

Greatness in the Math Corps family: integrating ethnographic, corpus, and cognitive approaches to a cultural model

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Stephen Chrisomalis

Wayne State University

chrisomalis@wayne.edu

Abstract

This study analyzes a cultural model for greatness at the Math Corps, an enrichment mathematics program of primarily African American students from public schools in Detroit, Michigan. Corpus analysis of staff addresses reveals eight interrelated conceptual relationships about greatness, conceptualized as a resource inside individuals motivating success. Compared to contemporary and historical American English corpora, this cultural model differs systematically from general understandings of greatness. Aspects of these conceptual relationships are then elaborated through gestural and graphic modalities. This cultural model produces a framework for decision and action, motivating student success in a challenging educational environment. This study integrates ethnography, corpus linguistics, and discourse analysis in understanding conceptual metaphor and cultural models, both in educational settings and other discourse communities.

Keywords

Conceptual metaphor, corpus linguistics, mathematics education, Math Corps, motivational discourse, American English

1. Introduction

Studies of conceptual metaphor and cultural models in cognitive linguistics and cognitive anthropology are at a crossroads. Methodologies such as corpus linguistics (Deignan 2005; Marley 2008; Stefanowitsch and Gries 2006) and critical discourse analysis (Hart 2008) highlight the need to better understand how metaphors are formed, acquired, deployed, and understood in language in use. Similarly, ethnographic perspectives can help disciplines focused on discourse to address specific problems regarding the motivational force of conceptual language on individuals and groups, particularly in educational settings. Cognitive anthropology examines how motives and decision-making schemata are produced, shared, transmitted, and integrated into conceptual networks (d'Andrade and Strauss 1990; Holland and Quinn 1987; Strauss and Quinn 1997).

The present study is based on a three-year ethnographic investigation at the Math Corps, a mathematics enrichment program for public school students in Detroit, Michigan, including over 500 hours of participant observation, 136 semi-structured interviews with participants including both students and staff, and additional interviews and interactions outside the context of the program. Although Math Corps is centrally concerned with the teaching of arithmetic, and although there is an important literature on mathematical metaphor (Lakoff and Nuñez 2002; Nuñez 2008; Schinck et al. 2008), this study does not principally concern the use of metaphor in specifically mathematical senses. Instead, it seeks to understand the cultural model through

which Math Corps motivates students for personal success and achievement in a variety of endeavors, including but not limited to mathematics. The interdisciplinary study of metaphor and cognition thus contributes more broadly to applied research in education and social policy, although these are beyond the immediate scope of the present paper.

Cognitive anthropology and cognitive linguistics share a common methodological and conceptual framework, and there has been considerable cross-fertilization among them. Most notably, Holland and Quinn (1987) brought together the work on conceptual metaphor pioneered by Lakoff and Johnson (1980) with insights drawn from cognitive anthropology. Cultural models are frameworks for meaning – learned, shared, culturally variable conceptual understandings of phenomena that motivate decisions and action in particular contexts. They are related to language and are elicited through language, but neither must they be purely linguistic. Rather, they are cognitive phenomena that structure activity and discourse in meaningful and patterned ways.

Data from language in use are necessary to build evidence for the specific cognitive frameworks through which language relates to cognition and behavior. Corpus data are increasingly being used to examine sociolinguistic variation among speech communities and to examine linkages between language-in-use and cognition-in-practice. Doing so allows us not only to avoid some of the pitfalls involved in identifying and analyzing such metaphors (McGlone 2007), but also to enrich the theoretical foundations of corpus-based studies with analytical frameworks derived from anthropology and discourse analysis.

Collocations, or co-occurrences of lexical patterns within a corpus of data, provide a framework under which specific ideas about the relationships between words in actual texts can be evaluated, refined, and analyzed (Stubbs 1996, 2001). Moreover, examining specific aspects of syntax and discourse structure can be extremely useful in evaluating the way in which metaphors affect individual decision and action. Stubbs (1999: 234-6), a corpus linguist, notes that earlier and characteristically woolly notions of linguistic relativity inadequately demonstrate specific correspondences between language and thought and instead rely on minimal informant data or (at worst) supposition. From an anthropological perspective, Lucy (1997) advocates for a rigorous testing of specific claims regarding language-cognition relationships and shows how this might be done. From their very different research traditions, both Stubbs and Lucy insist on integrating a deeply empirical approach to language in use with the more abstract foci of earlier traditions.

The present study is an analysis of a particular cultural model for *greatness* at the Math Corps program using corpus data. *Greatness* is a generalized, metaphorically-driven concept that is regarded as motivating success within the program and more broadly in students' lives. It is a major topic of discourse among both staff and students, in ways that differ from its ordinary English usage, and thus is highly suitable for study as a cultural model.

This paper has five general goals:

- a) to identify systematic patterns among specific forms of discourse about *greatness* at Math Corps, which are then identified collectively as a cultural model;

- b) to compare these patterns with the way that *greatness* is conceptualized in English outside Math Corps;
- c) to demonstrate cultural transmission of this model by comparing staff and student discourse about *greatness*;
- d) to link this cultural model to nonverbal (gestural and graphic) representations of *greatness*;
- e) to identify aspects of the *greatness* cultural model that motivate academic and personal success.

2. Math Corps

The Math Corps is an enrichment mathematics education program designed and run by the Department of Mathematics and the Center for Excellence and Equity in Mathematics at Wayne State University in Detroit Michigan. It was founded in 1992 by Prof. Steven Kahn, a mathematician who remains the executive director of the program. It serves middle-school students who attend or will be attending Detroit public or charter schools in the seventh, eighth, and ninth grades, as well as promoting enriched learning for teaching assistants in the tenth, eleventh, and twelfth grades. Approximately 95% of the students in the program are African-American, which roughly reflects the composition of Detroit public schools. It operates primarily as a six-week summer program, with Saturday programs throughout the academic year. The curriculum is designed to supplement the school-year academic curriculum while providing a social environment that encourages peer mentorship and the development of self-esteem. Described in these terms, it may seem little different from other university-sponsored enrichment mathematics programs that operate throughout the country.

There is a broad consensus that Detroit public schools are not currently providing a sound foundation in arithmetic and mathematics suitable for most students (Gawlik et al 2010). While charter schools have been touted as a solution, recent evidence suggests that American charter schools are not outperforming their public counterparts in mathematics (Berends et al 2010; Esposito 2011). Most new Math Corps students initially lack the educational foundations needed for success in mathematics. The program starts at a very elementary level (the number line, fractions, arithmetic) but rapidly moves students who were working well below grade level into college-level concepts (imaginary and complex numbers, graph theory). Math Corps not only straddles the line between remediation and enrichment, but dissolves that distinction entirely.

Minimal social-scientific research on the Math Corps program has been conducted to date. Edwards et al (2001) emphasize the integration of social, emotional and educational factors as contributing to the success of the program. While this is certainly true, it is a fairly general account that could apply to any number of programs. One challenge encountered when conducting research on Math Corps is that it is impossible to control for the variety of factors that lead to improved outcomes. There exist little data that could pinpoint the degree to which Math Corps directly affects students' mathematical achievement, independent of socioeconomic status, parental involvement, or school quality. The goal of the present study, then, is not to demonstrate that Math Corps has a specific effect on mathematical outcomes that would not have occurred otherwise, but to illustrate, using ethnographic and linguistic data, how particular outcomes can relate to a cultural model.

Students in the program are not selected on the basis of grades, and thus run the gamut from extremely mathematically gifted students working at or above grade level, to students working perhaps four or even five grades below expectations. While many of the instructors are middle-school teachers in the Detroit public school system, the Math Corps curriculum and teaching philosophy are distinct from the DPS, and in several respects are set up in opposition to it. The result is that participants in Math Corps acquire a distinct mathematical culture – a set of practices, skills, concepts, and beliefs about mathematics. It is a community of practice (Lave and Wenger 1991; Wenger 1998) focused around mathematics, and has as explicit goals both the transmission of particular skills and also the creation of an enduring sense of community and social identity among members. Given this social integration and a high degree of consensus-driven governance at Math Corps, this study is also a contribution to what David Graeber (2004: 76) calls the “sociology of micro-utopias”, in which the functioning of small-scale consensus-based institutions is the focus of study.

Social and moral discourse at Math Corps is also distinct from that experienced by students outside the community. To give one very basic example, students and staff alike generally describe the program as a *family*, not as a *program* or *camp*. Math Corps distinguishes itself through frequent and repeated moral discourse that seeks to instill a set of key values such as kindness, compassion, courage, and integrity, and to back these up through action. This template for action is underspecified – there are few rules governing specific action – but structures both discourse and practice within the group. The structure of this discourse is thus of great interest insofar as it has the potential to shape participants’ schemata for moral action.

But lying above all these values is a meta-value --- greatness --- which plays a central role in shaping discourse and social practice. At Math Corps, *greatness* is frequently discussed and is openly asserted to be the most important concern of the group (as opposed to, say, mathematical achievement or personal comportment). The key insight regarding *greatness* at Math Corps is not, however, that it is frequently discussed, but that the way in which it is discussed differs radically from other American speech communities, and has a systematically different meaning in the other social groups of which its members are part. In this study, the cultural model of *greatness* is examined to relate the syntactic and lexical context of the term to the program’s broader socio-moral framework. Because building self-esteem is a key element of the program’s success, *greatness* is used at Math Corps in ways that are meant to improve students’ confidence and, ultimately, their educational outcomes.

3. Greatness in Math Corps assemblies

The corpus of texts considered here includes transcribed material from Math Corps morning assemblies recorded between 2009 and 2011, totaling 74,463 words, or approximately ten hours of spoken oration by four different Math Corps senior staff members.¹ Assemblies are complex events at the beginning of each day at Math Corps. They are designed to inspire and entertain participants and, most importantly, to build community solidarity. Assemblies range in length from fifteen to eighty minutes (median: 35:05), and are characterized by joke-telling, public recognition of student accomplishments, communication of essential information, ritualized call-and-response activities, and other performances. The present corpus was developed using only those portions of assemblies in which a single senior staff member was on stage, addressing the

entire assembly. Of the 71 assemblies I attended and recorded, 69 had portions characterized by this form of discourse.

Math Corps assemblies have much in common, discursively, with other forms of public address such as sermons, political addresses, or motivational speeches, and as such can be usefully compared to other forms of spoken American English. I compare the Math Corps assembly corpus to two other corpora of American English: the SUBTLEXus corpus of 51 million words and their frequencies derived from American television and film subtitles (Brysbaert and New 2009), and the COCA (Corpus of Contemporary American English) of 425 million words from American English between 1990-2011, and specifically the 90-million word subset of COCA representing spoken American English (Davies 2011a). Demonstrating significant differences not only in word frequencies but also collocates allows a more detailed comparison of the cultural model than would be possible through ethnography alone.

Within the assembly corpus, there were 210 unique instances of *greatness*, or 2820.129 words per million. In comparison, it occurs at a rate of 4.18 words per million in SUBTLEXus and 3.11 words per million in COCA. This is to say that *greatness* is used hundreds of times more frequently in assemblies at Math Corps than in general American English. No other word in the assembly corpus is used with such a higher degree of frequency than its rate of general use.

Each instance of *greatness* was treated using the keyword in context (KWIC) approach, and then coded in terms of basic conceptual relationships surrounding each token. Not all of these are metaphors in the strict sense; they are, however, all conceptual relationships or properties that recur frequently and that shape the way in which *greatness* is talked about and understood. I thus follow Quinn and Holland (1987) who similarly treat metaphorical and non-metaphorical relationships within cultural models using all-capitals notation. Eight relationships occurred at least ten times, and were thus identified as central to the cultural model (Figure 1); 71.0% (149 / 210) of all instances of the use of *greatness* in the corpus invoke at least one of these relationships. No other conceptual relationship occurred five times or more.

Conceptual Relationship	N	%²
GREATNESS IS VISIBLE	48	22.9%
GREATNESS IS FOUND/REALIZED	32	15.2%
GREATNESS IS INSIDE A PERSON	31	14.8%
GREATNESS IS UNIVERSAL	25	11.9%
GREATNESS IS DEMANDED	17	8.1%
GREATNESS IS A STRUGGLE	16	7.6%
GREATNESS IS BELIEVED	16	7.6%
GREATNESS IS A PATH	10	4.8%
Other / None	61	29.0%

Figure 1: Frequent conceptual relationships within the *greatness* cultural model expressed in the assembly corpus.

GREATNESS IS VISIBLE: This metaphor, which is the most common one used at Math Corps to describe greatness, is frequently expressed lexically as *see*, *show*, *make manifest*, or *shine*. Example: *I look for his greatness, he has that, he can be a beautiful person, is a beautiful person, but outwardly, it doesn't always show, believe me, it doesn't.*

GREATNESS IS FOUND/REALIZED: Lexically, this relationship is most often expressed using *find*, but sometimes as *seek* or *realize*. Example: *Because at that moment, he found his own greatness, cause at that moment he came to understand who he really was, as he looked at the choice that was presented to him.*

GREATNESS IS INSIDE A PERSON: This common metaphor, treating greatness as a resource or substance within a person, is of critical importance, as discussed below, even though it is not the most frequent. It is most often identifiable through the prepositions *in*, *within*, or *inside*. Example: *You got the ugly guy inside of you, and you got greatness inside of you.*

GREATNESS IS UNIVERSAL: Greatness is not a property of actions but of all individuals, not just some. It is readily identifiable lexically through collocation with the quantifiers *each*, *every*, or *all*. Example: *Each one of you has greatness in you.*

GREATNESS IS DEMANDED: Lexically this relationship is expressed through the verbal collocates *require*, *expect*, or *demand*. It operates in two ways: greatness is expected (by the staff) of the students, and also greatness (as a resource or property) makes demands or expectations on a person. Example: *The courage to succeed, that's something, cause I will tell you, there's a price to pay for greatness, cause once you reveal it, people expect it, and they expect it forever.*

GREATNESS IS BELIEVED: Because greatness is within a person and must be shown, it is necessary that staff express their belief in greatness, because it is not necessarily evident. Example: *Professor Kahn talked about our fundamental belief, being a belief of the greatness of each and every single one of you ...*

GREATNESS IS A STRUGGLE: Lexically this metaphor is expressed not only with collocates such as *struggle* and *fight* but more broadly, with modes of discourse that emphasize hard work or challenge. Example: *And greatness, because it's a fight, because you don't just summon it up any minute you want.*

GREATNESS IS A PATH: As a struggle, greatness is not simply any arbitrary conflict, but a struggle to follow a winding and treacherous path. The idiom 'the road to greatness' is commonly used, but not always. Example: *And that moment, he found his path, he found his greatness.*

Of the 210 instances of *greatness*, 42 (20%) involved two or more of the above relationships (Figure 2), demonstrating that this is an extremely rich set of coherent properties, each with their own entailments. So, for instance, in the sentence, "I will **demand** to **see** the greatness **inside** you that we **believe** is there," the speaker believes in the students' greatness, which is inside them, but which can be made visible, and then demands it.

# of Relationships	N	%
0	61	29.0%
1	107	51.0%
2	31	14.8%
3	10	4.8%
4	1	0.5%
Total	210	100%

Figure 2: Number of key conceptual relationships expressed around each instance of *greatness* in the assembly corpus.

These eight relationships interact with one another in complex ways, and apparent contradictions are often resolvable by reference to the linked aspects of the cultural model. So, for instance, GREATNESS IS INSIDE A PERSON does not contradict GREATNESS IS VISIBLE; rather, it sets out a course of action in which a person FINDS the greatness INSIDE them, and then SHOWS it to those who BELIEVE IN it and thus DEMAND it. That GREATNESS IS UNIVERSAL does not deny that GREATNESS IS A STRUGGLE; it is exactly because it must be FOUND INSIDE oneself along a PATH TO GREATNESS, that it is not always VISIBLE.

In all these relationships, *greatness* is only a property of human beings (and, because GREATNESS IS UNIVERSAL, of every human being). One can show one's greatness through action, but the action itself is not characterized by greatness. Math Corps, as an institution, is not characterized by greatness. Lexically this is demonstrated by the very frequent collocation of *greatness* with possessive personal pronouns (especially *your* but also *his*, *her*, and *our*); 51 of 210 tokens (24.3%) are immediately preceded by one of these four words (span of 1:0); in 12 additional examples it is intensified using *own* (e.g. *her own greatness*), and in 29 additional instances of the metaphor GREATNESS IS INSIDE A PERSON use a prepositional phrasing 'greatness [in/within/inside] [her/him/us/them]' instead of a possessive construction. Thus, 92/210 (43.8%) instances of *greatness* make specific and immediate reference to it being a property of individuals, and of course many more make indirect reference. None characterize *greatness* as a property of abstract entities, objects, or institutions.

Finally, while *greatness* can be expressed through skill, it is not definable with respect to domain. One can be great at mathematics, at basketball, or at music. Perhaps unusually, considering Math Corps' focus, greatness is not principally about greatness in mathematics. In fact, while greatness can relate to excellence in professional, academic or artistic achievement, it is more importantly linked to values. The highest expression of greatness is in using one's skill in ways that express the values of courage, integrity, kindness and compassion, such as helping one's peers with mathematics, or using music to inspire others to change the world.

From these corpus data, and the conceptual relationships that emerge from them, it is possible, then, to identify a cluster of features, and linkages between features, that comprise the cultural model for *greatness* at Math Corps. Taken as a constellation of interrelated features and entailments, *greatness* at Math Corps is a potent and frequent object of discourse that can be approached by speakers in several interrelated but distinct ways, allowing for a rich range of messages and stories to be told using this concept. At the same time, there are many ways in

which *greatness* is not discussed at Math Corps – for instance, it is never a property of non-human agents.

Having established how *greatness* is conceptualized at Math Corps, let us now turn to its conceptualization in English speech communities more broadly, both historically and in contemporary American English. The contrast between the use of *greatness* at Math Corps and its general English use will help illustrate the relevance of the concept within this community.

4. Greatness in historical and contemporary English

Despite its seeming simplicity, *greatness* is semantically complex and has had a variety of connotations throughout its history. Following the lexicon-entry analytical style of Raymond Williams (1976), a consideration of the historical semantics of the terms *great* and *greatness* will demonstrate a trajectory from the original physical reference to size to metaphorical senses of rank and ultimately to the sense of a generalized positive quality. This trajectory continues to shape the understanding of *greatness* at Math Corps.

In Old English, *great* meant roughly ‘coarse, composed of large particles’ (cf. *grit*), although that sense is contested among Anglo-Saxonists (OED). The reference to physical size, specifically stoutness or thickness, is also found in Old English, and *great* is thus cognate with German *Groß*. *Great* largely replaced the once-common *mickle* as a synonym for *big* by the seventeenth century. By the thirteenth century, references to a ‘great heart’ were common, extending the reference to size metaphorically to include ‘big or full of emotion’, although the emotion in question could be positive or negative (courage, sorrow, anger). Although this specific sense became obsolete by the eighteenth century, it parallels the sense described above at Math Corps, in which *greatness* is conceptualized as a quality contained within an individual. Also in Middle English, *great* began to be used to describe high social rank or station, a further extension of the reference to size to illustrate elevation within the social hierarchy of humans and, particularly, of God.

That ‘great = big’ and ‘great = good’ are still both active and easily conflated is illustrated by its humorous use in *The Simpsons* (episode 2F06 ‘Homer Bad Man’, which aired 11/27/1994), in which a group of protesters in front of the Simpson house chant:

Two! Four! Six! Eight!
Homer's crime was very great!
[pause]
"Great" meaning "large" or "immense",
We use it in the pejorative sense!
(snpp.net)

Still, *greatness* is rarely used today as a synonym of *size* or *extent*, and rarely refers to social rank specifically, but generally entails a positive quality of indeterminate sort, just as *great* has become, practically, an intensive form of *good*. The positive yet indeterminate nature of these senses allow them to be used very flexibly to refer to almost anything – a person can be great (of mind, of spirit, of character, of accomplishment), an action taken by an individual can be great, and, of course, ‘Great!’ serves simply as a positive affirmation.

The connotations of *greatness* today were most famously employed in *Twelfth Night* (II.V): “In my stars I am about thee, but be not afraid of greatness: Some are born great, some achieve greatness, and some have greatness thrust upon them.” The importance of this key phrase has led to this well-known line being often quoted and re-purposed. So, for instance, it is still very common to talk about someone *achieving greatness* or *having greatness thrust upon* someone.

The word *greatness* is relatively infrequent in contemporary American English; in the SUBTLEXus corpus, there are 213 instances of this token (4.18 WPM), while in COCA there are 1973 instances across all genres and media, ranging from a low of 2.98 WPM in fiction to 5.62 WPM in magazines, with 280 instances (3.11 WPM) in spoken contemporary American English. *Greatness* has become significantly less frequent in English over the past two centuries, and is today about one-tenth as common as it was in the early nineteenth century. Data from the Corpus of Historical American English (COHA) show a decline, from 44.02 words per million in 1810-1819 to 4.40 words per million in 2000-2009 (Davies 2011b). There is no obvious explanation for this decline, which is evident to a lesser extent for *great*. The result (though not the explanation) is that *greatness*, for many hearers, has a somewhat old-fashioned connotation in contemporary use. It is possible, though not demonstrated, that in specific discourse genres (e.g., sports commentary or religious discourse) *greatness* remains at a higher level of frequency than its current level of general use.

To examine the differences between the use of *greatness* at Math Corps and its use in spoken American English more generally, an investigation of the collocates of *greatness* in both contexts was undertaken, specifically focusing on the verbs that are used to describe the concept. As Wikberg (2008) points out, it is often through examining verbs that the metaphorical force of nouns and nominal phrases can be evaluated. Of the 1973 instances of *greatness* in the full COCA corpus, eight verbs collocate with *greatness* in more than 10 instances, within a 4:4 span (words to the left or right of the token), as shown in Figure 3:

Token	N-COCA	%	N-MC	%
greatness	1973	100%	210	100%
<i>achieve*</i>	65	3.29%	0	0
<i>destined</i>	39	1.98%	1	0.48%
<i>measure*</i>	22	1.12%	0	0
<i>lies</i>	20	1.01%	0	0
<i>thrust</i>	16	0.81%	0	0
<i>define*</i>	13	0.66%	0	0
<i>aspire*</i>	11	0.56%	0	0
<i>restore*</i>	11	0.56%	0	0
Total	197	9.98%	1	0.48%

Figure 3: Collocations of *greatness* with specific verbs in Corpus of Contemporary American English (4:4 span). Items marked with an asterisk indicate that any word-form of the lemma may be involved, while those without an asterisk indicate only that specific word-form.

Thus, nearly one in ten overall instances of *greatness* collocate with one of the above eight verbs in general English usage. However, at Math Corps, only one instance of *greatness* from the assembly corpus collocates with *destined* “and I see the greatness they are destined for,” and none with any of the other seven verbs ($1 / 210 = 0.48\%$).

The frequency of *achieve* and *thrust* can partly be explained through the use of those verbs in the famous quotation from *Twelfth Night* cited earlier. This is not to say that most of the instances are direct quotations; rather, these two verbs have become associated with *greatness* to the point that their use in general contexts has become commonplace. The phrase “destined for greatness”, in contrast to other uses of *greatness*, has increased greatly in frequency over the past two centuries, as shown in Figure 4:

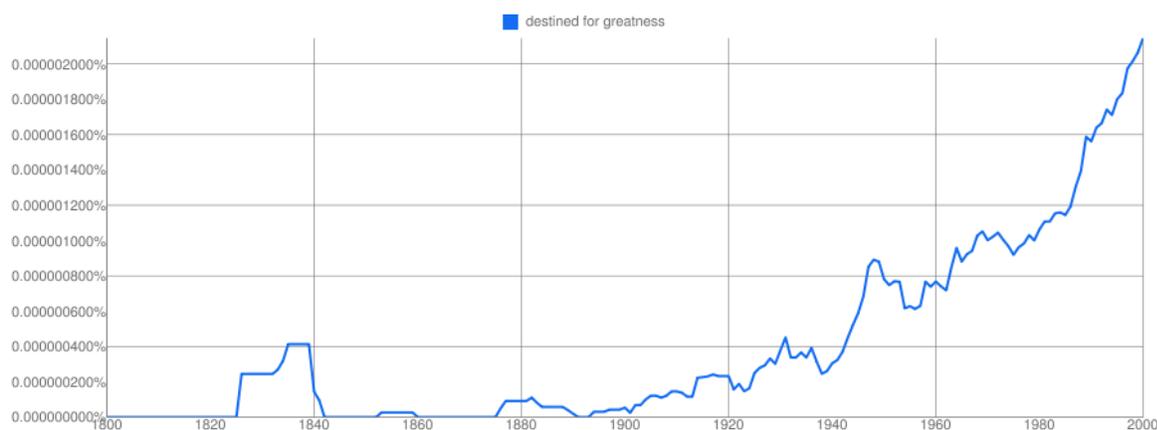


Figure 4: Increase in relative frequency of *destined for greatness*, 1800-2000. (Google Ngram Viewer)

Similarly, when we look at nouns, we see dramatic differences with discourse about *greatness* at Math Corps: the top three nominal collocates of *greatness* in COCA (within a 4:4 span) are *America* (53), *nation* (29), and *country* (28). In part, this is explainable by the forms of discourse towards which COCA is biased (e.g., news talk shows, magazine articles); we would hardly expect Math Corps staff to spend extensive time in assemblies praising America. In general American English, *greatness* is a property of achievements or of abstract entities more often than it is of people, whereas at Math Corps, *greatness* is always a property of individuals, never of groups, concepts, or other non-personal entities.

There are enormous differences in the way that *greatness* is used, both lexically and conceptually, at Math Corps and in general American English use. These can be explained, largely, in reference to the cultural model described above. If GREATNESS IS INSIDE A PERSON and GREATNESS IS UNIVERSAL, it is not something to be *achieved* or *thrust upon* someone, nor is there any need to *aspire* to greatness or to be *destined* for greatness. At Math Corps, greatness is an internal quality of a person that is found within the self, and then expressed (shown) through action. In general American English discourse, *greatness* can be a property of a nation or an accomplishment, but at Math Corps, it is the students themselves who possess greatness.

5. The family talks about greatness

While the Math Corps assembly corpus is comprised of discourse from only four staff members, they speak to an audience of hundreds each day. In turn, that audience of teenaged Detroit students talks about greatness frequently and meaningfully in private and interpersonal contexts. If it were otherwise – if it were simply a concept invoked in assembly but not integrated into the attitudes and discourse of the audience – then the value of the above analysis would be limited. However, greatness is a frequent subject raised by my consultants in interviews, often in response to questioning about the core values of the program. Not only do they use the word *greatness* frequently and without prompting, but they do so using the same set of conceptual relationships discussed above.

The following discussion took place between Monica Rodriguez, my assistant, and Paul³, an eighth-year Math Corps member who, at the time of the interview, was a college instructor (age 18):

MR: So, what are the values that Math Corps represents to you?

Paul: The values would be just the idea of like, greatness, looking at people through the eyes of greatness. Like, rather than always assuming the worst out of people, it does make a difference just assuming the best and then questioning why they may be messing up. And it helps, changes your perception of people.
(2011/07/11)

Not only is greatness clearly important to Paul, but the GREATNESS IS VISIBLE metaphor permeates his talk about greatness, which in turn shapes how he regards students and their occasional failings. Or, for instance, from another answer to the same question, asked by Monica of Jerome, an eighth-grade student (age 13) in his second year in the program:

MR: And what are the values that Math Corps represents to you?

Jerome: Well it, Math Corps is a big family, pretty much seems like one. If you know a lot of people they pretty much start to become a family, and they tell you that greatness is the key and I do believe that everyone has greatness in them.
(2011/07/19)

Here we see a different set of relationships within the model: GREATNESS IS UNIVERSAL and GREATNESS IS WITHIN A PERSON. One of the most powerful spontaneous uses of *greatness* occurred in the following discussion I had with Octavia, a seventh-grade student (age 12), in only her eleventh day of her first year of the program:

SC: Now, you know, Professor Kahn and Mr. Boehm and Pops and everybody in assembly, they tell like a lot of stories or a lot of things - say a lot of stuff that has like important messages or is really powerful, and I'm just wondering if there's something that you've heard from them that you thought was, like, especially powerful?

Octavia: Oh, when Professor Kahn was telling us about how we're all special and nobody is like... , and how there's like a certain path to greatness. You don't, like,

automatically go there. You know, take little steps and things. That really touched me. I felt really at home with that.
(2011/07/20)

Here we see that for Octavia, GREATNESS IS A PATH and GREATNESS IS A STRUGGLE, and that of all the things she had heard in assemblies, this was the most important and personally meaningful.

Of course, Math Corps students do not go about their lives talking about greatness on a constant basis in informal discourse, because they do not always have an interviewer asking them about the values or messages of the program. On the other hand, they do sometimes do so in very public ways. For instance, in November 2011, three months after the end of camp, a male TA made the following Twitter post to another male TA: “I ain't NEVER doing that...I'm going to be myself. He will recognize my greatness *math corps agreement*”.⁴

It is unsurprising that *greatness* is not invoked as frequently by middle-school students in daily talk as it is in formal assemblies characterized by moral discourse. What is surprising is that it is used spontaneously during interviews, using the same set of conceptual relationships as they hear in assemblies. Rather than simply parroting back phrases and words, though, students use these relationships as part of their own socio-moral reflections on success and failure.

6. Greatness in gesture and notation

Math Corps has a rich inventory of conventional and non-conventional gestures that form part of daily practice. Some of these (identified as ‘signals’) have become a well-known means by which group members index themselves as members, and by which other members of the Wayne State community identify the group. At Math Corps, gesture is used to facilitate silent communication in class, but more importantly, it serves as a vehicle promoting social solidarity, as a demonstration of mutual support for group members, and as an index of common identity. In a single five-hour program day, an average student will produce fifty or more such gestures.

There is a distinct, well-understood gesture at Math Corps relating to the concept of greatness, which I will call the *greatness gesture*, annotated as [G:grt]. One arm is placed in front of the body, pointing upward at an angle, then, in emulation of a line on a graph, is moved and pointed upwards and down in a succession of rises and dips, but with an overall upward trend. It stands in contrast to another gesture, [G:/] which begins the same way but in which the arm proceeds in a straight line (normally while the speaker makes the sound effect of a rocket).

Professor Kahn, the founder and executive director of the program, describes it as follows:

Greatness, for those of you who have been here know this, greatness is not this, the road to greatness is not this [G: /] ffft; the road to greatness is this [G:grt]. Always down, always down, always down, but generally, the trend is always up. Everybody getting that? There's a mathematical description for that that I don't, or can't go into now, cause it's actually complicated, well, it's calculus, it's stuff like that, max-min points and inflection points and stuff like that. But I will tell

you that we are all human, and because we're all human, we're all failures.
(2010/07/09)

In the above fragment, the repetition 'always down, always down, always down' makes sense only in the context of the gesture; each repetition of the phrase coincides with the downward stroke of the greatness gesture, while the corresponding movement upwards on the 'graph' is remarked upon at the end of the utterance. The literature on the integration of gesture and language (co-speech gesture) in constructing conceptual metaphors focuses on domains where gesture is obviously relevant to cognition, such as spatial orientation. Parrill and Sweetser (2004) discuss the role of co-speech gesture in their examination of non-conventional representations of metaphors involving motion in arguing for a model of *conceptual integration* that allows us to be explicit about the relationship between gesture and discourse.

The greatness gesture, in contrast, is a non-spatial metaphorical gesture. It evokes several of the key lexical relationships discussed above, and frequently occurs in the same discursive contexts. The most obvious of these is that GREATNESS IS A PATH; the gesture is, in fact, known to Prof. Kahn as the 'road to greatness'. It also entails that GREATNESS IS AN ENTITY INSIDE A PERSON – it must be measurable, in terms of the much more general MORE IS UP. Finally, it reinforces that GREATNESS IS A STRUGGLE; the contrast between the greatness gesture and its straight-line counterpart illustrates the cultural model representationally.

The greatness gesture is not understood as a Math Corps 'signal', emically; in my interviews, students and staff were asked to produce a free list, without priming, of all the signals they knew, and no one ever produced the greatness gesture as part of this set. Yet, although it stands outside the narrow category of the signals, it is a well-understood gesture within the family, and I have found no one who is completely unfamiliar with it. In one notable instance, I observed a seventh-grade student, in only his eighth day in the program, spontaneously respond to some assembly discourse about another student's mathematical achievement by using the greatness gesture, before the word 'greatness' was ever spoken.

The greatness gesture also forms part of the linguistic landscape of Math Corps – the visual language to which members of the speech community are regularly exposed. In State Hall and other areas where Math Corps activities take place, a wide range of artistic representations adorn hallways, classrooms, and doors.⁵ Figure 5 shows one such representation, which was on the walls throughout my three years of study:

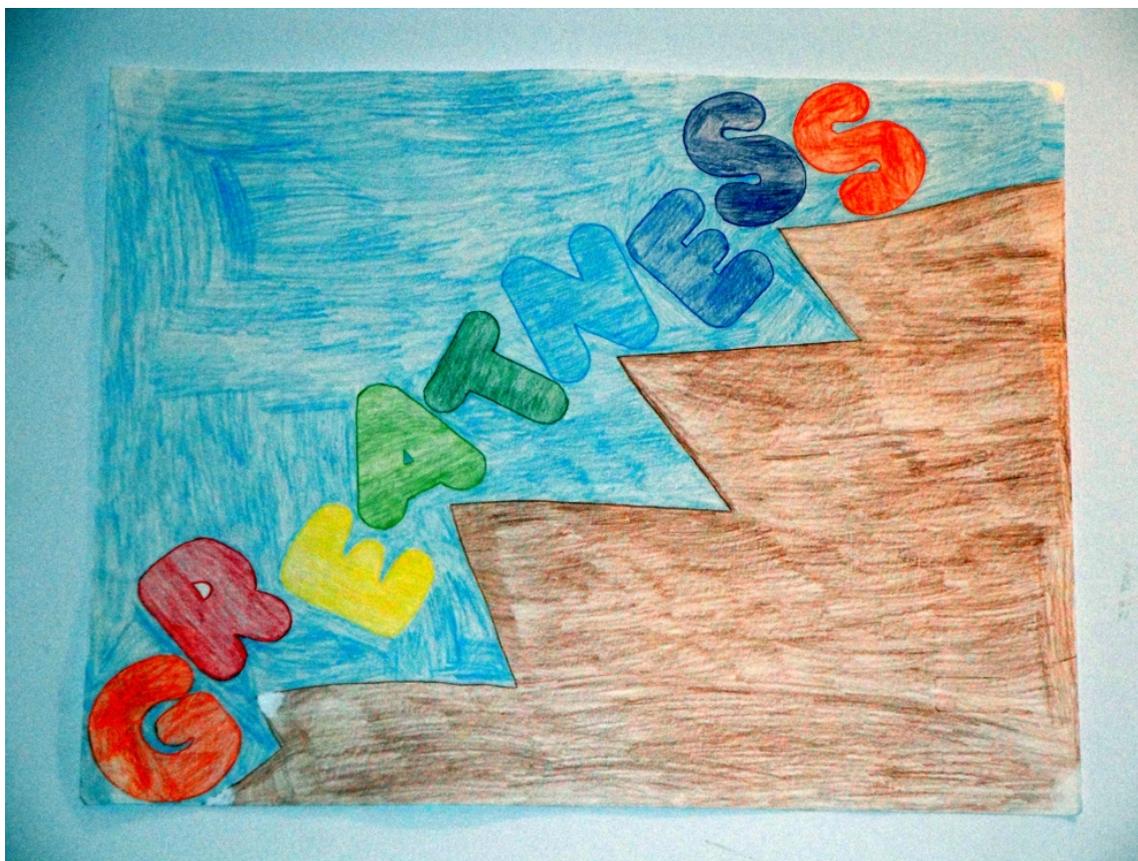


Figure 5: A visual representation of the cultural model for *greatness*. (Photo by Monica Rodriguez)

This is a visual representation, located prominently in a well-travelled hallway, of the ROAD TO GREATNESS, the STRUGGLE with its ups and downs. This cultural model at Math Corps is thus reinforced by its use in three different modalities: verbal, gestural, and graphic. Ortman (2000) uses similar evidence of a textile metaphor for containers in prehistoric Puebloan societies to demonstrate ways in which conceptual metaphors can be put into a visual-graphic modality, from which they can then be inferred by archaeologists in the absence of linguistic evidence. At Math Corps, where of course we have abundant linguistic evidence, we can confirm the interlinkage of graphic aspects of conceptual metaphor with gestural and linguistic ones into a multi-modal structure.

The greatness gesture is, on the one hand, a visual-gestural representation of a mathematical object (a graph) and, on the other hand, a representation of a core principle of the Math Corps, namely that greatness is achieved through struggle, that it comes with ups and downs. It serves to inoculate students against despair in the recognition that they will never achieve perfection and that they will, from time to time, fail to live up to their greatness through their actions. That it occurs in multiple modalities not only increases the frequency with which students encounter it, but gives them visual and embodied ways of understanding the metaphor to complement the linguistic ones described above.

7. Greatness as bigness

I suggest that the conceptualization of *greatness* prevalent at Math Corps relates to historically important but now dormant aspects of the word in English. In particular, the cultural model reinforces the original, non-metaphorical sense of *great* as *big*. At Math Corps, the road to greatness is not just any path; it is not, for instance, directly parallel to the LIFE AS A JOURNEY as explicated in detail by Lakoff and Johnson (1980). It is specifically that the road to greatness is an uphill climb – that it is a struggle measurable by an increase in a positive quality. It thus recapitulates the conceptual linkage between GREAT IS BIG and GREAT IS GOOD.

Because greatness, at Math Corps, is not defined in terms of a specific domain of activity (i.e. it can be shown through social, mathematical, artistic, or other endeavors), it cannot, under this conceptualization, be measured in terms of any specific external achievement. Yet it must be measurable in a general sense, as the greatness gesture and graphic notation demonstrate. Greatness is thus a ‘bigness’, a potential or tendency to take actions that show that greatness. Similarly to the way that emotions are understood metaphorically as substances and the body as their containers, greatness, though a potential for success rather than a specific emotional state, can be felt as a (hopefully growing) state within oneself (Kövecses 2000, 2002).

While ‘great’ = ‘good’ is the prevalent sense of *great* (and *greatness*) in contemporary American English, at least at Math Corps, it retains a strong association with the original ‘great’ = ‘big’. To become great is not simply to do great (good) things; it is to express more and more of a quantity of a resource (greatness) that is conceptualized as existing within a person. We can thus see that, despite the semantic cleavage between the two senses of ‘great’ and ‘greatness’, there exists the possibility for earlier and now-archaic senses to be expressed when supported by discourse in a specific genre and context.

I do not regard it likely that this conceptualization of greatness represents a retention of earlier associations, an archaism that had lain dormant for centuries. The thirteenth-century notion of a ‘great heart’ being full of emotion evokes the metaphor that the body is a container, but does not do so in a way that sees greatness as a substance. Once Math Corps had adopted *greatness* as a specific, delineated cultural model, the dual meaning became available for metaphorical and conceptual use.

8. Having greatness versus being great

While cultural models are not exceedingly challenging to elicit and describe, it is challenging to show that they matter. For the cultural model of *greatness* at Math Corps to be useful, it needs not only to be a pattern of beliefs and attitudes; it needs to be consonant with the situations in which participants find themselves and provide a template for action in academic, social, and moral situations. One of the more interesting such attempts is White’s (1987) analysis of proverbs as personal problem-solving tools in American English. White analyzed how American informants talked about and thought about proverbs that are offered in problematic situations, such as ‘Where there’s a will there’s a way’. By showing how proverbs appeal to common-sense cultural models of experience inferentially, rather than explicitly, he demonstrated that proverbs provide ways to respond usefully and flexibly to different sorts of situations.

Like the set of proverbs analyzed by White, the cultural model for *greatness* at Math Corps is used to reflect on problems and solve them. How, then, do we identify how and when the cultural model for *greatness* at Math Corps matters? I was troubled by this problem for some time, and eventually turned back to language in use to resolve it. I was struck by the fact that, despite the very high frequency of *greatness*, other word-forms such as *great* are not particularly common, as seen in Figure 6.

	N (Math Corps)	WPM (Math Corps)	N (SUBTLEXus)	WPM (SUBTLEXus)	Ratio
great	93	1248.94	41864	820.86	1.52
greatness	210	2820.19	213	4.18	674.69
$\chi^2=14341.304$, $df = 1$, $p < 0.0001$					

Figure 6: *Great* vs. *greatness* at Math Corps and in American English

In the SUBTLEXus corpus of 51 million words, *great* occurs at a frequency of 820.86 words per million while *greatness* is only at 4.18 words per million; in contrast, in the Math Corps assembly data, *greatness* (2820.19 WPM) is over twice as frequent as *great* (1248.94 WPM). Put another way, at Math Corps, *greatness* occurs at a rate nearly 700 times greater than expected in spoken American English, whereas *great* occurs only 1.5 times as frequently as expected.

The relative infrequency of *great* relative to *greatness* is the key to understanding the conceptual framework of the messages conveyed in assembly. Why should this be the case? Why do Math Corps staff very frequently tell students they have greatness inside them, but only rarely that they are great?

The answer to this puzzle, I believe, helps illustrate the importance of conceptual metaphor in constraining cognition and behavior. For staff to tell students that they are great, which occurs only rarely, is momentarily gratifying for a student to hear. Such statements, however, do not provide any means of analyzing and understanding their experiences in the classroom, and more broadly in their social life. Inevitably a student will not be great, at some point, and then there is a very real risk that the student will conclude that he/she is not great, in general.

In contrast, “You have greatness inside you”, coupled with the conceptually rich greatness gesture, allows a student to interpret a momentary lapse or failure as part of a generally upward-trending but not inevitable process, rather than as a blemish on themselves. If greatness is a substance or entity within a person, the goal should be to FIND and SHOW it, and because it IS A STRUGGLE, failures are inevitable. Greatness is a UNIVERSAL resource that IS INSIDE A PERSON, but can never be achieved permanently. Moreover, because greatness is underspecified referentially as to domain, students can apply the cultural model to academic or non-academic activities as required.

There is a parallel here with the research on motivation, praise, and the effects of different sorts of discourse on children’s learning and attitudes towards success and failure (Dweck 1986; Mueller and Dweck 1998). The structure of micro-scale discourse events can have a powerful

effect on these outcomes (Cimpian et al. 2007). This body of literature shows, for instance, that attributing student successes to their innate abilities is potentially counterproductive in that it does not provide resources to deal with challenging tasks or failures. In contrast, attributing successes to effort and practice instead motivates students to further positive action. Although the Math Corps staff was not aware of this literature in developing their discourse about *greatness*, they readily agreed that it reflected their approach.

The structure of the cultural model for *greatness* lends itself to specific praise of the processes underlying both mathematical and social achievement, including the inevitability of failure and the need for struggle. By conceptualizing greatness as a resource to be found inside oneself, Math Corps staff encourage a positive, mindful, and reflective attitude towards the sorts of activities that occur in the program and beyond. This cultural model thus organizes the experience of students, helping to explain both the inevitable successes and failures that come with acquiring mathematical and social competency.

9. Conclusion

Math Corps is a program that operates most actively for only six weeks a year, that involves only a few dozen staff, and that has existed for only around twenty years. It is striking that it should have such a well-developed and distinct cultural model for *greatness*, and that it should so rapidly be transmitted to students. This model was not borrowed from any specific source but emerged over the past two decades and has become self-reinforcing as students graduate and become staff themselves. It is reflected in the transmission of patterns of talk from staff to students, and is reinforced both through commonly understood gesture and through graphic notation. Studies of metaphor and concepts that focus on localized groups and institutions provide new opportunities for scholars who work on discourse and metaphor have an opportunity to reflect on the formation and transmission of patterns of talk.

Students coming into Math Corps are painfully aware that they attend schools in one of the worst school districts in the country, in a city whose residents are unfairly portrayed in the media as unruly, undisciplined, and perennially unable to control their behavior. This is a considerable challenge for any summer program to surmount, and I certainly do not claim that a single cultural model, alone, can radically change educational outcomes. Yet nearly 90% of Math Corps graduates attend college, a level of attainment that cannot be matched by any sample of Detroit Public School students one could select, regardless of family situation or socioeconomic status. Without claiming that the cultural model for *greatness* used at Math Corps can be demonstrated to cause the high levels of achievement observed, it clearly provides a framework for discourse that students actually use in conceptualizing their successes and failures.

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Notes

¹ Total word counts: 2009: 24,558 words; 2010: 27,165 words; 2011: 20,362 words. All annotations were removed from the full transcriptions prior to the lexical analysis undertaken here, to prevent incorrect word counts and frequencies. The data used for this analysis, as well as the keyword-in-context (KWIC) data for *greatness* used below, are available upon request from the author.

² The totals are higher than 100% because many utterances expressed two or more conceptual relationships.

³ All named students have been given pseudonyms. Because the program is highly visible and senior staff have substantial public and media profiles, senior staff are not pseudonymized, with their permission.

⁴ 'Math Corps Agreement' indicates a conventionalized gesture used by members of the program, part of a complex system of signals that both communicate information and mark identity in the group (see below).

⁵ A photographic corpus was compiled in August 2011, consisting of 234 distinct posters, photos, and other such objects placed by Math Corps staff and students.