

Towards a Unified Concept Theory: Pattern Similarities Between the  
Etymology of the Term *Concept*, Student Definitions of the Term *Concept* and  
Those Pattern Relationships to Coherence, Fragmentation and Meme Theories

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## FACULTY APPROVAL

Towards a Unified Concept Theory: Pattern Similarities Between the  
Etymology of the Term Concept, Student Definitions of the Term Concept and  
Those Pattern Relationships to Coherence, Fragmentation and Meme Theories

Approved for the Faculty

\_\_\_\_\_, Faculty Advisor

## ABSTRACT

The etymology of the term *concept* was researched and compared with the origins of coherence theory (Kuhn) and fragmentation theory (Toulmin) which each utilized different meanings for the term *concept*; as a static noun (coherence theory) and as an active verb (fragmentation theory). These divergent uses of the term were traced historically and linked to changes in philosophy and language. A possible cause for the different meanings of the term *concept*, the change in meaning over time, the divergent theories of coherence and fragmentation was meme theory. If memes were an underlying principle of both coherence and fragmentation theories, it was possible that a unified concept theory could be developed.

Student responses, to a question asking for their definition of the term *concept*, patterned the etymology of the term and their definitions could be divided into either coherence theory or fragmentation theory perspectives, based upon whether the term was defined as a verb or as a noun. These preliminary results, which could not be generalized to a larger population, suggested that further studies, which tested for the existence of memes, and which related term definitions to philosophies and term usage as verbs or nouns, could lead towards a unified concept theory.

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## CHAPTER 1

### Introduction

#### Background for the Project

While some of the elements discussed here were included in the project, the intent of this background was to set context for ongoing work. This project was neither an isolated event nor a culminating event. It represented the author's continued effort to wrestle concepts and relate to the research and literature of others. This project was intended to be part of a larger study on conceptual change and to provide a platform from which the author could base future research upon.

For several years, the author has had an ongoing discussion with his colleague and mentor, a well-respected senior scientist. The discussion involved whether or not students actually learned scientific concepts taught in university science courses. It led to questions about the students' responsibilities and an instructor's role if those concepts were not learned. It raised questions as to whether concepts were some "thing" learned or a process of thinking.

If students discussed concepts, solved problems, wrote papers and passed exams, yet still did not learn those concepts, then what could be done? What evidence existed for those concerns? Who was responsible if concepts were not learned? Why did it seem, as each year passed by, fewer students comprehended the subjects being taught?

Implications that students were not learning scientific concepts came from observations in upper division courses and during research internships. Sometimes, students could not apply a concept to a new problem, or when questioned, stated a concept in a manner which was scientifically unacceptable. At other times, students offered explanations for a problem without relating them to any scientific concept. In another instance, a student could not explain the meaning of a concept, when asked by a former instructor. Those were concepts which had been taught, tested and over which students had successfully passed examinations during prior semesters.

Since problems were observed with upper division science majors, who already had taken 20-40 semester hours of science courses, further questions arose. If upper division science majors did not understand some scientific concepts, what did that imply about non-majors, such as pre-service elementary school teachers? Historically, at Heritage University, non-majors were only required to take eight semester hours of introductory science courses to graduate. In the case of pre-service elementary teachers, they were expected to teach science concepts to students (up to eighth grade sometimes), concepts which they might not have learned themselves.

What effect did prior learning have upon university students' ability to learn scientific concepts? The author thought about factors which could impede students' learning of scientific concepts. He queried his colleague whether a

limited or imprecise vocabulary might explain why students failed to learn concepts. His colleague suggested that vocabulary was only one factor and proposed poor memory retention and lack of persistence as additional factors to consider. Were those the primary factors, or were other factors more important?

What students had already learned, from childhood throughout their education, was discussed. How much needed to be unlearned? The magnitude of influence from this prior learning raised more questions. Cartoons, video games, movies, popular myths and fiction were discussed as ideas and images conflicting with scientific observations of the natural world, yet the level at which students distinguished between, or construed those ideas together was unknown. The ability of their elementary school teachers, parents, secondary teachers and community to help them distinguish scientific concepts from all the other ideas was also questioned. What ideas were being brought to the university classroom that could they be built upon? Did any need to be removed? How could instructors know what happened to prior ideas after students were taught new concepts? Would the students discard their old ideas, would they reject the new concepts and hold to their original ideas or would they formulate hybrid ideas and concepts?

Philosophies, cultures, language, politics and religions were discussed as influences which sometimes led people towards polarized positions, to a mistrust of scientific thought and a misunderstanding of scientific terminology. The level

of those effects was unknown. This led to debate about whether knowledge was some “thing” constructed, discovered, or of itself insufficient for understanding concepts. More debates, contrasting student-oriented inquiry with instructor-centered teaching, argued processes in learning concepts rather than concepts as some “thing” to be learned. The list of possible student factors which impeded concept learning grew; how to address those perceived impediments grew uncertain.

The instructor’s role in student learning of concepts was debated. Problems in using examinations as indicators of a student’s future ability to apply concepts raised questions on how best to determine student learning. Examinations essentially provided an indication of the student’s ability at a point in time, within the parameters of the examination. When a problem or situation differed from that which was taught and tested, would the student be able to solve it? Did laboratory experiences improve a student’s ability to learn concepts or did the experiences merely provide skills practice? Was knowledge about the students’ culture, language, religion and politics required to teach them scientific concepts or could/should concepts have been taught without any such emphasis? At what point did subjective factors minimize objectivity and science become unscientific?

How unacceptable were student misconceptions? Did the instructor need to teach scientifically acceptable concepts, repeatedly, until students discarded

their misconceptions? What influenced students to discard their misconceptions? Where did they come from and why did there seem to be so many?

These questions influenced the author to research peer-reviewed literature for topics related to conceptual change. An early reading of part of that body of literature led the author to conduct qualitative studies designed to elicit student misconceptions and then try to convince students to abandon them. The elicited misconceptions surprised the author – in range, unpredictability, incomprehensibility and persistence. In the classroom, once the misconceptions were elicited, scientifically acceptable concepts seemed harder to teach to students, while the elicited misconceptions appeared to strengthen. Students preferred to adopt the misconceptions of their peers over taught concepts. Test scores plummeted. The research work began and halted several times, as the author struggled to comprehend the results. Student self-evaluations soared, as did course evaluations. Students responded well to the participatory process and thought they had learned much; the author thought the opposite.

In order to continue his research, to contribute anything useful to the discussion on student learning of scientific concepts, or any concepts, the author determined that additional reading of peer-reviewed articles, related to conceptual change, was necessary. It was hoped that after reading the works of more researchers, the author might be able to re-examine his accumulated data and analyze it from another perspective.

The author's doctoral dissertation advisor, at the University of Washington, provided him with a key review article, entitled "A history of conceptual change research, threads and fault lines" by Andrea diSessa (diSessa, 2005). This article contrasted two major conceptual change theories within the discipline of education—coherence theory and fragmentation theory—and traced them back to the opposing views of Thomas Kuhn (1962) and Stephen Toulmin (1972). The author wondered if answers to any of the questions he had been discussing for years with his mentor might be answered by reviewing the works of these two theorists and their successors.

From a study of various educational researchers' beliefs about concepts, and how those beliefs influenced their research, the author hoped to comprehend increasingly divergent views among conceptual change researchers. The study was to focus on why the views were diverging, and ask if they could they be unified together into a concept theory. If physicists could work for years towards a unified field theory, why couldn't educational researchers begin the search for a unified concept theory?

As the author began reading the works of educational researchers, he found uses of the term *concept* which appeared to support a view that *concepts* were like things, products or something created. Other researchers seemed to use the term for a process of thinking. Often, no definition for the term was provided. Why couldn't researchers agree on definition(s) for the term *concept*?

The author also found new terms used in place of the term *concept*. Why did some researchers use terms like *facets* (Minstrell, 1982, cited in diSessa, 2005) and *p-prims* (diSessa, 1983) as the lower part of a spectrum which progressively led through *nominal facts*, *narratives*, *mental models* until reaching the level of *coordination classes* to which *concepts* belonged (diSessa, 1996; diSessa & Wagner, 2005, cited in diSessa, 2005)? Why did other researchers debate that *concepts* were equal to, but different from *beliefs*, yet both were less than *intuitive theories* (Carey, 1986)? Why did some debate *modes of construal* as “weak theories” (Keil, 1994, cited in diSessa, 2005) or replace *theories* with *ontologies* (Chi, 1992, cited in diSessa, 2005)? Was there really a “fault line” between “theory-theory perspectives” and “knowledge in pieces” perspectives (diSessa, 2005)?

All of these questions could not be answered by one professor, posing as a full-time student, during a single-semester course. Nevertheless, the process of collecting the writings of others, along with personal thoughts, committing them to print, selecting one to focus upon, and asking students for their definitions, represented the author’s commitment to searching for at least one answer to one question among an endless array of questions—what was a concept?

### Statement of the Problem

The term *concept* has not been satisfactorily defined in educational literature. In the previous section, the author noted that some researchers

preferred to generate and define new terms rather than define the term *concept*. Others appeared to assign different meanings to the term *concept*. A major barrier to a unified concept theory has been the lack of commitment by educational researchers to align the term *concept* with what they perceive a *concept* to be. “The term *concept* is one that everybody uses and nobody explains—still less defines” (Toulmin, 1972, p. 8). Thirty five years later, “We have not progressed enough since Toulmin complained that no one ever says what a concept is.” (diSessa, 2005, p. 279).

### Purpose of the Project

The author attempted to provide a definition of the term *concept*. That definition was based upon research into the origins of the term, and how educational researchers used the term. Beyond a definition of the term *concept*, the author attempted to analyze two diverging perspectives (fragmentation theory and coherence theory) among educational researchers, to see if the terms from each perspective might fit into a unified concept theory. The author attempted to describe what that theory might be. Data from the author’s own work, some of which was intended to elicit student misconceptions, and some which simply asked students to define the term *concept*, were analyzed for any patterns which might support a unified concept theory. If such a theory could exist, then future research or debate, to support or refute the theory, was needed.



If questions were replicated in the reader's mind—and became part of memory—if they fueled the debate over *concepts* and promulgated more discussions among educators and natural scientists, then perhaps the questions presented in this project successfully asked fragmentation theorists to question where their fragments came from and whether or not they were once whole and coherence theorists to question why paradigms eventually fragment.

### Delimitations

Most of the literature for this project came from journal articles within the discipline of education. The project did not include literature from all other disciplines. The intent was to provide depth of study, within the discipline of education, rather than a generalized survey across disciplines. Therefore, any conclusions reached in the project were intended to apply primarily to education. If implications for other disciplines were found, it was fortuitous. A qualitative analysis of data was for purposes of preliminary theory testing only. It was neither an empirically designed study nor could conclusions be generalized to a larger population. The data analyzed came from questions asked of students enrolled in an introductory physical science course at Heritage University, during the spring semester of 2008.

### Assumptions

The author assumed that the majority of this paper's reviewers adhered to modern or post-modern constructivist philosophies, exemplified by Thomas

Kuhn's paradigms (Kuhn, 1962). It was also assumed that reviewers were familiar with Kuhn's work as the foundation for coherence theory. The minority view of fragmentation theory was assumed to be less well-known by reviewers as an alternative constructivist philosophy. While other theories in educational research may have existed, for purposes of this project, only fragmentation theory and coherence theory were considered.

It was assumed that reviewers may have known that the author was a natural scientist, but not that he also adhered to an old philosophy of mind-body dualism, described well enough in modern times by the writings of Carl Jung, and in times past by Socrates (as recorded by Plato). That philosophy urged people to remember the past, (Socratic shame; Jung's collective unconscious); it urged them to contemplate coherence when surrounded by fragments. That philosophical position or bias influenced the author to ask many questions, as a method of interacting with the thoughts of others and engaging them in dialogue; it influenced a review of literature beyond the five-year limit requirement.

The third person, past tense format of the project presumed a conclusion to a debate which had already been underway when the author began the project and was to have continued long past the writing of this project. Multiple tenses would have made writing less difficult, as the author worked within another *concept* of time. The author assumed that the debate between fragmentation theorists and coherence theorists was due, in part, to a commonly held concept of time as

unidirectional. A one-way time paradigm was assumed to have influenced the development of progressive, constructivist views of human existence and thought. It was assumed that reviewers were less likely to hold a concept of cyclical time, such as Native Americans and Eastern philosophers have described. These assumptions influenced the author's approach to the study and were stated as known biases.

Terms have had different meanings assigned to them by individuals and different groups of people. As cultures, beliefs, group association and languages have changed, communication among people has been difficult due to the same term having different meanings—especially if one group or individual expects that others will apply the same meaning to the term. This project attempted to focus on one of those terms—*concept*—with the assumption that an acceptable definition could improve communication among divergent theorists.

### Research Question

Was it possible to state a definition of the term *concept*, and if so, could it encompass the divergent terms used by educational researchers? Would it be sufficient to begin the process of integrating diverging theories into a unified concept theory?

### Significance of the Project

In physics, the quest for a unified field theory, which would relate the strong, weak, electromagnetic and gravitational forces together by another

underlying principle, has been pursued for many years. Newer theories, such as string theory (Kaku, 1994), originated out of the quest for a unified field theory. That theory has not yet been found. That has not deterred physicists from searching for it, nor has it deterred them from learning more about the physical universe during the process.

This project's significance relied upon the building of a platform for the development of a unified concept theory, and stimulation of educational researchers to consider that both coherence theories and fragmentation theories might have an underlying principle which unites those theories—to ask what that principle might be and to debate its existence. Even if only a definition of the term *concept* was stated effectively, it was significant in addressing the complaints of other educational researchers that the term *concept* was not defined.

#### Procedure

The author began an etymological study of the term *concept*, by utilizing several dictionaries and discussing those findings with language professors. Literature sources, representing coherence and fragmentation theories, primarily those cited in the diSessa article, (2005) were read for usage of the term *concept*. Particular attention was paid to the original works of Kuhn (1962) and Toulmin (1972), since coherence theory and fragmentation theory developed from each of these works, respectively. Both coherence theory and fragmentation theory were compared and contrasted with a less known theory of thought – memetics, which

the author had read about prior to the project. The intersection of these three theories of thought formed the basis for the proposal of a unified concept theory.

The author proposed what a unified concept theory might look like, and suggested the elements of coherence theory and fragmentation which might fit into such a theory. Data from students, obtained anonymously and with student permission, but without human subjects review board approval, was reviewed after the unified concept theory was proposed, to see if the data might fit the theory.

The author discussed results of the project and its relationship to ongoing discussion and debates related to conceptual change. The project was summarized and recommendation for future research was suggested.

#### Definition of terms

Since the etymology and change in definitions of the term *concept* was the major focus of this study, a redundant replication of those definitions, in this section, was not included.

#### Acronyms

No acronyms were used in this document.

## CHAPTER 2

### Review of Selected Literature

#### Introduction

In the first subset of selected literature, the etymology of the term *concept* and change in definitions, over time, was reviewed. Dictionary references and language professors were consulted to supplement the review. The term *concept*, as defined in educational literature, was also provided.

The second and third subsets of literature were based upon debates described by diSessa (2005), between the ideas of Kuhn (1962) and Toulmin (1972). Educational researchers who followed one of those two views became known as coherence theorists (Kuhn) or fragmentation theorists (Toulmin). The development of each view was reviewed in these respective subsets.

The fourth subset dealt with a small, relatively unknown, generally misunderstood and not readily accepted body of literature related to *memes*, “a neologism that combines hints of *memory*, *mimetic* and *gene* in one pithy package.” (Aunger, 2002, p. ). Questions about the credibility of the small body of literature and pertinence to the project were included in the discussion.

#### Etymology and Definitions of the Term *Concept*

The search term *definition of concept* yielded over nine million links at the Google website, in April of 2008. A careless researcher could have read the first

definition (figure 1), and ended their search. The author proceeded to a recognizable fifth link, an online version of the Merriam-Webster Dictionary.

[Sign in](#)

Google

en	definition of concept	Search	<a href="#">Advanced Search</a> <a href="#">Preferences</a>
----	-----------------------	--------	--

**Web Scholar** Results **1 - 10** of about **9,340,000** for **definition of concept**. (0.26 seconds)

### Web definitions for CONCEPT



The general idea behind a slogan, pitch, or campaign.  
[www.motto.com/glossary.html](http://www.motto.com/glossary.html) - [Definition in context](#)

### Scholarly articles for definition of concept



[Apparent y Irrelevant Decisions in the Relapse Process](#) - JENKINS-HALL - Cited by 10  
[The Decision Matrix](#) - JENKINS-HALL - Cited by 9

[Concept image and concept definition in mathematics with ...](#) - Tall - Cited by 295

**concept - definition of concept by the Free Online Dictionary ...**

**Definition of concept** in the Online Dictionary. Meaning of **concept**. What does **concept** mean? **concept** synonyms, **concept** antonyms. Information about **concept** in

...

[www.thefreedictionary.com/concept](http://www.thefreedictionary.com/concept) - 35k - [Cached](#) - [Similar pages](#)

**ReadingQuest Strategies | Concept of Definition Map**

A **concept of definition** map helps broaden their experience of new words. ... **Concept of Definition** maps consider words in light of three properties or ...

[www.readingquest.org/strat/cdmap.html](http://www.readingquest.org/strat/cdmap.html) - 7k - [Cached](#) - [Similar pages](#)


**concept - Definition from the Merriam-Webster Online Dictionary**

**Definition of concept** from the Merriam-Webster Online Dictionary with audio pronunciations, thesaurus, Word of the Day, and word games.

[www.merriam-webster.com/dictionary/concept](http://www.merriam-webster.com/dictionary/concept) - 24k - [Cached](#) - [Similar pages](#)

Figure 1. Google web page for search terms *definition of concept*.

Merriam-Webster Online had two definitions for the English term *concept*, as a noun and as an adjective (figure 2). The etymology indicated that the term

**<sup>1</sup>con·cept** 

Pronunciation:  
    \ˈkän-,sept\  
Function:  
    *noun*  
Etymology:  
    Latin *conceptum*, neuter of *conceptus*, past participle of *concipere* to conceive — more at [CONCEIVE](#)  
Date:  
    1556  
1 : something [conceived](#) in the mind : [THOUGHT](#), [NOTION](#) 2 : an abstract or generic idea generalized from particular instances  
**synonyms** see [IDEA](#)

**<sup>2</sup>concept**  
Function:  
    *adjective*  
Date:  
    1896  
1 : organized around a main idea or theme <a *concept* album> 2 : created to illustrate a concept <a *concept* car>

Figure 2. Merriam-Webster Online definitions for the term *concept*.



came from Latin *conceptum*-conceived-a neuter past participle of the Latin verb *concipere*- to conceive. A discussion with a Latin professor (Mary Alice Muellerleile, personal communication, April 4, 2008), revealed that the dictionary had provided an inaccurate translation. Conceive/conceived were not the most appropriate English words to describe those Latin terms. In Latin, *Concipo* was a present stem verb, translated directly *I-with-seize* or *I-with-take*. A clearer translation could have been *I seize together*. *Concipere* was an infinitive stem, *(to) seize together*. *Concepta*, *conceptus*, and *conceptum* were feminine, masculine and neuter past participles for *seized together*. Merriam-Webster Online provided no explanations for the use of conceive/conceived instead of seize/seized or take/took in the translation.

Why the Latin verbs and past participles became English nouns and adjectives was unknown. Latin *Conceptum* and *concipere* had become, in the English term *concept*, a thing, real or abstract (noun), or an attribute of a thing (adjective) rather than the actions and states of being the Latin words conveyed. Even in modern English, “conceived” was not the same as “something conceived.” No explanation for the change from the Latin verb to English noun was given in the Merriam-Webster Online dictionary.

Webster’s Revised Unabridged Dictionary (concept. n.d.) also attributed the etymology of the term *concept* to the aforementioned Latin terms, but provided an additional linkage of the term to the French past participle,

nominative *conciez*. *Conciez*, translated as *conceived* in current English, was once translated into English as the term *conceit* (concept, n.d.). For some time, *conceit* and *concept* were used similarly, in English, but their roots conveyed different meanings. They were not exactly equivalent. While the use of the term *conceit* for *concept* diminished, the term *concept* acquired the attributes of the French *conciez* (conceived) and lost the attributes of the Latin *conceptum* (seized together). The process, which allowed the meaning of one term to become the meaning of another term, was described by an English Professor as transference (Dr. Loren Schmidt, personal communication, April 11, 2008).

A dictionary of literary terms (*conceit*, n.d.) also describes the change in meaning of the term *conceit* after the transference of its original meaning to *concept*:

Before the beginning of the seventeenth century, the term *conceit* was a synonym for "thought" and roughly equivalent to "idea" or "concept." It gradually came to denote a fanciful idea or a particularly clever remark. In literary terms, the word denotes a fairly elaborate figure of speech.

Thus, the meaning of *conceit* and the meaning of *concept* had both changed.

No other dictionary explanations were found for the change in meaning of the English term *concept*, other than the references to different etymology and those provided by the Latin professor. While not explanatory, additional evidence

for gradual change in the English meaning of the term *concept* was found in the Oxford English Dictionary Online (concept, n.d.):

1566-7 PAINTER *Pal. Please*. I. 33 Being in this louing concept, hee extolled the prayse of his wife to one of his garde.

1571 GOLDING *Calvin on Ps. lxxiii*. 20 We forge fantastick toys in our own concepts.

1663 G. HARVEY *New Philos.* I. 66 Oviedo makes it a great difficulty to distinguish the concept of Peter and horse.

1837-8 Sir W. Hamilton *Logic* viii. (1859) I. 134 The concept *horse*...cannot, if it remain a concept, that is a universal attribution, be represented in imagination. *Ibid.* xv. (1866) I. 275 Concepts are merely the results, rendered permanent by language, of a previous process of comparison.

These quotes show that the Latin past participle gradually changed to *Being in this louing concept* to a noun in *Concepts are merely the results*, over a relatively short period of time. Evidence that the term *concept* was also part of Old English and how the English Forms waned in use was found in the Oxford English Dictionary Online (concept, n.d.):

1706 PHILLIPS (ed. Kersey), *Concept*, a set Form; a term used in Publick Acts.

1921 E. Sapir *Language* ii. 28 Ever since the breakdown of the English forms that set in about the time of the Norman Conquest, our language has been straining towards the creation of simple concept-words.

1923 J.S. Huxley *Ess. Biologist* i. 25 The attainment of the power of generalization—of reason, concept-formation, or what you will.

1938 *Mod. Lang. Rev.* Oct. 555 This concept-chasing is a consequence of the more or less arbitrary ‘periodization’ of literary history.

In the educational references reviewed, few of them defined the term *concept*. Two examples were provided in this section, one from coherence theorist Susan Carey, and another from fragmentation theorist Stephen Toulmin. Further uses of the term *concept*, in relation to other terms specific to either coherence theory or fragmentation theory, were provided in the respective literature review subsets.

Susan Carey (2000, p. 38) discussed concepts as entities having core and peripheral features. Carey used the modern definition of *concept* as a noun. She distinguished between what entities looked/sounded/felt like (perceptual) and what entities were (their core features):

The core of the concept includes its causally deepest properties, those properties that determine what kind of thing the entity is and its particular properties....Core properties, or essential properties, are often not perceptually available....If concepts’ cores include nonobservable causal

constructs, then concepts that have cores have a nonperceptual component...The attribution of causality goes beyond spatiotemporal analysis.

Carey also claimed that beliefs were relational entities; beliefs related two or more concepts together, changing beliefs was easy but changing the concepts which made up the beliefs was difficult (Carey, 1986, cited in diSessa, 2005, p. 274).

Stephen Toulmin (1972, p.11) asked two questions before he provided a definition of the term *concept* in a third question:

What is Man that he may understand the World? And what is the World that Man may understand it? In particular, so as to focus on the central element in human understanding, we must ask: What are the skills or traditions, the activities, procedures, or instruments of Man's intellectual life and imagination—in a word the *concepts*—through which that human understanding is achieved and expressed?

Toulmin used the term *concept* as a verb, rather than a noun, as Carey did.

### Coherence Theory

Andrea diSessa (2005, p.268) stated that for many, Thomas Kuhn “defines the enduring relevance of the history of science to studies of conceptual change broadly.” He then cited evidence of strong contemporary opposition to those views (Toulmin, 1972), later including some of his own articles (diSessa, 1996, diSessa and Wagner, 2005, cited in diSessa, 2005). Since diSessa supported the

opposing view, the author decided to review Kuhn's original works (1962) and those of a few of his successors, in this literature subset. Toulmin and diSessa were reviewed separately in the fragmentation theory literature subset.

Kuhn (1962) researched the history of science and described a dichotomy in which once accepted, but out-of-date beliefs either had to be described as myths or as incompatible theories which were "not in principle unscientific because they have been discarded" (Kuhn, p.3). Choosing the latter, Kuhn described a process of "normal science" in which scientists performed their work on the assumption they knew what the world was like (Kuhn, p.5) and only changed their view when "incommensurable ways of seeing the world" (Kuhn, p.4) and "anomalies that subvert the existing tradition of scientific practice" brought about "extraordinary episodes" and "scientific revolutions" (Kuhn, p. 6).

Kuhn (1962, p. 10) considered normal science to mean that a group of scientists based their research upon mutual acceptance of some past achievements, which was usually kept in textbooks. If achievements were significant enough to attract adherents away from another "competing mode of scientific activity" and if the achievement left enough problems for the adherents to address, a new "paradigm" was created (Kuhn, p. 10). Kuhn claimed this was necessary because the absence of a paradigm would make all possible pertinent facts to a developing science equally relevant (Kuhn, p. 15); a "body of belief" (Kuhn, p. 17) had to be present:

To be accepted as a paradigm, a theory must seem better than its competitors, but it need not, and in fact never does, explain all the facts with which it can be confronted.

Kuhn did not believe that concepts, laws and theories could be learned “in the abstract and by themselves” but rather through “professional initiation.” (Kuhn, 1962, pp. 46-47). Terms like *force* are not learned from definitions; meaning, if ever discovered, was said to have come from “observing and participating in the application of these concepts to problem-solution.” (Kuhn, p. 47). As long as the problems continued to be solved, the paradigm was not challenged.

In order for a new theory and subsequent paradigm to arise, a crisis had to occur (Kuhn, 1962, p. 77). This crisis was precipitated by a “pronounced failure in the normal problem-solving activity” (Kuhn, pp. 74-75). At this time, alternatives were studied; a scientific theory could only be rejected if an alternate candidate was available to take its place. Kuhn claimed that these paradigms were not just compared with nature, but with each other (Kuhn, p. 77).

Kuhn believed that a crisis-caused transition from one paradigm to another was not a cumulative process, but a reconstruction (Kuhn, 1962 p. 84). Goals, methods, and views all would have changed in the new paradigm; as if “picking up the other end of the stick” (Kuhn, p. 85). Kuhn compared this to gestalt (p. 85). New paradigms were said to have “redefined science” or even to have “old

problems relegated to another science or declared entirely ‘unscientific’” (Kuhn, p.102).

Kuhn claimed that while new paradigms borrowed vocabulary from old ones, they “seldom employ these borrowed elements in quite the traditional way” (Kuhn, 1962, p.148). Therefore, communication between different paradigms was only partial. Kuhn concluded that proponents of different paradigms “practice their trades in different worlds” (p. 149).

Wellman and Gelman (1992, p. 338) provided a link from the time of Kuhn to that of diSessa. The ‘threads’ of diSessa (diSessa, 2005) described the branching development of Kuhn’s (1962) coherence theory into paradigms of naïve theories (Carey, 1983, cited in diSessa, 2005), which compared the development of student ideas with Kuhn’s history of science, and theory theory (McCloskey, 1983, cited in diSessa, 2005), which claimed that students have theories analogous to scientists’ theories:

Common sense theories are nonscientists’ everyday understandings of certain bodies of information such as folk zoology or naïve astronomy. Various serious claims have been advanced: that human concepts are entrenched in larger naïve theories; that conceptual change and thus important aspects of cognitive development are akin to theory change in science; that cultural world views are instantiated in folk theories; and that



theories supplant similarity-based conceptions both in current scientific thinking and in the individual's own learning or development.

In 1976, Posner and Strike (1976, p. 683) published an article which described content sequencing principles as a set of concepts, which were “tools of thought.” Posner and Strike worked with other researchers to develop these tools into the 1982 rational model of Posner, Strike, Hewson and Gertzog, as described by diSessa (diSessa, 2005, p.271). This early work with rational models supported the coherence theory paradigm in that students and scientists alike “maintain current ideas unless there are good (rational) reasons to abandon them (diSessa, p. 271).

### Fragmentation Theory

Andrea diSessa (diSessa, 2005), described the field of research in conceptual change as consisting of “... multiple perspectives that combine many commonsense and theoretical ideas in kaleidoscopic fashion.” diSessa ascribed the beginnings of fragmentation theory to Toulmin's rejection of coherence theory. Toulmin (1972, p.35) distinguished thoughts from concepts; “Each of us thinks his own thoughts; our concepts we share with our fellow-men.” Toulmin viewed “thoughts and beliefs” as “personal and individual” while concepts were “communal and collective” (pp. 35-37) and compressed it into “... a single epigram: every concept is an intellectual micro-institution.” (p. 166). Toulmin went on to make a major point; he claimed that scientific disciplines were more

than individual concepts - or even sets of concepts - that concepts had a relationship to disciplines similarly as individuals did with societies.

Toulmin (1972, p. 98) claimed that Kuhn's work was based upon unanswered questions of an earlier researcher, R.G. Collingwood; the work was so similar "that a glossary can be established for translating between them" (p. 99). Toulmin disagreed with the relativistic implications in the theories of Collingwood and Kuhn. He (Toulmin, p.102) stated those implications as:

...a Newthinker and an Oldthinker have no common vocabulary for comparing the rational claims of their respective theoretical positions .... The merits of intellectual 'revolutions' cannot be discussed or justified in rational terms—since no common set of procedures for judging this rationality are acceptable, or even intelligible, to both sides of the dispute .... Only after the victorious new paradigm is securely enthroned in acknowledged power can the rule of rationality be restored .... New frameworks of fundamental theory cannot themselves be arrived at in a 'rational' or 'rule-following manner. Paradigms are sovereign; they make their own laws.

Toulmin argued against Kuhn for several pages (1972, pp. 98-130) accusing Kuhn of misusing words and changing definitions between the 1962 and 1970 editions of his book. He wrote that Kuhn's use of the term revolution was an exaggeration in that underlying continuities on a methodological level were

concealed by the intellectual discontinuities on a theoretical level (Toulmin, p. 105) and that the doctrine of paradigms originally had nothing to do with revolutionary paradigm-switches (p.106). Toulmin ( p.106) traced the origin of the term *paradigm* to the German term *paradeigma*, attributed to Georg Christoph Lichtenberg, who modified the Latin term *paradeigmata*, a standard related to fundamental patterns of explanation. He (Toulmin, p.106) summarized Lichtenberg's definition as "... we explain puzzling phenomena by relating them to some standard form of process, or paradigm, which we are prepared to accept for the moment as self-explanatory." Toulmin (p.107) claimed that, prior to Kuhn, the term *paradigm* was never used to imply that changes occurred "in an abrupt, discontinuous, or 'revolutionary' manner and that Kuhn's theory of scientific revolutions (later called coherence theory) must be separated from any theory of paradigms.

Toulmin (1972, pp. 128-130) claimed it was a mistake to assume that a natural science must be viewed as an entirely coherent logical system. He (Toulmin, p. 128) stated that "systematically related concepts and procedures" coexisted with others "which are logically independent of, and even at variance with, one another. He (Toulmin, p. 129) stated that it was also a mistake for sociologists to assume that "...society as a whole forms a single coherent and functional 'social system.'" His main point (Toulmin, p. 130) was that both

science and societal institutions were “...related more loosely than has recently been assumed.”

How an apprentice scientist grasped science concepts from a previous generation, was termed ‘enculturation’ (Toulmin, 1972, p. 159). This was a process by which explanatory skills were transferred to the next generation. The ‘thing’ learned was comprised of “intellectual techniques, procedures, skills, and methods of representation” for “giving explanations of events and phenomena within the scope of the science concerned” (Toulmin, p. 159).

In his conclusion, Toulmin (1972, p. 496) wrestled with empirical and relativistic views of science:

By allowing each separate culture and epoch to decide, by its own standards, what properly counts as ‘scientific understanding’ (or ‘technical efficiency’, or ‘justice’) we plunge ourselves back into relativism; once that is done, the very question, whether some new set of concepts promotes the fundamental goals of ‘scientific understanding properly so-called’, will be understood in quite different senses in different milieus, and answered in correspondingly independent ways. By imposing universal, abstract definitions of the ‘scientific; and the ‘legal’ from outside, we land ourselves equally in an arbitrary absolutism; once that is done, we are laying down *a priori* standards of rationality for anything we shall acknowledge as (say) ‘science’ or ‘law’ in advance of any

consideration of the actual diversity to be found in those enterprises ....

From what source do they derive their supposedly universal authority?

Toulmin desired to find a middle ground between absolutist and relativistic extremes (Toulmin, 1972, p.497) and he urged people not to substitute formal dialectic for fundamental substantive questions. Neither formal definitions nor analytical dialectic could achieve the “impartial rational standpoint” (Toulmin, p. 500) he advocated, which included accumulated experiences of “...all cultures and historical periods.” Toulmin (p. 503) stated that “rationality then consists in the fundamental obligation to continue reappraising our strategies in the light of fresh experience.”

diSessa (2005, p.273) stated that he and Minstrell (Minstrell, 1982, cited in diSessa, 2005) supported Toulmin’s critique of coherence theory and were the early advocates of fragmentation theory, sometimes known as knowledge in pieces. In their theories, “facets” (Hunt and Minstrell, 1994, cited in diSessa, 2005, p.273) which were “elemental and instructionally relevant ideas students have upon entering instruction” and their equivalent “P-prims” (diSessa, 1983, cited in diSessa, 2005, p.274), “explanatorily primitive elements” need “reweaving into a different, stronger, and more normative conceptual fabric.” (diSessa, 2005, p. 273).

Modern fragmentation theorists usually developed their own terms for their constructs, and provided their own models and definitions rather than using

existing terms such as *concept*, and *theory* (diSessa, 2005, p. 275), yet the term *concept* still appeared in many of their statements. Some of the other terms and their relationships were listed in the Background for the Project section of this paper. Central to fragmentation theory was the idea that most learners did not have strong, coherent theories, naïve or otherwise; their knowledge was not yet put together in a manner which would result in “distinct knowledge in different circumstances .... ensuring that the concept works in functionally the same way in different contexts.” (diSessa, p. 276). In this instance, diSessa used the term *concept* as a ‘coordination class,’ defined as “an explicit model of a certain kind of concept” (diSessa, p. 275). He later stated (diSessa, p. 277) “...few explicit models of coherence exist” as an argument favoring fragmentation theory over coherence theory, but tempered the statement with “No one thinks children are completely unsystematic in their thinking about domains...” (diSessa, p. 278). Rather, he claimed that systematicity (coherence) was the emergent result of knowledge in pieces theory (diSessa, p. 278).

### Memes

In *The Electric Meme*, Auger (2002, p. 3) proposed that memes are cultural replicators, a causal force underlying the communication of information, with an evolutionary process that has occurred along with genetic evolution. He questioned whether or not socially transmitted information, central to every culture, when it was transmitted, was also replicated. Much of the debate about

memes revolved about what they were, because their existence had yet to be demonstrated (Aunger, p. 21). Aunger based his work upon the earlier works of Dawkins (1976) and Blackmore (1999).

Culture, according to Aunger (2002, p. 29) was predominantly viewed as “a cohesive and coherent set of mental representations that is reproduced relatively intact through the enculturation of subsequent generations.” This represented “... a collection of ideas, beliefs, and values that can be abstracted from individuals and considered as a pool of information at the population level.” Aunger argued that cultural snapshots should be traced over time to define “a cultural tradition or lineage.

Aunger (2002, p. 325) proposed that memes were the electric part of the brain; “If electricity is a stream of electrons—small atomic particles moving quickly through a channel—then perhaps memes are small conceptual elements transmitted through a particular channel, a linked chain of neurons.” Genetic research had shown genes to be responsible for long term memory; memes, if they existed, had to work very quickly to replicate on a rapidly changing substrate (Aunger, p. 325). Rather than being the electrical nodes themselves, he proposed that memes represented the electrical state of a node within the neuronal network, which controlled the “electrochemical propensity to fire an action potential (or spike) at other neurons in the brain” (Aunger, p.325).

Aunger (2002 p. 326) presented an argument for the replication of electrical states (or patterns of electrical states among a group of neurons) to other parts of a brain, creating additional copies of the original electrical state. The flow of electrons represented a signal, propagating from one place to another. Aunger's argument proceeded to relate genetic evolution and the evolution of electrical memes along parallel pathways. As humans became more complex, more signals were replicated internally. His subsequent argument was that social evolution was the result of memes replicating between brains, a step beyond replicating internally within a single brain (Aunger, p. 327). He (Aunger, p. 327) explained this replication as;

The memetic spike simply has to stimulate a motor neuron to engage the host organism in a behavior that produces a social signal, such as a stream of speech, that can be consumed by a second organism. Sensory receptors in the receiving organism then convert this signal back into a spike train that can instigate the local replication of the memetic state in *its* brain .... In effect, a meme had jumped the gap from one host to another.

Aunger ( 2002, p. 328) proposed that the evolution of signals, from neural communicators, to social ones, then progressed to artifacts, which were static, compared with dynamic signals; "Artifacts can store information safely, while signals are designed for moving information around efficiently." He defined artifacts as "...a heterogeneous group sharing only the quality of being produced



from environmental materials through the activity of organisms” (Aunger, p. 276). He proposed that evolutionary theory should have to concern itself with artifacts, because evolution should have to account for the apparent lineages and inherited features of successive generations of computers, tennis shoes and even clothespins (Aunger, p. 276). He argued (Aunger, p. 277) that natural selection was the only currently accepted explanation for increased complexity; “The evolution of culture has come to depend more and more significantly over time on the evolution of artifacts” (Aunger, p. 329).

If natural selection was the primary explanation for increased complexity, Aunger (2002, p. 329) claimed that the study of memes would make a “naturalistic theory of both communication and culture plausible.” He went on to claim (Aunger, p.331) that meme replicators could unify the sciences, because, as states of matter, they could be described in the language of physics; they could catalyze chemical reactions (chemistry) which reproduced a packet of information—perhaps with mutations during transmission—resulting in a pattern of descent (biology), which could also explain sociocultural phenomena (social sciences) which would require understanding of the mechanism (psychology). Aunger reminded readers (p. 332-333) that if memes did not exist, we would face some profound problems because:

...the entire biological world is the result of the activity of genes, replicators *par excellence*. Even the infections that computers can

“catch” evolve because the agents that cause them, computer viruses, are replicators. Without memes, we would have, for the first time, a pool of things—ideas and values, in this case—that exhibit similarity, duplication, and inheritance without a replicator being involved .... How can we get something like descent through the constant *re-creation* of beliefs and values in each person’s head? Such a phenomenon would cry out for explanation, should memes be proven impossible.

One of the problems Aunger described (2002, p. 333) was that a world without memes required individuals to assemble bits of pieces of information, received from others, into a mental box of their own construction. He claimed that the absence of memes left researchers with no explanation for communication, or how the brain could “reliably remake the meaning of messages from signals sent through the air.” Any explanation of cultural evolution then required ritualized routines or “Institutions to regularize social interaction, which assure a familiar context for the transmission of signals...” (Aunger, p. 333).

### Summary

The first literature subset researched the etymology and changing meanings of the term *concept*, over long periods of time, and described the transference of meaning from one term to another. Sometimes the term *concept* was used as a verb; at other times as an adjective or noun.

The second and third subsets described the development of two diverging theories about conceptual change. Coherence theorists, such as Kuhn, described revolutions in paradigms, which subsequently redefined terms like *concept* after each revolution. Fragmentation theorists, who built their theories upon Toulmin's refutation of coherence theory, constructed other definitions, new models and also redefined the term *concept*. Fragmentation theorists did not totally refute coherence, but claimed that coherence was the result of assembling knowledge from pieces.

The fourth subset of literature comprised the writings of Aunger, who theoretically reduced *concepts* to electrical states, or action potentials between neurons, at an inter-cellular level within the brain. These action potentials, termed memes, could replicate via signals (the flow of electrons) and transmit information either directly to other brains, or indirectly, through cultural artifacts. The net result was the replication of the same electrical state within another brain.

## CHAPTER 3

### Methodology and Treatment of Data

#### Introduction

Prior to this project, the author had developed a process by which students could choose to anonymously write their responses to various questions asked of them. The original purpose was to elicit misconceptions in physics. For this study, that process was used to obtain student responses to one particular question, “What is a concept?” Student responses were obtained on the first day of classes and filed until after the literature search and analysis of the literature was completed.

After writing Chapters 1 and 2 of this project, the author analyzed findings of the literature review and postulated what a unified concept theory might be in the first half of the Discussion section of Chapter 4. Once postulated, the author examined the student responses, which were obtained earlier in the semester, as a preliminary test of the theory, near the end of the project. The student data was recorded in this chapter; the sequence of research did not match the sequence of this project report. The responses recorded in this section were analyzed and grouped in the Findings section and then discussed in the second half of the Discussion section of Chapter 4. The first half of that section was completed before the data was analyzed

## Methodology

The study was classified as a qualitative survey, without statistical analyses, for purposes of preliminary theory testing only. The results were not intended to be generalized beyond the preliminary testing.

## Participants

The students came from different ethnic backgrounds, varied in age and gender and in educational background and primary language spoken and written. About half were elementary education majors; the others were predominantly business majors.

## Instrument

The survey instrument consisted of four questions: 1) What is Science? 2) What is a Concept? 3) When presented with information that is different, possibly hard to believe, what do you do with the information? And 4) How do you make meaning out of the world around you?

All of the data has been saved for future reference. For purposes of this project, only the second question, "What is a Concept?" was analyzed for testing the possibility of a unified concept theory.

## Design

For purposes of this project, the survey was a single, point-in-time, qualitative study. It was not intended to be statistically analyzed. The survey

data, studied after-the-fact, was analyzed to see if students defined the term *concept* either as a noun or as verb.

### Procedure

On the first day of class, January 23, 2008, seventeen students in a science concepts and methods course, at Heritage University, were given a questionnaire and a release form, which asked whether or not they wanted to anonymously answer a questions related to a conceptual change study. Fifteen marked that they would allow their anonymous comments to be used; two agreed to supply comments, but asked that they not be published. Only the fifteen anonymous comments were provided in this report.

This was accomplished anonymously in the following manner. The instructor passed out a list containing words such as zenith, quark, and p-wave, and asked each student to choose a word, write it somewhere that they could remember it, cross the word off the list and pass it to the next student. Then, the students used the word they chose to complete the consent form and to answer the questionnaire. The collated papers were used to determine which comments to include or exclude from the study. More than one survey was given during the semester, but only the concept question, from the first survey, was used for theory testing.

### Treatment of the Data

The entire data, from the fifteen participants who consented to participate in the study, was presented, in the order collected, without change in punctuation or grammar. The only alteration was in typing the written responses to the question “What is a Concept?” The responses were:

A concept is a generalized idea of a thing or class of things. Astronomical unit.

The method that we use to come to the conclusion of whatever method of research that we use. P-wave.

What is the main idea that we need to know. Asthenosphere.

A concept is an idea. Zenith.

An idea. Angstrom.

The main idea of what I am studying. Lepton.

A concept explains how and why or the purpose of something works. Fermion.

A concept is an idea or thought which one uses in his/her decision making. Right Ascension.

An idea or belief about something that can be observed. Carbon.

A concept is an understanding of how something works or something functions.

Declination.

A concept is a view on something else. Hydrogen.

A concept is an idea or group of ideas. Bason.

To understand how other possibilities exist in creation of earth and outer space.

Quark.

A concept is a theory observed by an given field of work. Meson.

To understand and develop and understanding of the object/source that is being studied. Oxygen.

### Summary

Fifteen student responses to the question “What is a Concept?” were obtained, with permission, by an anonymous qualitative survey. The responses were among responses to other questions, obtained on the first day of class, prior to any instruction. The specific responses were reserved for analysis in this report until after the research into the etymology of the term *concept* and an analysis of coherence, fragmentation and meme theories was completed, near the end of the project time frame.



## CHAPTER 4

### Analysis of the Data

#### Introduction

The analyses in this chapter were twofold. The first analysis comprised a comparison of the etymology of the term *concept* with coherence, fragmentation and meme theories. From that analysis, the existence of a unified concept theory was proposed. The second analysis comprised an initial test of that theory, utilizing survey responses from students, who were asked, “What is a concept?”

#### Description of the Environment

The unified concept theory was based primarily upon literature from within the field of education. The students surveyed were participants in a system of education. As a qualitative preliminary study, the analysis was not intended to be generalized to larger populations, either within the field of education, or without.

#### Research Question

Was it possible to state a definition of the term *concept*, and if so, could it encompass the divergent terms used by educational researchers? Would it be sufficient to begin the process of integrating diverging theories into a unified concept theory?

## Results of the Study

The etymology of term *concept* revealed that the term had changed from a verb to a noun and that other terms, through transference, changed the meaning of the term, over time and across languages.

Nine of the survey respondents specifically stated that a concept was an idea. Five of those respondents related the idea to some thing which existed in reality. Two of the respondents related concepts to more than one idea or thing. The primary usage of the term *concept* by this group was as a noun.

The six remaining respondents described concepts as actions; some described the actions more specifically than others. Oxygen and Quark both began their definition of *concept* with “To understand...” a present tense, infinitive verb. P-wave defined it as “The method...” an action similar to Fermion’s “explains” or Hydrogen’s “a view.”

## Findings

The preliminary analysis of student responses to “What is a concept?” indicated that without any instruction, at the beginning of this project, nine students defined the term *concept* as a noun; five of the students provided definitions which implied action; two specifically defined *concept* as an infinitive verb. These responses matched the etymology of the term, and indicated that both ancient and modern usages of the term still exist.

## Discussion

Dictionaries provided much of the etymology of the modern English term *concept*, but without the assistance of language professors, the dictionaries would not have shown how much of the original meaning had changed. The etymology came from more than one source and those sources differed in meaning. Most of the dictionary definitions did not convey the meaning of the Latin past participle term *conceptus*, as “seized together.” The translated term *concept* survived but conveyed the meaning of a French past participle, nominative term *conciez* as “conceived” in modern English. The French term used to be translated as *conceit*. Both *conceit* (conceived) and *concept* (seized together) coexisted in the English language. Over time, the meaning of *conceit* transferred to the word *concept*, altering the meaning of *concept*. *Conceit* then came to mean something else in modern English. Few people in the 21<sup>st</sup> century were cognizant of the changes to either term.

That change in meaning, while seemingly subtle, provided the author with an explanation for how two opposing perspectives, coherence theory and fragmentation theory, could use the same term in different ways. It explained why they were different: each used different etymological roots for the term *concept* within their respective theories, and may not have even been aware that each use has common ancestry.

Coherence theorists, in their conceit (French *conciez*), internally conceived, gave birth to *concepts* and matured them into theories and ontologies. Observations in biology, particularly the development of higher life forms, supported the idea of a *concept* as something conceived; something which eventually reached a higher state of coherent existence. The focus of coherence theory was therefore inward.

On the other hand, fragmentation theorists seized together (Latin *conceptus*) small pieces of p-prims or facets from the natural world, some larger pieces of nominal facts and some big fragments of narratives and mental models into coordination classes = *concept*. In this theory, concepts came from the fragments of the natural world, which were assembled in the mind. For fragmentation theorists, coherence was achieved through the assembly of external fragments. The focus of fragmentation theory was therefore outward.

The debate over the dualistic inward/outward aspects of human thought is nothing new; coherence and fragmentation theories appeared as modern reiterations of that debate. In both cases, each theory used the term *concept*, yet neither theory acknowledged that the etymology of the term allowed it to be used in either theory, depending upon which line of etymological descent was used. The author wondered whether or not Aunger's replicator memes had found a way to replicate, in both their original and mutated forms, through the artifact word *concept*, a word which has persisted for hundreds of years. Did natural selection

favor the term *concept*? Was it a term that could relate the actions and state of beings of humans (verbs) to the things they observed or created (nouns)?

A reference to verbs in language was found in the writings of Gregory Cajete (2000). Although not concerned with the term *concept*, his discussion of the role of language showed a correlation between philosophy and language. Cajete (p. 184) cited Gary Witherspoon (Witherspoon, 2000, cited in Cajete, 2000), who was known for his scholarly work with Navajo language:

Dominance of verbs in Navajo corresponds to the Navajo emphasis on a world in motion....A Navajo premise that is significant and relevant to the powers of thought and speech is that all matter and all living beings have a dualistic nature: static and active. The assumption that underlies this dualistic aspect of all being and existence is that the world is in motion, that things are constantly undergoing processes of transformation, deformation, and restoration, and that the essence of life and being is movement.

Cajete concluded, "Movement is associated with life and the creative processing of the universe. When something becomes static, whether it be human, animal, or the ecological processes of an environment, atrophy and death usually follow." (Cajete, 2000, p. 184).

The term *concept* predated modern and post-modern philosophies. It originated in a time and language when dualism was a predominant philosophy.

Perhaps as Aunger's electric meme and Witherspoon's static/active components of language, the term which was both a verb and noun, survived changing languages and philosophies.

The perceived fault line between coherence theory and fragmentation theory, as described by diSessa, did not really exist in the physical world, but reflected an inward/outward divergence of mental perspectives common to postmodern philosophies. In the story of Babel, the common (coherent) language of people became confused (fragmented); the story survived within the term *babbling*. Whether or not the story ever happened, the noun Babel (static) and the verb babble (active) have survived millennia.

A unified concept theory needed terms that functioned both statically and actively, terms that were both verbs and nouns. The terms needed to be flexible enough to allow coherence theorists, fragmentation theorists - even dualist theorists - to communicate among each other. Like a Rosetta Stone, a unified concept theory needed to translate among different theories; an artifact of fragments (different languages) with coherence (similar meaning) and process (translation) all in the same place. Whether or not such a theory would develop within the field of education would be determined by the willingness of coherence theorists to question paradigm fragmentation and fragmentation theorists to question the origin of those fragments upon which their coherence is based.

## Summary

The author researched the etymology of the term *concept*, and related that etymology to both coherence and fragmentation theory. The theory of memes provided a possible explanation for the persistence of both modern and ancient meanings of the term. A proposed unified concept theory needed to include both active and static components; it must be able to do something such as unify coherence and fragmentation theory and be comprised of terms which included both theories. A preliminary survey of student definitions of the term *concept* indicated that current usage of the term includes both active and static components.

## CHAPTER 5

### Summary, Conclusions and Recommendations

#### Summary

The project represented an intermediate step in a process which looked both forward and backward. The background for the project and the assumptions represented a concerted effort to collect the author's thoughts together for the purpose of searching for the answer to a question; "What is a concept?" By reviewing an article of Andrea diSessa (2005), by reading the original works of Kuhn (1962) and Toulmin (1972), and some of their successors, and by comparing their ideas with the etymology of the term *concept*, by examining a relatively new and controversial theory of memes and by examining his personal philosophy, and the author attempted to begin the formulation of a unified concept theory, a theory which could include both coherence and fragmentation theories within it. With preliminary student survey data, the author found evidence that the English term *concept* is still used as both a verb and as a noun.

#### Conclusions

The findings indicated that the similarity between the etymology of the term *concept*, as both a noun and verb, the related theories of coherence and fragmentation, the student definitions of the term *concept*, all suggested that there may be an underlying principle, or cause for these parallel similarities. Replicator memes may have been a source for those similarities, or a basis for a unified



concept theory, but the theory was not developed sufficiently beyond identifying possible relationships. Without further development and testing, the theory remained weak.

The findings were only preliminary; they represented neither an empirical study nor were they intended to be conclusive. The patterns provided enough of a platform for the author to engage in further discussions with proponents of coherence theory, fragmentation theory and meme theory; to design studies which could a unified concept theory.

### Recommendations

Aunger (2002, p. 330) claimed that testing meme theory would be possible. The author needs to determine if any tests have been done, and if not, determine if any can be done. Further testing and analysis of patterns of similarity between term usage, conceptual change theories, philosophies, understandings of space-time, along with studies designed to test these patterns as ordered or random, would be required before a stable unified concept theory could be advanced. Some of these aspects could be addressed by the author in future work; some would necessarily come from inspiring others to explore the possibilities and complexities therein.

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