Language and culture are inextricably intertwined [11]. Understanding language and culture is a military mission-critical capability [65]. Language, cultural training, and cultural readiness are receiving more attention at the service level as well as the Department-of-Defense level [1]. Understanding the culture and the impact of military actions on the culture is essential to mission success [11]. For example, social-network analysis [6], [25] has become a significant discipline among intelligence analysts. The understanding of a language in a particular society implies the understanding of the social structures and networks in which language is embedded [59].

A systematic study of concepts in language can help identify factors that contribute to a more comprehensive understanding of social networks and individual behavior, especially where cognition and behavior reflect an ingroup-outgroup identification.

Natural language, culture, and cognition interact in feedback loops depicted in Figure 1. (N.B. Figure 1 is not a run-time data-flow diagram.) A study of this interaction has identified concepts that relate to cognition, especially about groups. Concepts describing cognition are found in upper ontologies because of the general and universal nature of cognition. (See, for example, [27].) Therefore, concepts from language and other sources, e.g. the Universal Core (UCore) [46] can augment the integrated upper ontology that supports Marine Corps decision-support applications.

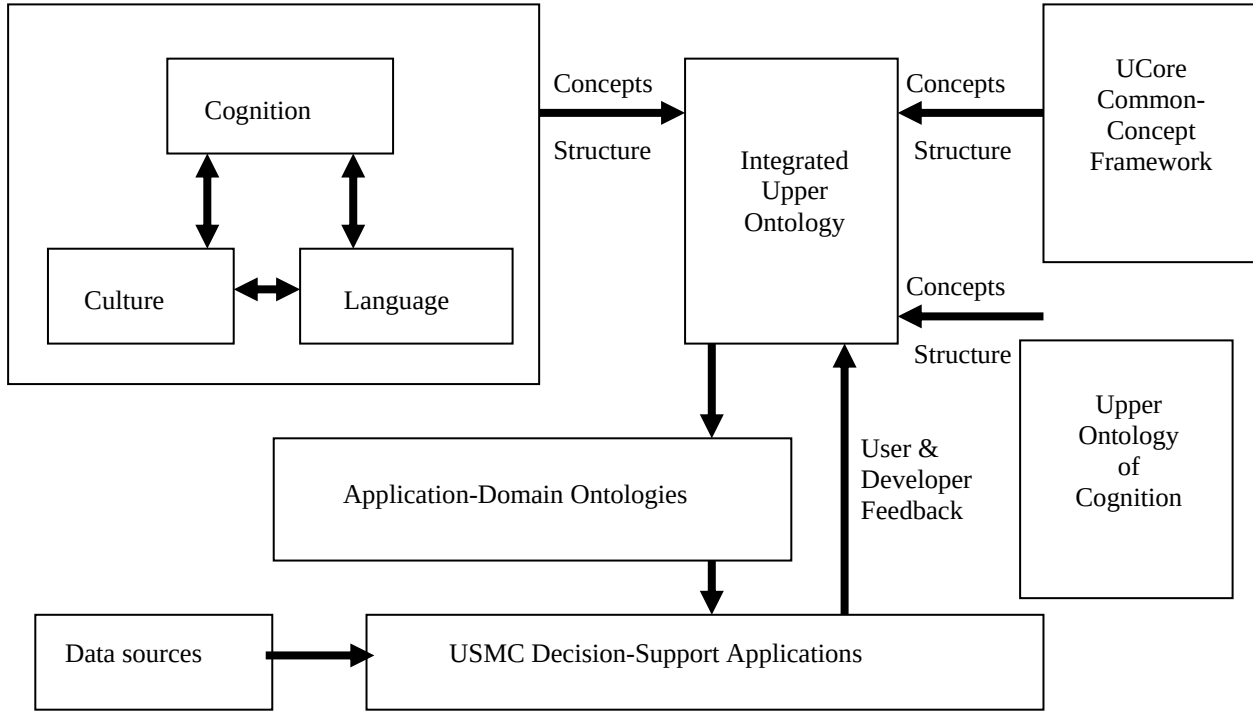


Figure 1. Overview of ontological development for cognitive-information operations

Sociolinguistics is the study of the effect of society and culture on language usage whereas the sociology of language is focused on the effect of language on society [59]. Natural languages evolve in societies and cultures to express, or capture in some way, the objects, rules, assumptions, environments, customs, traditions, values, beliefs and concepts that are important to their respective cultures. Thus, natural language provides a window into the essence of a culture through which we can observe, analyze, and understand culturally specific, as well as general concepts, perceptions, assumptions and the actions that depend on them.

3.0 Grammatical categories and group awareness

Martin Haspelmath has observed that pre-established categories for parts of speech, such as grammatical categories, in languages don't exist [20]. This philosophy has some merit considering the aggregate of known world languages, some of which have structures that are very different from those of Indo-European languages. Some languages encode one part of speech into the morphology of another. For example, Navajo encodes much situational information in its verb structure [32]. At the other extreme, the Chinese do not conjugate their verbs; tense information is encoded in other parts of speech. Still other

languages, such as Hebrew, have words that don't translate into English [45]. Other examples can be found in [20]. In this case, English monoliterates would not have a pre-determined category for such foreign words.

Given that this is the case, any attempt at grammatical categorization must be described within a limited context of specific languages or language groups. Models that apply and accurately describe languages within this context would not necessarily apply or provide utility outside that context. With this in mind, we introduce the Grammatical-Category Model (GCM), which applies at least to the languages described below but may not apply to other languages.

Cultures and their associated natural languages evolve in society through usage and group consensus. Groups exert considerable influence on new individuals who enter an established culture, either through birth, marriage, initiation, familiarity, or some other means of affiliation and/or proximity. Language rules of grammar and word choices have evolved in society to "put people in their places" i.e. to categorize people according to de facto group membership (or lack thereof) in general. Such linguistically reinforced groupings include but are not limited to those defined by gender, social status, rank, familiarity, degree of sentience, and other particular classes.

The LCM, employs the dimension of abstractness-concreteness with respect to interpersonal predicates [43]. In contrast, the GCM employs a different categorization based on the durability and estimated strength of the grammatical category's interaction with the ingroup-outgroup selection.

Table 1. Grammatical categories in rank order of durability from the most dynamic to static

Grammatical Category [51]	Definition	Examples
Clusivity [8] (most dynamic)	Distinction between inclusive and exclusive plural pronouns (e.g. we)	You and I = "we" vs. She and I = "we"
T-V distinction [61] (See Section 3.2, p. 6 below for explanation.)	Second-person pronouns distinguish levels of politeness, respect, social distance, courtesy, familiarity, or insult toward the addressee. (Most languages have between one and three levels.)	Tu, du vs. Vous, Lei, Usted, Sei; Vosotros vs. Ustedes; Catalan: tu, vós, vostè Basque: hi, zu, berori
Noun class [51]	Linguistic system of categorizing nouns	Augmentative vs. diminutive
Animacy [19], [43], [44],[48], [51]	Degree to which a noun or pronoun referent is sentient or alive. Verbs, prepositions, and word order also can indicate sentience.	Navajo [32] Adult human Infant Large animal Medium-sized animal Small animal Natural force Abstraction
Gender [33] [51] (most static)	Noun, pronoun, and in some languages, verb class that distinguishes between masculine, feminine, and neuter.	Romance Languages: (M, F nouns) Hebrew: (M, F nouns, verbs)

Grammar rules call attention to word groups. Words also must be put in their proper place in a sentence. For example, the choice of noun and pronoun word order can signal a person's degree of politeness and education. (See, for example [3], [8], and [33].) Thus, the speaker will select categories of words based on their membership in certain word groups, and the listener will select mental categories for speakers based on the speaker's choice of words. These mental categories are the seeds of opinion. The ability of a language to help categorize entities such as people, objects, ideas, nouns, and pronouns can force the speaker to assign importance to various concept categories. In the absence of such grammar rules, the speaker might not perceive as important the distinctions between these entities.

Given the importance of groups in cognition, culture, and language, various grammatical categories were studied that can influence cognition. A total of 21 grammatical categories [51], including ergativity and T-V distinction, were examined for possible effect on the speaker to influence ingroup-outgroup awareness. In spite of the focus of ergativity on the distinction between transitive and intransitive verbs, this characteristic of language grammar was not selected for further study because of the low probability that grammatical selections to conform to the rules of ergativity would relate to the ingroup-outgroup dimension of cognition. Five of these categories were selected for future study because of the likelihood that these categories would contribute to this awareness. These categories are defined in Table 1.

Cultures exert considerable social pressure on individuals to speak and write correctly according to the grammar rules of their language. Individuals who ignore these rules appear ignorant, uneducated, careless, and not a member of the culture that the language supports, e.g. a member of the outgroup. Grammar rules typically specify one form for a given set of circumstances and a different form when key factors change. Word order also can be based on noun category [32]. Therefore, grammar rules force speakers or writers to decide among various choices, e.g. to determine the group, and then select words that will reveal their specific thoughts about the groups to which people and objects belong. Rules that force specific selections will not allow speakers and writers to keep specific choices vague. Each grammatical category contributes to ingroup-outgroup awareness in the following ways.

3.1 Clusivity

Clusivity is a grammatical category that pertains to the selection of pronouns, particularly first person plural. The distinction is reflected in the first-person plural morphology in some languages [8], [52]. English is rather vague about clusivity. "We" can include or exclude the second or third person. "We" can mean "you and me" or it can mean "a third person and me." Some Australian and Austronesian languages have different words for "we" when it means exactly two people and "we" when it means more than two. The inclusive "we" signifies that the second person is "ingroup" whereas the exclusive "we" signifies that the second person is not included in the referent and thus is in the outgroup with respect to the clusivity of that instance.

3.2 T-V Distinction

T-V distinction [61] is a grammatical category that pertains to the selection of second-person pronouns and sometimes third-person pronouns, as well as verb-conjugation morphology. In T-V, "T" stands for "tu" and "V" stands for "vous" in reference to the difference between the French familiar and respect form of the second-person pronoun. This distinction is found in many Indo-European and Semitic languages. The rules on how to apply it vary considerably from one language to another. Formal English offers only one

word for the second person, both plural and singular, “you.” Therefore, the concept is unfamiliar to many English monoliterates. However, “y’all” (a contraction of “you all”) is common in some regional variations of English as an attempt to distinguish the singular from the plural second person.

Speakers and writers of languages that feature T-V distinction are forced to consider the relative social standing, level of prestige, familiarity, and ingroup-outgroup status of their audiences before they can address their audiences. This reveals thoughts of the first person, as to whether the listener belongs in one group or another. In languages where T-V distinction is important, this forced choice can (but does not always) imply bias, perception and/or opinion about other individuals or groups. In contrast, English speakers and writers have a better opportunity to cloak their perceptions under linguistic ambiguity. This ambiguity allows English speakers and writers to keep their opinions vague about the relative social status of the second person.

3.3 Noun class and animacy

The rank order of noun class and animacy are considered here as roughly equal because of the theoretical and logical non-orthogonality of these categories and because of the difficulty of separating their influences and effects in practice. Linguists classify nouns according to many criteria, including but not limited to animacy and gender. Depending on the specific language, noun-class distinction includes nouns associated with food, trees, abstractions, size, shape, consistency, and light reflection [54]. Additional noun classes are divided by criteria such as strong vs. weak or augmentative vs. diminutive [54]. Language groups that have detailed grammar rules concerning noun classes include but are not limited to Athabaskan (e.g. Navajo and Koyukon), Algonquian, Latin, Niger-Congo, and Caucasian [54]. The Australian aboriginal language of Yanyuwa has 16 noun classes [54], [63].

Noun-class grammar rules call attention to whether an object (or person) is in one group or another. For example, the four-fold hierarchy of animacy classes in the Australian aboriginal language of Dyirbal is as follows [54]:

- a. Animate objects and men;
- b. Women, water, fire, and violence;
- c. Edible fruit and vegetables;
- d. Everything else.

This class distinction must become an important part of cognition if the speaker is to select the right words to speak correctly. The existence of animacy hierarchies suggests that some classes are more sentient than others, thus leading to a possible ingroup-outgroup distinction and bias regarding one’s own group or class vs. a group or class of the “others.” This is particularly evident in noun class b. described above, which mixes women with what European cultures would classify as “inanimate” entities, as listed in Table 1.

3.4 Gender

Gender is a sociolinguistic variable that has far-reaching consequences in grammar, speech, word selection, and in the way culture enforces societal roles based on sex [33]. This is true even in languages such as English. Even when grammar rules do not force the selection of gender-specific noun endings (declensions), gender-specific verb conjugation, and gender-specific inflections in other parts of speech that group according to gender, women and men are reinforced to select role-specific words. Some

languages, such as Yanyuwa, have men's and women's dialects [63]. The only time a Yanyuwa speaker of one sex uses words in the dialect of the other sex is in direct quotation [63].

The stronger the grammatical gender dimorphism of the language, the more explicit the cultural reinforcement of sex-specific roles. Thus, gender is among of the most powerful criteria for grouping nouns. Sex and its stereotypical characteristics are closely associated with grammatical gender. Therefore, attention to grammar-enforced categorization based on gender is likely to provide a strong reinforcement for the cognition responsible for ingroup-outgroup bias among people.

3.5 Rationale for GCM rank ordering

The rank ordering in Table 1 was justified in much the same way that [43] justified the rank ordering of word categories with respect to concreteness and abstractness in the LCM. The rank ordering in Table 1 of the GCM is based on two factors.

- Permanence vs. transience of the referents' group membership particular to each category. Grammatical category membership ranges from "dynamic" to "static" with respect to this variable.
- Strength with which the culture enforces the prevailing notion of order that is reflected and implied in the use of these categories.

Other criteria could be used, such as how widespread across languages the categorical distinctions are observed. However, this particular criterion would result in different rank ordering. The authors assumed that any factor that required a statistical survey in comparative linguistics among many languages would not have as strong an influence on cognition as factors that could be considered in the context of a single culture and/or language group.

Clusivity is the most dynamic grammatical category because of the ease with which a second or third person (the referent) can shift from ingroup to outgroup and back again in a matter of minutes, as fast as the subject of a sentence can change. When speaking in a conversation, the speaker can include the second person in one sentence and in the next sentence, exclude the second person and include the third person, depending on the details of the conversation.

A less dynamic but not totally static grammatical category is the **T-V distinction**. No polite way exists to change between the T-V usages in many conversations. For example, close friends and certain family members always use the familiar "T" form. Similarly, polite business negotiations among strangers always are conducted using the respect "V" form. However, when strangers are in the process of becoming friends, which is likely to be a one-time event, a conversation will take place in which one person proposes the "T" form and the other person accepts its use thereafter. Changing back to the "V" form in the same conversation after the "T" form is proposed and accepted is unusual, awkward, and offensive. Such a change signifies either a gross ignorance of the language and culture at best, or a deliberately unfriendly social distancing at worst.

Animacy is mostly static except that an infant or a small animal (considered less animate or sentient) can grow to become an adult person or a larger animal (considered more animate or sentient). This takes a long period of time compared to the duration of a typical conversation. Unlike the T-V ingroup-outgroup distinction, which could change back from T to V depending on hostility or lack of familiarity, the transition from one animacy group to another is a one-way one-time event. For example, infants grow to become adults, thereby becoming more "sentient." Moreover, some languages have animacy classes that

are temporally invariant. For example, an abstract idea will never become a natural force and a natural force will never become a human or an animal.

The most static grammatical category listed in Table 1 is **gender**. The nouns, pronouns, and verbs that constitute the parts of speech that are subject to the grammar rules based on gender do not change their categories very quickly, if at all. The gender categories of these parts of speech are static within the timeframe of a single conversation. If they change at all, the timeframe for change would be measured in years, decades, and centuries, rather than minutes. For example, “il mare” (the sea, masculine singular) will always be masculine in the beginning, in the middle and at the end of an Italian conversation. No simple and general grammatical mechanism is available to change the gender of a noun without going outside of the lexicon of the language into another language, (e.g. “la mer” is feminine gender in French). Simply changing the gender marker, such as an article form (“il” or “la”) or a noun ending, usually does not work. Any change of this nature will alter the meaning of the word, or result in a grammatical error.

Gender designations can change when new languages emerge gradually from an ancient-root prototypical language. For example, when modern Italian and modern French emerged (and diverged) from their parent romance language based on Latin, the idea that “the sea” should be a masculine vs. a feminine noun reflected divergent cultural perceptions.

4.0 Concentric-group theory

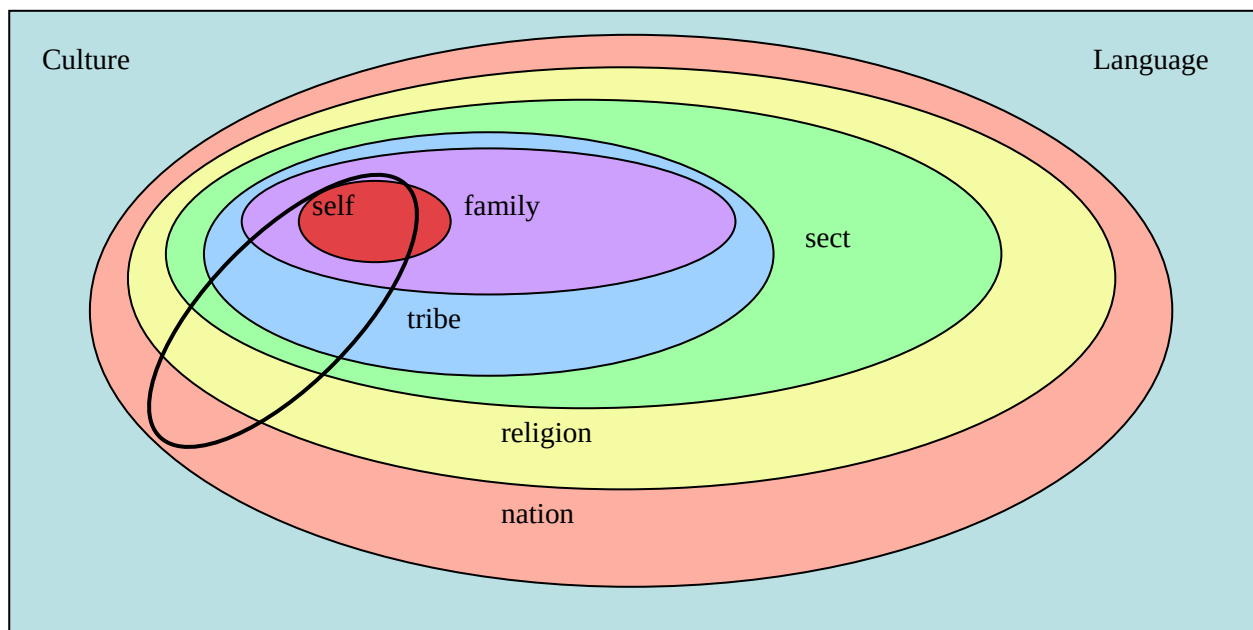


Figure 2. Concentric-Group Theory Diagram

Many theories have been developed regarding group identity in political and social situations. For example, Huddy presents a summary of theoretical approaches in [22]. Most theories focus on methods of categorization of group membership and self perception with regard to ingroup and outgroup. CGT builds on a key idea from self-categorization theory in that a person has both an individual and a social identity

[22]. CGT holds that individuals are members of multiple groups simultaneously, including the group that consists only of the self, to define where to place the dividing line between ingroup and outgroup.

Group size and composition are relative, arbitrary, and context specific. In Figure 2, CBT places the “self,” “ego,” or subject at the center of each group diagram to construct a system of groups based on self and group perception in various contexts. For example, the ingroup-outgroup concept can apply to self vs. family, family vs. tribe, tribe vs. nation, national vs. foreigner, sect of Islam vs. Islam as a whole, or Islam vs. other monotheistic religions, or “religions of the book” (e.g. Judaism, Christianity and Zoroastrianism.) The inspiration for CGT, was not mathematical or chemical group theory per se. Rather, CGT relates to what an individual might conceptualize as ingroup and outgroup in a given context.

In CGT, two kinds of groups are defined, “**orbits**” and “**eccentrics**,” as depicted in Figure 2, where the group structure is expressed in a Venn diagram. The group types were selected with the culture of Afghanistan in mind. The orbit-group system, depicted in color (or shading) in Figure 2, is based on a rank ordering of group size and scope. The terms, “orbit” and “eccentric,” were selected from the nomenclature of astronomy. Group hierarchy can be conceptualized as concentric orbits of planets, or as a system of subsets and supersets where each orbit is a proper subset of the next more generalized superset. This is the origin of the term “concentric.” Orbits are depicted in Figure 2 as non-intersecting ovals. Orbits tend to delineate homogeneous groups. For example, a local tribe may be part a larger regional ethnic group.

In contrast, **eccentrics** tend to delineate heterogeneous groups. Eccentrics are composed of much more diverse and heterogeneous cross sections of the population. An eccentric is not a proper subset of any orbit or concentric group. The term “eccentric” was inspired by the trajectory of a typical comet, which describes an eccentric ellipse where the major axis is much larger than the minor axis. An example of an eccentric is shown on the left side of Figure 2 as a black oval that crosses the orbits. In CGT, an eccentric does not mean that any specific individual in a group is “eccentric” per se in the personality sense, or is changing identity. It refers only to the manner in which the group composition is selected. The rank ordering among eccentric groups, if it exists at all, is vague. This is not to say that rank ordering is absent in heterogeneous groups, but rather, this ordering may not be readily apparent to members of outgroups.

Upon inspection, one can surmise that members of orbits tend to have more observable traits in common with each other than members of eccentrics. Behavior and non-verbal communication reflects this awareness. For example, when people viewed faces of individuals in their ingroups their faces assumed positive expressions whereas their faces would adopt negative expressions when viewing faces from outgroups [5]. In cases in which people are focused on visible traits, members of orbits are likely to conceptualize and exhibit stronger ingroup identification with each other than members of eccentrics might exhibit with each other. However, some strong, unifying characteristics of groups can be delineated by eccentrics when the members of these groups share a common belief system that does not depend on outwardly observable traits. The influence of belief systems is described in the next section.

A major difference between CGT and Reference-Group Theory [10] is that in CGT the self is always included in the group that the individual conceptualizes [22]. In contrast, Reference-Group Theory deals with the identification of an individual with a group to which he or she does not belong. In either case, the identification is subjective, in contrast to social-identity theory where group membership is objective [22]. Each theory mentioned above applies in some situations but does not work as well in others.

5.0 Culture, language, and religion

5.1 Comparing languages, philosophy, behaviors

Cultures enforce their norms through language constructs. (See, for example, [24] and [26].) The interaction between culture and cognition [43], [15], and, more specifically, religion and cognition has received considerable attention in the literature [5], [28], [66].

Language may influence individuals to accept power structures as natural and justified [2]. Linguistic choices convey and promote ideology, dominance, power, and status [2]. Table 2, which lists grammatical features of various languages, suggests that a philosophy that co-emerges historically with language development will share some of the features of that language. For example, note the differences between gender inflections in the Persian-based Iranian language group compared to those of the Semitic group. The Semitic group in general features much more detailed grammatical attention to gender and number.

Table 2. Inflections for agreements with gender and number in parts of speech

Language	Gender	Number	Gender Inflections	Reference
Persian①	none	Singular, plural	none	[57]
Dari①	none	Singular, dual, plural	none	[47]
Pashto①	F, M	Singular, plural	Adjectives, pronouns, nouns	[56]
Arabic②	F, M	Singular, dual, plural	Adjectives, pronouns, nouns, verbs	[4]
Hebrew②	F, M	Singular, dual, plural	Adjectives, pronouns, nouns, verbs	[45]

① Indo-European language group, Iranian subgroup

② Semitic language group, central Semitic subgroup

Most Al-Qaeda terrorists speak Arabic, either as a first language or as a second language. However, the influence of an individual's native language alone is insufficient to explain observed the individual's behavior. For example, the overwhelming majority of Arabic-speaking people, most of whom are Muslims, completely reject Al Qaeda's terrorist philosophy and approach [21], [37]. Similarly, Hebrew-speaking Hasidic Jews and Arab Christians living in Israel also reject Al-Qaeda and other terrorist groups.

5.2 Wahhabism vs. Sufism and mainstream Islam

The influence of the relatively new extremist Wahhabi sect [9], [38] in Saudi Arabia provides a better insight into terrorist thinking than language and grammar alone. "Religious" sect as an ingroup, reinforced by language structure, may be a better predictor of behavior, depending on the prevailing culture within that group and their attitude toward members of outgroups. Figure 3 illustrates the group dynamics of various sects in the Islamic world in terms of the CGT. For example, Figure 3a depicts the viewpoint of mainstream Islam. The Wahhabi sect, which is only 250 years old, rejects all forms of non-Wahhabi Islam, especially the spiritual forms of Islam [38], as depicted in Figure 3b. Thus, Wahhabi is their ingroup whereas everyone else, including mainstream sects of Islam, constitutes the outgroup. Al Qaeda represents Wahhabism in its purest form [38], [39].

The Wahhabis have a long history of persecuting various sects of Islam, especially the Sufis [62], [17], [38], [39]. The Wahhabi terrorism makes them *persona non grata* to mainstream Muslims, as depicted in Figure 3a, which shows no intersection between the Wahhabi and mainstream Islam in the Venn diagram.

Not surprisingly, most sects of Islam oppose the Wahhabi approach [41]. Al Qaeda is outgroup to Islam because Al Qaeda's behavior is contrary to the tenets of Islam, as well Islamic philosophy and culture.

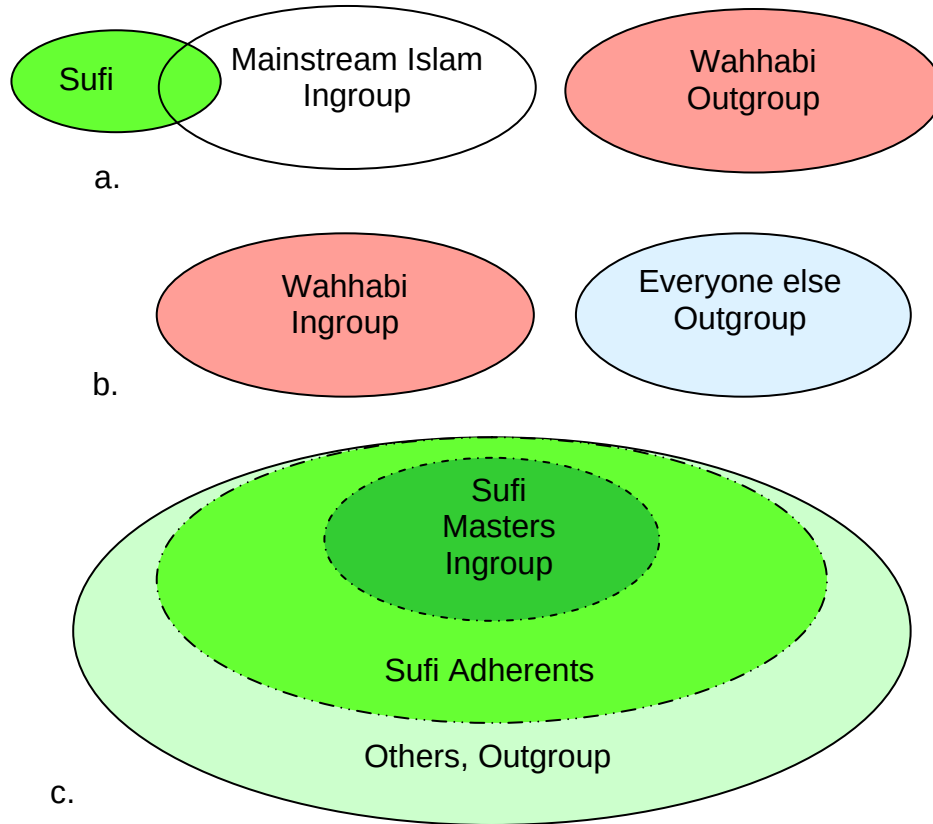


Figure 3. Ingroup-outgroup perceptions from different viewpoints

In contrast, the Sufi sect of Islam is much older than the Wahhabis. Sufis are diametrically opposed to Wahhabi philosophy and culture [39]. Persian Sufi Masters, such as Bayazid Bastami [49] and Mansur al-Hallaj [53] descended from families that practiced Zoroastrianism, which predates Islam by about 12 centuries [64]. Zoroastrianism was a popular religion in Persia prior to the Islamic conquest, which occurred during the mid 7th century. Zoroastrianism's tenets of gender equality [64] are reflected in the absence of gender inflections in Persian grammar, listed in Table 3.

Sufi Master Farid al-Din Attar used instructional material from ascetic legacies that are older than Islam [50], a practice that is not unusual among Sufis and among other mysticism-oriented groups. This demonstrates a lack of ingroup-outgroup thinking divided along Islamic-sectarian lines. Unlike the Wahhabi sect, Sufi culture is oriented inward toward self control, meditation, contemplation, and expansion of consciousness rather than outward toward violent expansion of their political power base. (See, for example, [13], [39], and [60].)

Ingroup-outgroup thinking among the adherents of Sufi sect, and other groups with similar esoteric philosophy, differs considerably from that of outward-oriented Islamic sects. Some Sufis see themselves

as belonging to the “outgroup” and their teachers or spiritual adepts as forming the “ingroup” as depicted in Figure 3c. This is an example of Reference-Group Theory [10], [22], where the individual identifies with a group to which he or she does not belong. It is also an example of self-categorization theory [29] where a group member tries to conform to the most extreme or idealized ingroup “norm” or example. Being “on the outside looking in,” the main objective in Sufism is to achieve unity with the Divine through the spiritual practice of “going within,” thereby becoming part of the ultimate ingroup [13]. This type of ingroup-outgroup cognition does not lead to terrorist behavior, which the Sufis view as a one of the worst impediments to spiritual progress.

For example, Persian Sufi Master Farid al-Din Attar, quoted another Persian Sufi Master, Bayazid Bastami as having said (translated) “...I stood with the warriors in the cause and I didn’t find a single step of progress with them...” [49]. Sufi Master, Mir Bulleh Shah Quadiri Shatari Sayyid (1680-1758) is credited with having written a passage that translates as, “A jihad against self-will was, to Shiekh Abdul Qadir far superior to that waged with the sword.” [36]. Sufi Master, Hazrat Sultan Bahu (1680-1758), denounced violence in a poem excerpt that translates as, “...They have wasted their lives fighting over worldly things, devoid of good sense, foolish in their ways...” [35]. Bulleh Shah and Sultan Bahu were Arabic and Persian scholars, well respected during their lifetime.

Although various Sufi sects and schools of mysticism within the greater Islamic community had their differences, they were either accepted outright, or at least tolerated, for over a millennium. In contrast, shortly after the Wahhabis began their reign of terror, they became an outgroup. By the 19th century, mainstream Muslims had had enough of the extreme violence and terror directed against them. In an effort to oppose Wahhabi philosophy and discourage Wahhabi attacks, Ottoman religious scholars of the highest authority issued an extensive literature of fatwas (religious edicts) against Wahhabism that amounted to about 80 anti-Wahhabi classics [42].

More recently, in a landmark theological study, prominent Muslim cleric, Muhammad Tahir ul-Qadri, issued a fatwa against terrorism in general and suicide terrorism in particular. He indicated clearly and categorically that suicide terrorists are not true believers of Islam [21]. This type of analysis again placed terrorists in the outgroup with respect to mainstream Islamic sects and schools of thought.

The fact that Muhammad Tahir ul-Qadri is founder of the Minhaj-ul-Quran International movement, with centers in 90 countries [21] demonstrates the continuing widespread influence of Muslim spiritual leaders who condemn terrorism. Other contemporary clerics also have rejected terrorism [21], [37]. Thousands of young people in Saudi Arabia are turning to Sufism and rejecting Wahhabism [38].

This rejection notwithstanding, from the Wahhabi point of view, the Shia and the Sufis are among the outgroup that, according to the Wahhabi approach, deserves especially violent persecution [39], [62]. Factors that contribute to the hostility of the Wahhabi sect toward the Sufi sect include the Wahhabi violent rejection of the following:

- a. Anyone except the Wahhabi [40], [41]
- b. Sufi Masters, (and anyone else seen as “holy intermediaries” [34]) which are central to the Sufi esoteric philosophy [14]
- c. Anything that put everyone, regardless of sex, on a more or less equal footing. This includes mixed groups participating together at Sufi meetings.
- d. The acceptance of women as spiritual leaders, for example Rabia Basri [12].

Prominent Sufi Masters wrote their poetry in Persian. The influence of the Persian language, which does not include gender inflections, could have influenced the acceptance of mixed groups and women as Masters, thus blurring some social distinctions between the sexes. In reference to Figure 2, the Sufi culture and belief system is oriented along the lines of “eccentric” groups. For example, non-Muslims participate in some Sufi groups [60]. This is depicted in Figure 3c by set boundaries consisting of dashed rather than solid lines. In contrast, group thinking among the Wahhabi sect is oriented toward “orbits” with membership in the Wahhabi sect as a “litmus test” for the categorization of ingroup vs. outgroup.

6.0 Ontological contributions

The concepts that emerged from the analysis of language, culture and cognition in this study are summarized below in Table 3, where language concepts are approximately aligned with their cultural and general counterparts so that the rows in Table 3 reflect corresponding or related concepts across the domains.

Table 3. Associated concepts in language, culture, and cognition

Language Concepts	Cultural Concepts	General Concepts
Grammar	Religion	Cognition, Thought
Grammatical categories	Religious sect	Group (set of individuals)
Grammatical Category Duration	Ingroup vs. outgroup	Set theory, Events, Perdurance [18]
Grammatical Category Persistence	Tradition	Endurance [18] Time invariance
Grammatical Category Strength	Strength of tradition	Concept strength
Grammar rules	Social norms	Subset vs. superset
Word groups	Population cross section	Eccentric (Figure 2)
Noun	Person, place, thing	Recursive subsets
Clusivity	Specificity, politeness	Orbit (Figure 2)
T-V Distinction	Dominance-subservience	Status hierarchy
Noun class	Social strata	Disjoint sets
Animacy	Sentience	Status
Gender	Sex roles	Diversity
Strong & weak domains	Cultural support for domain activity	Detailed specific concepts and multiple concept classes

The categories listed in Table 3, as described in this paper can be translated into ontological classes in an integrated ontology that is designed to support reasoning with respect to cognitive information operations. Such an ontology will need to include these and many other such classes and their relationships for counterfactual reasoning, reasoning under uncertainty, and future prediction. A multi-dimensional ontology should include concept and domain strength, as described in Appendix A as additional dimensions.

7.0 Metrics, experiments, and hypothesis testing

The theories and models described above can help improve our understanding of group dynamics but by themselves, they are not very useful. Theories and models have much greater utility when testable hypotheses and metrics based on their concepts produce experimental results and “actionable” information. In this case, the information can help distinguish one group from another and identify an individual’s bias toward or against a particular group. When an individual displays bias in favor of a terrorist group, the appropriate action is to watch that individual more closely, looking for signs of terrorist behavior or additional influence.

Language not only affects cognition, it reflects cognition. With these ideas in mind, the following hypothesis was formed: Members of various groups, including but not limited to terrorist groups, can be classified as “ingroup” or “outgroup” with respect to a specific group by their use of language if the right metrics can be selected. If sufficient information is available and can be fused in a timely manner, a specific group can be identified. It is essentially equivalent to Identification Friend Foe (IFF), which is a classification task in level-one data fusion. The problem of selecting metrics to enable group classification, discrimination, and identification is approximately isomorphic to selecting the correct features of data sets for data mining and knowledge extraction. Each grammatical category in Table 1 can be used to generate a family of metrics, or ways to discriminate one group from others. Moreover, a test could be developed using speech patterns to determine whether or not a single individual is likely to be a member of a specific group, or at least to show bias toward or against a group.

Language can be observed and represented in at least three ways, including verbal speech, textual transcripts of speech, and formal text. Speech is a real-time activity that produces temporally finite events, the study of which requires analysis techniques that are very different from those used in the study of text. Speakers produce many non-verbal cues that are difficult to detect without training. Such cues can be very difficult to quantify. Most, if not all, non-verbal cues are likely to be lost in written transcriptions of speech unless the transcriber makes parenthetical notes of them. However, the same text can be studied in a variety of ways sequentially, whereas multiple techniques need to be employed concurrently in speech. Otherwise, the speech must be recorded, thereby losing some cues.

A more efficient way to test the hypothesis in speech communications is to use transcripts of speeches or conversations as source material. Members of groups will speak to each other using words and phrases that they do not use when speaking to others. People use certain words to describe outgroups that they do not use when describing an ingroup. Particular uses or misuses of grammar may indicate membership in or bias towards a particular group. By examining speech transcripts, a metric for group identity may be found. Hypotheses can be tested using a corpus of text to provide discriminanda for experiments with a statistically significant number of subjects in a multi-alternative, forced-choice paradigm. For example, a subject will read a transcript and classify the speaker as belonging to group A, B, C, etc. The Challenge of this approach is the acquisition of speech transcripts.

Formal text, as opposed to speech transcripts, is a third representation of language. Text is amenable to the experimental techniques of Computational Linguistics (CL). To test the hypothesis with formal written text, two texts can be selected, one by a Sufi writer and the other text written by a member of an extremist Islamic group. CL techniques can be applied to develop a similarity metric from the results of a CL word search. Keywords and phrases in each text can be identified. A distribution of usage is expected to enable a researcher to distinguish one group from the other as characteristic patterns of words and

phrases emerge from each text. These distributions can be used as baselines for classifying future texts as to whether they originated from one group or the other (or neither). Then a cross analysis can be performed on each text using the key words and phrases derived from the other text as a validity test. For example, low detection rates should be observed when searching for characteristic Sufi word patterns in the text written by the member of a different sect. The experimental method can be tested with English text, and then with an Arabic text. If the methodology is successful in identifying the patterns of each group's written texts, it could be extended to include additional groups, both inside and outside mainstream Islam.

Another way to use Table 1 is to categorize the results of a CL study to develop something like a "group spectrum" for each category in Table 1. This would generate a distribution of words and phrases that can be used to describe group-speech or group-text characteristics. CGT could be applied to characterize a group at a one level but not at a different level. For example, a particular tribe may exhibit distinct linguistic characteristics that may not be as distinct or even present in a cross section of individuals from the nation for which the tribe is a subgroup. CGT awareness can help determine the limits of applicability of this type of metric. If a group is too diverse (such as an eccentric coming from a very large pool of individuals) no distinct patterns may emerge that can be used to characterize the group with unique features, whereas, a smaller and more homogeneous group may exhibit much more distinct characteristics that are different from other groups of the same size at the same CGT level. Some data sets may allow one group to be distinguished from another group, whereas other data may be necessary to classify an individual as a member of one group vs. another. Comparing groups at the same CGT level is important.

8.0 Challenges and future research

Many aspects of cognition vis-à-vis language have not been studied due to the difficulty of doing so. For example, the social aspects of language use often are disregarded in language description [8]. Another difficulty is the lack of complete documentation and characterization of many "exotic," minority, ancient, endangered, and extinct languages that may have exhibited diverse grammars that require ingroup-outgroup distinctions.

A survey of linguistic details could be conducted with the focus on some local language used in Afghanistan with a view toward identifying properties of the languages that may lead to specific thought patterns. A metric or set of metrics needs to be developed using concepts described in tables 1, 2, and 3. The ontological concepts in Table 2 can be correlated with a general ontology of cognition from an existing upper ontology. (See, for example, [16], [27], and [31].) The result will be a richer, more detailed ontology.

9.0 Acknowledgments

The authors thank the Office of Naval Research, Code 30 for financial support, and Dr. I. R. Goodman, J. Howell, Dr. C. Butts, C. M. Ceruti, and E. W. Medina for their review and helpful suggestions. This paper is the work of U.S. Government employees performed in the course of employment and no copyright subsists therein. It is approved for public release with an unlimited distribution.

10.0 References

- [1] A. Alrich, *Framing the Cultural Training Landscape: Phase I Findings*, IDA Document D-3709, Log: H 08-001888, Dec. 2008.
- [2] P.S. Angermeyer, "Language, Power and Persuasion" 2009-2010, <http://www.yorku.ca/laps/dlll/linguistics/Courses/2430/index.html>
- [3] P.S. Angermeyer and J.V. Singler, "The case for politeness: Pronoun variation in co-ordinate NPs in object position in English," *Language Variation and Change*, Vol. 15, pp. 171–209, 2003.
- [4] Arabic Grammar, 2010. <http://www.arabic-language.org/arabic/grammar.asp>
- [5] L.W. Barsalou, A.K. Barbey, W.K. Simmons, and A. Santos, "Embodiment in Religious Knowledge," *Journal of Cognition and Culture*, Vol. 5. No. 1 and 2, pp. 14-57, Special issue on Psychology and Cognitive Foundations of Religiosity, ed. R.N. McCauley and H. Whitehouse, Brill Academic Publishers, Cambridge U. Press, 2005.
- [6] S.P. Borgatti, K.M. Carley, and D. Krackhardt, "On the robustness of centrality measures under conditions of imperfect data," *Social Networks*, Vol. 28, pp. 124-136, 2006.
- [7] *Collins Italian Dictionary* 2nd Edition, "Reverso," Harper Collins Publishers, 2005. <http://dictionary.reverso.net/english-italian/nut/forced>
- [8] M. Cysouw, "A Typology of Honorific Uses of Clusivity," *Clusivity: Typology and Case Studies of the Inclusive-Exclusive Distinction*, E. Filimonova, ed. J. Benjamins Publishing Co., 213-230, 2005.
- [9] R. Dailey, "The Wahhabi Sect: The Center of Islam Fundamentalism," Aug 22, 2007 http://islamic-history.suite101.com/article.cfm/the_wahhabi_sect
- [10] E.M. Dawson and E.A. Chatman, "Reference group theory with implications for information studies: a theoretical essay," *Information Research*, Vol. 6, No. 3, 2001. <http://InformationR.net/6-3/paper105.html>
- [11] D. Eliot, "US troops train for both combat and conversation," Associated Press, 29 March 2010.
- [12] J. Fadiman and R. Frager, *Basic Sufism*, p. 119, Castle Books, New York, NY, 1998.
- [13] Ibid., p. 13, Chap. 18, pp. 209-215, Chap. 23, pp. 243-250.
- [14] Op.cit., Chap. 12, pp. 127-128.
- [15] S. Feldman, "Values, Ideology, and the structure of Political Attitudes," Chap. 14 in Sears, D.O., Huddy L. & Jervis R. *Oxford Handbook of Political Psychology*, pp. 477-508, Oxford University Press, Oxford, New York, 2003.
- [16] A. Gangemi, N. Guarino, C. Masolo, A. Oltramari, L. Schneider, "Sweetening Ontologies with DOLCE," *Proceedings of the 13th International Conference on Knowledge Engineering and Knowledge Management. Ontologies and the Semantic Web (EKAW 2002)*, LNCS Vol. 2473, pp. 166-181, 2002. <http://www.loa-cnr.it/Papers/DCOLCE-EKAW.pdf>
- [17] K. Ghosh, "Sufism, Wahabism, and Kashmiriyat," *Mainstream Weekly*, Vol. XLVI, No. 43, 17 Oct. 2008. <http://www.mainstreamweekly.net/article987.htm>.
- [18] P. Grenon, *BFO in a Nutshell: A Bi-categorical Axiomatization of BFO and comparison with DOLCE*, Universitat Leipzig, Institute of Formal Ontology and Medical Information Science (IFOMIS) Report 06/2003, ISSN 1611-4019, December 2003.
- [19] M. Haspelmath, "Descriptive scales versus comparative scales" pp. 39-53, (Linguistische Arbeitsberichte, 86.), Marc Richards & Andrej L. Malchukov (eds.), Universität Leipzig, 2008.
- [20] M. Haspelmath, "Pre-established categories don't exist: consequences for language description and typology." *Linguistic Typology*, Vol. 11, No. 1, pp. 119-132, 2007. <http://email.eva.mpg.de/~haspelmt/Preestablished.pdf>
- [21] H. Hassaballa, *The Faithful Fight Against Terror*, 8 March 2010, <http://www.middle-east online.com/english/opinion/?id=37688>

- [22] L. Huddy, Group Identity and Political Cohesion, Chap. 15 in Sears, D.O., Huddy L. & Jervis R. *Oxford Handbook of Political Psychology*, pp. 511-558, Oxford University Press, Oxford, New York, 2003.
- [23] Italian/English Dictionary <http://www.aromatic.com/itaeng/search.php>
- [24] H.A. Klein, K. Peng, M.H. Lin, K. Bhal, M.H.B. Radford, I. Choi, N.M. Noor, H.M. Khalid, and D. Chan, *Rosetta Phase II: Measuring and Interpreting Cultural Differences in Cognition - Final Report*, 31 July 2008, 107 pp. AOARD-074043, DTIC. <http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA493207&Location=U2&doc=GetTRDoc.pdf>
- [25] V. Krebs, "Social Network Analysis, A Brief Introduction," 2008. <http://www.orgnet.com/sna.html>
- [26] A. Majid, M. Bowerman, S. Kita, D. B. M. Haun, and S. C. Levinson, "Can language restructure cognition? The case for space," *Trends in Cognitive Sciences*, Vol. 8 No. 3, March 2004.
- [27] V. Mascardi, V. Cordi, and P. Rosso, "A comparison of Upper Ontologies," Technicl Report DISI-TR-06-21, *Proceeding of the Joint Workshop "From Objects to Agents:" Agents and Industry: Technological Applications of Software Agents*, Sep. 2007.
- [28] R.N. McCauley and H. Whitehouse, "New Frontiers in Cognitive Science of Religion," *Journal of Cognition and Culture*, Vol. 5. No. 1 and 2, Special issue on Psychology and Cognitive Foundations of Religiosity, ed. R.N. McCauley and H. Whitehouse, Brill Academic Publishers, Cambridge U. Press, 2005.
- [29] C. McGarty, J.C. Turner, M.A. Hogg, B. David and M.S. Wetherell, "Group polarization as conformity to the prototypical group member," *British Journal of Social Psychology*, Vol. 31. pp. 1-20, 1992.
- [30] J. Miller, "Model sheds light on the language of culture," *Physics Today*, Vol. 63, No. 3, pp. 20-21, March 2010.
- [31] Napierski, N.P., Young, A.S. & Harper, K.A. "Towards a Common Ontology for Improving Traceability of Human Behavior Models." *Proceedings of the SISO Conference on Behavior Representation in Modeling and Simulation (BRIMS)*. 2004.
- [32] Navajo Language, <http://www.angelfire.com/nv/navaholang/language.html>
- [33] F. Ngom, "The social status of Arabic, French, and English in the Senegalese speech community," *Language Variation and Change*, Vol. 15, pp. 351-368, 2003
- [34] "Principles of the Wahhabi sect," *San Jose Mercury News*, December 29, 2001. <http://www.rickross.com/reference/islamic/islamic46.html>
- [35] J.R. Puri and K.S. Khak, *Sultan Bahu*, p. 288, Radha Soami Satsang Beas Publishing, Amritsar, India, 1998.
- [36] J.R. Puri and T.R. Shangari, *Bulleh Shah*, p. 7, Radha Soami Satsang Beas Publishing, Amritsar, India, 1986.
- [37] M. K. Qasmi, *We Reject all Forms of Terrorism: Deoband Scholars from Major Muslim Schools of Thought Join Hands*, 12 March 2008, <http://khaliliqasmi.sulekha.com/blog/post/2008/03/we-reject-all-forms-of-terrorism-deoband-declaration.htm>
- [38] S. Schwartz, *Saudi Arabia and the Rise of the Wahhabi Threat: A briefing*, February 27, 2003, <http://www.meforum.org/535/saudi-arabia-and-the-rise-of-the-wahhabi-threat>
- [39] S. Schwartz, *The Two Faces of Islam: The House of Sa'ud from Tradition to Terror*, pp. 68, 71-78, 83, 107, Doubleday, 2002.
- [40] Ibid., p. 69.
- [41] Op. Cit. p. 74.
- [42] Op. Cit. p. 81.

- [43] G.R. Semin. "Language, Culture, Cognition: How Do They Intersect?" Chap. 14 in *Understanding Culture: Theory, Research, and Application*, pp. 251-262, 2008.
<http://cratylus.org/people/uploadedFiles/1226249796958-4616.pdf>
- [44] Y. Shen and D. Gil, "Language, Thought and the Hybrid Animacy; Experimental Studies of Hybrids in Hebrew, Indonesian and Minangkabau"
lingweb.eva.mpg.de/jakarta/seals/Shen_SEALS_XVI_Abstract.pdf
- [45] H. Shacter, *Elef Milim, An English Companion to Part 1*, pp. 10-12, Achiasf Publishing House, Ltd. Jerusalem.
- [46] B. Smith, L. Vizenor, and J. Schoening, "Universal Core Semantic Layer," *Proceedings of the conference on Ontology for the Intelligence Community (OIC'09)*, Oct. 2009.
- [47] Transparent Language, "Overview of the Dari Language," 2010
<http://www.transparent.com/languagepages/dari/overview.htm?link=leftnav>
- [48] <http://en.wikipedia.org/wiki/Animacy>
- [49] http://en.wikipedia.org/wiki/Bayazid_Bastami
- [50] http://en.wikipedia.org/wiki/Farid_al-Din_Attar
- [51] http://en.wikipedia.org/wiki/Grammatical_category.
- [52] http://en.wikipedia.org/wiki/wiki/Inclusive_we
- [53] http://en.wikipedia.org/wiki/Mansur_al-Hallaj
- [54] http://en.wikipedia.org/wiki/Noun_class
- [55] http://en.wikipedia.org/wiki/Navajo_language
- [56] http://en.wikipedia.org/wiki/Pashto_grammar
- [57] http://en.wikipedia.org/wiki/Persian_grammar
- [58] <http://en.wikipedia.org/wiki/Sanskrit>
- [59] <http://en.wikipedia.org/wiki/Sociolinguist>
- [60] <http://en.wikipedia.org/wiki/Sufi>
- [61] http://en.wikipedia.org/wiki/TV_distinction
- [62] <http://en.wikipedia.org/wiki/Wahhabi>
- [63] http://en.wikipedia.org/wiki/Yanyuwa_language
- [64] <http://en.wikipedia.org/wiki/Zoroastrianism>
- [65] E. Wilson, "Center for Language, Regional Expertise and Culture (CLREC) Training Enhances Mission Readiness" NNS061004-02, Oct. 2006.
http://www.navy.mil/search/display.asp?story_id=25853
- [66] S. Zebian, "Linkages between number concepts, spatial thinking, and directionality or writing: The SNARC effect and REVERSE SNARC effect in English and Arabic Monoliterates, biliterates, and illiterate Arabic Speakers," *Journal of Cognition and Culture*, Vol. 5. No. 1 and 2, Special issue on Psychology and Cognitive Foundations of Religiosity, ed. R.N. McCauley and H. Whitehouse, Brill Academic Publishers, Cambridge U. Press, 2005.

Appendix A

Strong concepts and strong domains

Table 1 A. Strong domains in various languages

Language	Strong Domain	Examples
English	Produce	nut – <i>fruta secca, fruto seco</i> The literal translation into English does not describe the domain uniquely or adequately. No generic term for the category of “nut” exists in Italian or Spanish. It is considered “dried fruit.” Specific nut types are named individually. [7], [23]
Italian	Music	<i>Musicare</i> – to set (text) to music, e.g. compose music for a poem <i>Stonare</i> – to play out of tune <i>Leggio</i> – music stand
Sanskrit	Philosophy	<i>Pancacita</i> – “five goals” [58]
Navajo	Actions	<i>ná’oolkil</i> “It is moved slowly in a circle” (N.B. ’ is an okina) <i>adisbqqs</i> “I’m starting to drive some kind of wheeled vehicle along;” <i>níljool</i> “Give me some hay!” [55]

Concept strength is defined as the number of single words in a language to describe a given concept, concept class, or domain. Concept strength is related to domain strength. A strong domain in a language is a domain that is so important to the culture where the language is spoken that its concepts appear “complex” to other cultures. Strong domains are characterized by many single words that express “complex” thoughts. Single words in strong domains require multiple words to explain the concepts when translated into other languages. It is particularly difficult to recognize strong domains in one’s native language as domain strength is discovered in relation to translations. Table 1A lists some examples of strong domains and their single-word examples. Strong domains tend to have more single-word descriptive terms as well as single-word terms for generic concepts of classification. Like the grammatical categories described in Table 1, the identification of a strong domain in a language provides another avenue of inquiry into the culture prevalent in the area where the language is spoken. The presence of a strong domain suggests what is important to that culture and provides a window into the cognitive influences that led to the formation of the domain strength.

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Filename: Ceruti.etal.ILCC.NSSDF.Language.v36.handout

Proceedings of the National Symposium on Sensor and Data Fusion (NSSDF), 26-30 July 2010, Nellis AFB, Las Vegas, NV.