SEMANTIC MODELS OF ECONOMIC EXCHANGE PHENOMENA: ASPIRING TO A MORE CONCEPTUAL BASIS FOR ACCOUNTING SYSTEMS (1999)

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SEMANTIC MODELS OF ECONOMIC EXCHANGE PHENOMENA: ASPIRING TO A MORE CONCEPTUAL BASIS FOR ACCOUNTING SYSTEMS

Significant disagreement abounds among accounting practitioners and researchers as to the future of double-entry systems in accounting. Some applaud double-entry for its robustness throughout the last five centuries and claim that it will prevail, albeit perhaps in an expanded form (see, for example, Ijiri 1993, Kirkegaard 1996, and Wagensveld 1997). Others believe that the transition from the Industrial Age to the Information Age has sparked a crisis in accounting systems that will cause a paradigm shift away from double-entry systems to a new breed of accounting systems (see, for example, Cushing 1989; Elliott 1992; David, McCarthy and Sommer 1996; and Waller 1997).

This paper examines the business phenomena that accounting systems represent to identify which aspects of double-entry systems must be preserved and which may reasonably be altered or discarded. In so doing, we also give readers an abstracted overview of an important methodological advance in the field of computer science, particularly as it has been applied to database theory and artificial intelligence. That advance is commonly called ***conceptual modeling***, and it has its roots in fields as varied as philosophy and linguistics (Sowa, 1984). Our overview for accounting purposes centers around conceptual modeling of economic exchange phenomena.

The structure of this paper is as follows. Section I discusses artificial versus natural phenomena. Section II presents the idea of "give and take" as an underlying construct of interpersonal dealings, and particularly of economic exchanges. This section uses an example to explain how the REA (resources-events-agents) accounting model captures the give and take nature of business phenomena. Four benefits of semantic modeling of business phenomena are proposed. Section III examines methods of accounting that have been used throughout history and evaluates them as to how closely they model natural phenomena as opposed to using artificial constructs. Section IV provides a summary and thoughts as to the features that must exist in future accounting systems.

I. NATURAL AND ARTIFICIAL PHENOMENA

Baseball and Double-Entry Accounting

The American sport of baseball, a close cousin of English cricket and other stick-and-ball games, has both a long history of over one hundred years and a complicated set of (sometimes inconsistent) rules that have evolved throughout that history. As the game was played and spread in popularity during the 19th century, those rules were constantly changed and updated with the intent of improving the sport. However, once the momentum of those changes slowed and the game became somewhat standardized, there was a tendency on the part of those closely associated with baseball to consider its structure and rules as inviolable, as if those structures and rules were naturally occurring phenomena such as one would see in a domain such as physics. Thus, when one of the two major leagues in the USA introduced a *designated hitter* rule in the 1970s – a change that swapped an overtly predictable and boring interlude of ineptitude with a set of much stronger scoring possibilities -- there were howls from the baseball purists that the natural rules of this game had been violated. What had actually occurred of course is that the highly artifactual rules of an artificial game had simply been changed in an attempt to make it more interesting. The purists were mistaking the fact that something had been done in a certain way for a long time for an occurrence of a natural phenomena, incapable of being changed.

In actuality, this absolute differentiation between natural and artifactual phenomena is exceedingly difficult. However, it is useful to ponder its implications as they relate to the long-term viability of the various conventions embedded in the double-entry accounting system, such as the basic *A=L+OE* classification scheme plus its accompanying matching and absorption rules. Are these conventions more like physics or more like American baseball? And if, as we argue, the answer implies that double-entry accounting lies more toward the artifactual end of the spectrum, are there representation and modeling disciplines whose use could move accounting systems more toward the natural end?

An interesting way to ponder the effects of substituting one method of accounting for another, especially for accountants who are accustomed to the traditional method, is to think of a society that might be faced with a choice of developing accounting systems from scratch, that is without any prior exposure to the A=L+OE classification system of Pacioli. To do this, we introduce the story of the Wola People, an aboriginal society of the island of New Guinea who only recently have been exposed to artifacts of 20th century civilization. For readers willing to temporarily suspend their disbelief as to the plausibility of this scenario, we pose this question: What form might an accounting system developed by these people take, especially if the development of that system were to (1) follow the natural methods of commerce and exchange that had evolved within the society over thousands of years and (2) be facilitated by computer technology?

II. THE WOLA, M&M ENTERPRISES, AND AN REA MODEL

A Give-and-Take Community

In this section we describe first the Wola society, a tribe of highland people of Papua, New Guinea, who were not "discovered" by the outside world until the 1930s. This community as it was described in the 1970s illustrates that it is not chronological time that determines the classification of societies into "ages", but rather it is the level of technological and organizational development which is present that distinguishes which age is an appropriate classification.

Sillitoe (1979) describes the Wola people based on his experiences living with them for fourteen months in the mid-1970s. The technology and organization of their society is consistent with those that we would classify as being pre-Agrarian. The give and take relationship of economic transactions is very well illustrated in Sillitoe's description of this society; however, there is little evidence of the concept of profit. The Wola value exchange as the central principle upon which their society is built. Sillitoe claims that the exchange of such objects of wealth as pigs and pearl shells gives order to their society, which he describes as otherwise too flimsily structured. He recounts the various events that lead to exchanges of wealth, including marriages, deaths, war reparation, and other exchanges and debts. When a Wola couple marry, the groom's family must present to the bride's family a bridewealth consisting of pigs, pearl shells, money, etc. If the bridewealth is not adequate, the bride cannot marry that groom. Once the bridewealth is accepted, the bride's family offers a return hogol payment to the groom's family. If that payment is not acceptable, they can nullify the marriage. The wealth received by each of the families is then distributed among the family members in proportion to the amount they contributed initially to the bridewealth or to the return hogol. Thus there was a basic understanding that for everything members of Wola society gave, they would in turn receive something in exchange.

When a member of the Wola society died, they always placed responsibility for the death on another member. If, for example, the death was accidental, whomever that person was with at the time of the accident was held responsible. If it was a suicide, whoever had driven the person to want to take his or her own life was held responsible. The responsible person was believed to have incurred a debt to the family of the deceased, and would then have to make a payment or series of payments to that family. War reparations were a similar phenomenon. If a person was killed or badly injured in a war, the leader of that person's allies in the war was responsible for making payment or a series of payments to the family of the deceased. Sillitoe describes other exchanges of goods or money that he calls debts or investments. In such a transaction, one man will give money to another as sort of a loan, and the other man is then responsible for giving him back the money plus something a little bit more (interest) when the creditor needs it.

Two things are striking in Sillitoe's documentation of his time with the Wola people. One is the strong idea of **give and take**. If you take somebody's life (or are judged responsible for taking that person's life) then you have to give something. If you take a loan from someone, you are responsible for giving the wealth plus interest back. The other striking thing is the fact that there does not appear to be any physical means or written record of accounting for these exchanges. They make great ceremony of the exchanges, with many people in attendance. These witnesses help the participants remember who owes what to whom. In case of a dispute between parties, they polled the witnesses to try to resolve the dispute. If they could not resolve it satisfactorily, war would often ensue. The Wola society incorporated the concept of private property, including land ownership. They were able to keep track of who owned what land without a written system. To claim land, members of the Wola society cleared that land and planted a garden. Once the land was cleared and planted, ownership was established. For the most part, this system worked for them. Occasionally problems arose because when members of the Wola wanted to use adjacent land, they requested permission from its owner to garden that land. If the owner was not planning to use it, permission was usually granted. Since there was no written record of ownership, confusion would often result among the descendants as to who actually owned the land.

Sillitoe attributes the success of the Wola exchange system thus far to the fact that the Wola people view themselves for the most part as equals. They have members that they consider as more skilled than others in various aspects of community life; for instance, they label those that are particularly good at arranging exchanges of wealth as "ol howma." However, when it comes to subsistence, no Wola is considered to be more important than another. Sillitoe claims that the concepts of authority, economic profit and exploitation of others are absent in the Wola society. The exchanges have social value rather than economic value. As the outside world introduces capitalism to the Wola, it is likely that the exchanges will become more profit-oriented, and as that occurs, a need for a formal accounting system will probably develop.

Give-and-Take Accounting

What might an accounting system for a society like the Wola look like if it were to be developed from scratch and based primarily on their centralized exchange notion of give-and-take?

Let us assume that they were to be suddenly thrust into the current time period and able to avail themselves of all aspects of modern knowledge and technology with one notable exception: double-entry accounting with its attendant notions of debit-credit, accounts, assets = liabilities + equity, etc. This means that the Wola would have computers, and even more importantly, they would have the

use of modern computer science methods such as conceptual modeling (from database theory) and knowledge representation (from artificial intelligence). Let us suppose further that the mores of the society changed to the extent their economic activity became governed by the more traditional notions of "economic man" which would mean, of course, that profit-oriented economic activity would become more prevalent.

The central idea of conceptual modeling is a close correspondence between objects of interest in the real world (principals) and their representations (surrogates) in the model. The principals are usually given names or other descriptions that are then used to create lexical objects for eventual implementation in a computer system. This process is often called knowledge representation or semantic data modeling.

It would be natural to assume that the Wola could conceive of a system for documenting economic activities that centered on their basic notion of give-and-take. If we suppose that conceptual modeling were used for these purposes, we would find that the Wola would invent terms for their economic activities, for the objects used in those activities, and for the people who participate in those activities. They would also find terms that described how all of these entities were linked together.

In one methodology for knowledge representation (pioneered by Schank (1984) and explained for accounting in McCarthy (1987)), the **set of economic phenomena** associated with a particular firm or enterprise would be conceptualized as a **story** with a certain **script**. The various **activities** of the enterprise would constitute the **scenes** in the story with the **economic objects** serving as **props** and the **people** filling certain **roles**. To see how a give-and-take accounting system might evolve with such conceptual modeling, we will apply Schank's methods, along with some more specific data modeling constructs pioneered by Chen (1976), to an example Wola firm called M&M Enterprises.

Company Overview of M&M

This is a story about a company called M&M Enterprises which was founded by two Wola women named Margaret and Mary. M&M determined that the worldwide market for agleclaps was underdeveloped and that this shortfall represented a genuine economic growth opportunity. Neither woman had much in the way of spare cash, but they figured that they could secure a bank loan for start-up financing and use their profits from agleclap sales (which they expected to be both quick and sizable) for continued growth.

M&M's script for success is portrayed in Figure 1. Readers should note that the scenes in this script are a representation of economic activities with arrows depicting some sort of loose temporal ordering. The first five bubbles represent "taking" activities (of the factors of production) for M&M, while the seventh represents "giving" activities (of cash). The sixth bubble (the M&M revenue cycle with dotted lines surrounding) represents both giving and taking. For simplicity sake at this overview level, not all activities are shown (payroll is skipped for instance). Also for simplicity, the only direct give-take link illustrated is the one between sales and cash receipts in the revenue process.

Let us suppose further that, after six months, M&M was running exactly as predicted. Margaret was a merchandising whiz, and she had successfully created an impressive agleclap market and a network for servicing it. Mary was a whiz of a different type, and she had built an enterprise information system that was always up-to-date and easy to use because it was based on the

principles of conceptual modeling. The database that resulted from her representation efforts allowed her to perform all the normal accountability procedures for creditors, customers, employees, etc., and to provide information needed for non-accounting decision-making as well. The structure of her database was patterned on the enterprise script that she and Margaret had developed. This patterning seemed quite natural to Mary, because this was the way the two owners always talked about the company anyway.

At times however, it was necessary to delve into more details and to manage the particular information components of economic activities within the firm at the data item level. These details were stored, maintained, and retrieved with a relational database system, and the semantic development of a component of that database (the revenue cycle of M&M as shown surrounded by dotted lines) with entity-relationship modeling is explained next.

The Revenue Cycle of M&M -- Extra Details

M&M sells its agleclaps to customers through a network of company salespeople. Each type of agleclap is bought from a particular vendor and is given an initial list price. Each salesperson services a separate group of customers and is allowed to offer them various discounts from list to induce sales. Each sale can include one or more types of agleclaps and can be paid for in any one of three ways: (1) immediately in cash, (2) on the 15th of the following month, or (3) over the course of six months. When cash is received, a cashier deposits it into a company bank account. Sales are signaled by invoices; cash receipts by remittance advices.

The policies above plus the information elements listed below are relevant to potential users of this data model, and M&M needs to include all of them in its final database structure (attributes with asterisks are hints for <u>some</u> (not all) of the needed relationships). Cashiers and salespeople both belong to an entity called “employee.”

-agleclap#
-agleclap description
-list price
-primary vendor for this agleclap type
-QOH (quantity-on-hand)
-remittance advice#
-bank for cash account
-bank account#
-bank-account type
-customer name
-a/r amount
-customer salesperson*
-customer#
-invoice#
-customer sold to*
-sale date
-sale amount
-inventory quantity sold
-actual price of each agleclap
-employee name
-receipt date
-salesperson quarterly sales
-salesperson comm. rate
-employee#
-fidelity bond rating of cashier
-cash receipt amount
-employee category
-bank account for receipt*
-employee's highest degree
-cash account balance
-number of employees in category
-medical plan for this category
-monthly salary of employee
-amount of cash receipt applied to a certain sale

Semantic Network Model of the M&M Revenue Cycle.

An Entity-Relationship (E-R) diagram of the M&M revenue cycle is shown as Figure 2. This conceptual model of M&M was derived from REA (McCarthy 1982) transaction templates and semantic analysis of both the policies and data elements listed above. As is explained in McCarthy (1982), the REA framework relies on naming elements from Ijiri (1975). On the page following the

E-R diagram, Figure 3 portrays a relational model of M&M's revenue cycle for July and part of August. The assets, transactions, and people in this example obviously constitute only part of the M&M story (i.e., the real M&M database would have more tables and those tables shown would have more rows). However, these extensional elements should allow readers to obtain a feel for what database accounting might look like and to reconstruct for themselves the details of M&M's business. The tables do tell an economic story in the sense that they fill in the scenes, props and roles for the revenue subscript. The next section looks at some details of that story further.

Database Retrieval -- Specific Story Details

The intensional features of an accounting database describe the types of actions, people, and things accounted for in its story. The database extension speaks of the specific instances or tokens of economic activity in M&M's operations. The instances of a specific entity in a relational database are always tracked with its key values that are underlined in the Figure 3 accounting database. It is possible, for example, to recreate details of customer "MICK"s activities by retrieving table rows with his particular "CUSTOMER#" in them. Thus, one can see that M&M made two sales to Mick during this time and that he sent the company cash three times. With a little practice, readers should be able to solve the following cases as well:

a. Explain where the $16,000 figure on sale invoice "INV-3" comes from (i.e., what was sold to give that total?);

b. Explain what payment option Mick seems to be using for sale "INV-2";

c. Fill in the missing instances in the "CASH.BALANCE" and the "SALESPERSON.QUARTERLY-SALES" columns;

d. Calculate and fill in the subsidiary accounts-receivable; calculate control A/R a different way and use it to check the subsidiary figures.

For readers who have not been able to follow the tables at this point, we have provided a natural language description (which is really just another form of knowledge representation) of M&M activities in Figure 4. **However, readers should try to solve the problems from the database first before resorting to natural language text for clarification.**

In solving each of the a-d examples from above, readers would be mimicking with pencil and paper the actual maintenance and retrieval operations of a relational database management system. Real databases obviously get much bigger and more detailed, but these software systems are able to use powerful set-oriented operators to deal with these levels of complexity (although there are some counterintuitive results associated with such retrieval in accounting environments [Gal and McCarthy 1986]). It is also possible to build more abstract and less aggregate structures on top of these tabular systems. For instance, it seems that Mary and Margaret manage M&M by understanding first the overall script in Figure 1. When they want more detail on salesperson "BOB," they can zoom first to the revenue cycle E-R diagram of Figure 2, then to the generalized employee and the category salesperson tables, and finally to the individual person's data.

The M&M Database -- A Summary

We have presented the two-month story of life at the agleclap company so that readers could gain an appreciation for the mechanics of a different type of accounting system (an REA accounting system) created through semantic modeling. Our M&M example is a simple one, but it is generalizable to practice. Readers should note that the examples used here are not ad hoc implementations of events accounting or multidimensional bookkeeping ideas. That is, they are not simple paper toys that are proposed only to make a case for different views of accounting. Models like M&M have been implemented on computers of all sizes. Dealing with the scalability and organizational integration issues of such implementations is the focus of research efforts with REA-type systems.

The Benefits of REA Accounting

Before leaving the Wola example, let us reiterate in this context the arguments for considering semantically modeled economic event tracking systems over traditional debit-credit-account (DCA) systems. Both methods would meet the accountability needs of Margaret and Mary, but the relational system has additional benefits.

1. The descriptions of economic resources (inventory, cash), economic events (sale, cash receipt), and economic agents (customer, employee) in the M&M database are available for use in marketing, distribution, personnel, and other types of information systems should the owners decide to avail themselves of such options. The various lexical object types used to identify real world phenomena are not constrained to accounting use, nor do the facts associated with M&M operations need to be stored multiple times for different uses.

2. If readers were able to follow the zooming down in terms of economic detail as we moved from Figure 1 to Figure 2 to the table headings of Figure 3 and finally to the actual row values in the M&M database, they can appreciate a conceptual model's ability to handle complexity with abstraction. Margaret and Mary are not overwhelmed with details; they are given particulars as they need them.

3. Because the modeling primitives used in the database accounting system of M&M arise from the same epistemological and linguistic roots as modern AI systems do, it would be possible to integrate their system well with modern methods for automated inference and learning. For their present small scale, this might seem like scientific overkill; but that is a proportional argument, not a substantive one.

4. Because the semantic gap between the database accounting system of M&M and the underlying reality is narrow, the M&M system is easily adapted when the nature of the business changes.

If readers now understand the major components of REA accounting and if they have a feel for its mechanics, we can move to a historical examination of accounting methods and evaluate the costs/benefits associated with moving to a more semantically-oriented information system.

III. ACCOUNTING SYSTEMS -- OBJECTIVES AND DESCRIPTION

Accounting has undergone many changes over the past five centuries, but the underlying premise of double-entry has stood firm. Changes have taken place as far as what tools are used to record information (pencil, computer, etc.), and conventions have been added, dictating how information must be valued and reported (depreciation, lower of cost or market, etc.). In spite of all the changes that have been made, many find the traditional accounting information to be inadequate. We will propose that the inadequacy is due to the double-entry system's artifactual nature and suggest that using a model that more closely represents the underlying reality of organizations (such as REA accounting) as the underlying premise for providing accounting information will be more useful. We review the methods of accounting through the ages, starting with the Agrarian Age, going through the Mercantile and Industrial Age, and moving into the Information Age. We suggest that it is in the transition from the Mercantile & Industrial age to the Information Age that the traditional double-entry or Debit-Credit-Account (DCA) system loses its usefulness. We present arguments made by Cushing (1989a), Elliott (1992), and Wallman (1997) that the accounting paradigm of double-entry is in a crisis stage and that to resolve the crisis, it must be replaced by a paradigm more well-suited to current technology and business environments. We propose the Resource-Event-Agent (REA) model as a replacement paradigm and describe how the accounting needs of the Information Age can be met with such methods. Before our historical review however, we review the objectives of an accounting system. Such objectives provide the basis on which our systems are built.

Accounting Objectives

Vatter (1964) identifies three groups of users for whom accounting results can be significant. The first group is management. He describes the accounting system as "a device for facilitating the managerial process ... to preserve minutiae of business events, and to collate related facts in systematic fashion." (p. 15). He describes the second group as "social control agencies". Social control agencies would include government, trade associations, economists, statisticians, and accounting researchers. The third set of users noted by Vatter is that of the owners, creditors and prospective lenders or investors. Ijiri (1975) specifically identifies two broad objectives of accounting that should be met for these various users: accountability and information usefulness.

Ijiri (1975) claims that accountability is the key function of accounting. He states that "accountability has clearly been the social and organizational backbone of accounting for centuries" and continues with a description of the type of system needed to support it:

> The accountability approach ... emphasizes the assurance implicit in financial statements that figures on the statements can be accounted for by records and supporting documents of detailed transactions. Here, to account for means to explain a consequence (e.g. a cash balance) by providing a set of causes (e.g. cash receipts and cash disbursements) that have

> collectively produced the result. Thus, from the accountability standpoint, financial statements are merely the tip of the iceberg; what is important is the system behind the statements. (p. x)

We believe that both accountability and information usefulness are important objectives, but agree with Ijiri that information cannot be useful for management, social institutions, or investors if it does not first meet accountability criteria. We thus adopt accountability (the keeping of a record of facts, keeping track of the assets) as a minimum necessity for an accounting system. This is not to imply that accounting systems should only provide accountability. We suggest that the extension of the accounting system to provide information which is in a form useful for decision making, or for predicting the future earning power of a firm should be made only after the "accountability infrastructure" of a firm has been built. The premise underlying REA accounting is that the accountability objective should be met within the core of the accounting system, and that the other objectives can be met via construction of specific "views" of information that do not permanently alter the raw data. To better illustrate the importance of the preservation of accountability as the foundation of an accounting system, we next review how the goal of accountability has been served throughout history.

Accounting Through The Ages

Our fundamental purpose in this historical review is to illustrate how accounting systems have changed as technology allows newer methods for tracking accountability. Figure 5 outlines the categories of accounting systems used throughout history. In all cases, the goal is construction of an information system (artifact) for tracking give-and-take economic activity (reality). These two levels are also called **surrogates** and **principals** by Ijiri (1975).

The Agrarian Age

Many examples of ancient agrarian societies' attempts at formal accounting systems have been described by accounting historians. We do not try to cover these comprehensively, but merely provide some examples which we believe represent the typical attempts to keep track of the necessary accounting information for an Agrarian Age society.

Chatfield (1977) describes several ancient accounting systems in various countries (Babylonia, Egypt, China, and Greece) as far back as 5000 B.C., long before double-entry bookkeeping was used. In these societies, as in the Wola society, give and take was the theme underlying business transactions. Unlike the Wola society, the concepts of economic value and profit did seem to exist, so these societies needed to record information regarding the business transactions. The accounting was done by methods such as making notches in sticks to indicate quantities of goods one was responsible for, or having scribes (called the predecessor of today's accountant) put business transactions into writing using a wooden rod with a blunt triangular end to record the agreement on a small lump of moist clay, noting the names of the parties, the items paid or received, promises made, and any other pertinent details. The clay tablet was then dried and kept as an accounting record. Chatfield describes Babylonian temple and government records as being on "a great mass of tablets", describing "a variety of receipts and disbursements, wage payments, rental income, interest

on loans, and real estate transactions." (p. 6). He also describes periodically prepared inventories of assets on hand and evidences of royal examination of audit.

Mattesich (1989) claims that he has endeavored since the 1950s to demonstrate that the foundation of accounting is not to be found in the techniques of double entry but in the logical form of a transaction. He describes the use by Sumerians in 3250 B.C. of sealed clay receptacles containing tokens that represented the portion of one person's wealth that has been loaned to another. An imprint was made on the seal to indicate what the contents were. This, according to Mattessich, represented both a receivable and owners' equity.

Thus, there were definite systems of accounting, even before double-entry bookkeeping was developed. One important point Chatfield makes is that it took a long time for double-entry bookkeeping to become widely used. As late as the early nineteenth century in colonial America, he notes that many people and businesses did not employ double-entry bookkeeping. The reasons for the lack of use included the fact that the British would not allow the colonists to coin money, thus they used mostly a barter system. The only accounting that was needed was a record of what was owed to whom. Success was measured in terms of asset increases; income was not isolated. Thus, ancient accounting systems focused on traditional objective of accountability - keeping track of the assets, and measuring the give and the take of economic transactions. No attempt was made to meet the more current objectives of accounting (providing information regarding earning power of the firm, or providing information useful for decision-making purposes). Chatfield (1977) suggests that this is partly due to a lack of need for the information, in that most of the population was illiterate, and also due to a lack of technology suitable to meet these other objectives (Roman numerals made calculations cumbersome, Clay tablets were bulky thus necessitating a minimal amount of record-keeping, etc). As the population became more literate, the need for such information arose, and as new technology developed (e.g. development of numbers and mathematics, invention of pen and paper, etc) the ability to provide information which meets more objectives than merely that of accountability became possible.

The Mercantile and Industrial Age

Early systems of accounting are also described by ten Have (1976), which in many ways are like those we have classified as Agrarian. However, there are some important changes that led us to classify them as belonging to the Mercantile and Industrial Age. These changes included a new form of business organization that brought with it different needs. as well as new technology which made new forms of recording data possible. ten Have emphasizes that the type of accounting system used depended heavily on the needs of the business. The main form of business was that of the merchant trader, or adventurer, who journeyed to far away places to trade their goods. Some traveled by land, others by sea. The only information they kept track of was the value of the cargo they returned home with. They didn't need any other information, because that was all that was important to them. If they returned home with a valuable shipment, the voyage was said to be profitable. As with the colonial American barter systems, success was not measured in terms of an isolated income figure, but by the increase in assets. Because a merchant trading voyage was a tremendous undertaking in terms of both expense and effort, the joint venture form of business

organization was created. These business organizations were basically merchandise oriented, with little need for large capital investments and likewise, with little need for formal accounting reports. They did, however, need more than just the lists, clay tablets, and notched sticks associated with the Agrarian Age in order to be accountable to all parties to the joint venture. It was to meet this need that the double-entry system as formally described by Pacioli in 1494 was created. The double-entry system was made possible by technological advances in the production of paper, writing utensils, and mathematics. The mechanics of this system were much the same as they are today. A written record of transactions was kept (called the Memorial or Memorandum). From this, journal entries were formed and entered into the Journal and then posted into the Ledger. Amounts were classified as debit and credit and recorded in separate columns in order to avoid the use of negative numbers (Ijiri 1982). As described by Littleton (1968), a trial balance was prepared to ensure the mathematical accuracy of the Ledger, and the nominal accounts were closed through profit and loss to capital. Littleton notes, however, that no separate financial statements were prepared. Littleton (1968) and Irish (1968) both note that this is probably because each joint venture was considered to be a separate business. There was no concept of a corporation as an ongoing entity. Once a voyage was over, the profit/loss was computed and the venture was over.

As the Industrial Revolution spread throughout the world, technology and forms of business organization changed even more, and the information needs also changed (ten Have 1976). The Industrial Revolution brought more manufacturing business organizations; these companies required substantial purchases of fixed assets. This made it difficult for sole proprietors or even for joint venturers to form manufacturing businesses. Commercial capital was in short supply. The corporate form of business thus evolved, allowing for many investors each contributing relatively small amounts of capital. Merchants also began to form corporations for their trading voyages, whereby the profits from one voyage would be reinvested in the next voyage. The corporate form of business created a need to provide accounting information to the contributors of the capital (shareholders). These users did not have ready access to the bookkeeping records, as did sole proprietors and small group venture participants. Thus, the mere keeping of profit/loss and capital accounts in the ledger was not adequate to meet the corporate information needs. The shareholders wanted a summary of the profit and loss activities, as well as a listing of the assets and equities of the corporations, in order to see how their money was being used. The use of double-entry bookkeeping and periodic financial statements to meet the need for formal record-keeping and reporting of accounting information spread throughout the world.

The double-entry system worked well for many years,and was appropriate for the forms of business organizations and available technologies in the Mercantile and Industrial Age. As more and more types of business were developed, the double-entry system was found to be generic enough to be used in nearly all of them. The dual entering of each amount into the accounting records provided an important check on the arithmetic of the bookkeepers, who had to perform all calculations manually. The double-entry system allowed for the newly needed concepts of depreciation, dividends, and income determination. As ten Have (1976) states, "it is remarkable that nothing had to be changed in the fundamental principle of double-entry. These principles remain the same to this day." (p. 52). He suggests that the reason for its resilience is that in essence the commercial structure of businesses has not changed. Although many businesses during the Industrial Age had expanded the scope of their enterprises and grown very quickly, the larger scale of commercial operations was

accompanied mainly by a need for more bookkeepers to handle the increase in transactions that needed to be recorded. The underlying give and take nature of the transactions to be recorded did not change. Eventually, bookkeeping machines were invented, to assist the bookkeepers in making the required journal entries, posting them to the ledger, and preparing financial statements. Still, as portrayed in Figure X, there was no recognized need for the substance or the mechanics of the double-entry accounting system to change. As computers became more prevalent in the 1960s, these same unchanged systems were implemented on changed technologies as record-oriented master files and a general ledger.

The Information Age

It is commonly accepted that our society is in the Information Age (Toffler 1980; Naisbitt 1982, 1989; Cushing 1989a; Elliott 1992). Elliott (1992) emphasizes the fact that the Agrarian, Industrial and Information ages consist of fundamentally different methods of wealth creation, and that each requires a different form of accounting information. He argues that an Information Age accounting mechanism must take advantage of the information technology capabilities such as automated data capture, instantaneous access and processing, geographical freedom, fully versatile analysis and reporting, capacity for additional data types, and access to external databases. He suggests that the use of a relational database for accounting information could take advantage of these features. However, construction of a relational database (or any equally as effective form of database) requires careful structuring of the input. Conceptual modeling provides a means of creating this structure. The increased technology and complexity in the business environment of the Information Age thus make the four benefits of conceptual modeling (discussed immediately after the Wola example) tremendously important. The next section will describe these reasons for conceptual modeling more fully, and note how some of the advances in technology and system complexity can be handled by conceptual modeling.

Database Rationale. The first reason for conceptual modeling is the traditional database rationale from computer science. This says that conceptual models encourage standardized use and definition of information structures across organizational boundaries. This facilitates electronic commerce, by enabling the retrieval, sending, and integration of data among business partners or research sources. Conceptual modeling also may realize the possibility of financial reporting via databases. Some people believe accountants need to change their focus from presenting information in conformity with arbitrary principles, to assisting users in manipulating financial information in various ways depending on the users' information needs (see, for example, Burton 1983; Abramson 1986; Cushing 1989b; Elliott 1992; and Hollander, Denna, and Cherrington 1996).

Complexity Management. The second reason for using conceptual models is that they make intellectual complexity manageable by using natural primitives that abstract to generalized descriptions of structures which in turn cover many thousands of cases with as few exceptions as possible. There is no doubt that companies in the Information Age have become increasingly complex. The mass of detail involved in coordinating the accounting and other functions of multiple locations, some with differing cultures, accounting standards, tax laws, languages, and time zones

could be overwhelming. Ackoff (1967) claimed that management information systems (MIS) are usually designed with the belief that managers are operating with a lack of relevant information. Thus the typical MIS attempts to give the user more information. Ackoff suggested that if one is preoccupied with supplying more relevant information, attention is almost exclusively given to the generation storage and retrieval of data. This involves constructing data banks, coding, indexing, updating files, access languages, etc. He noted that the ideal that emerges from this orientation is an infinite pool of data into which a manager can reach to pull out any information needed. Such a store of information could quickly cause information overload. Information overload occurs when a person has more information available than he is able to process. Ackoff suggested that MIS should be as concerned with reducing the amount of irrelevant data as they are with increasing the relevant data provided. He noted two key functions of an information system as being filtration and condensation. Filtration is a technique which separates the relevant data from that which is irrelevant, and discards the latter. Condensation is a function that summarizes the relevant data into a more compact form (Morris, Kasper and Adams 1992). An events-based approach to accounting information systems allows features that perform filtration and condensation. For example, the REA model allows the incorporation of abstraction features that can be used to suppress irrelevant details and to emphasize details appropriate to the current context (Brodie 1981). The abstraction techniques provide the user with means of filtering and/or condensing the information in an accounting system without permanently altering the database. Research still needs to explore which abstraction techniques provide the appropriate attention-management direction for various types of tasks (Dunn 1999).

System-Based Inference and Learning. In the 1980s and 1990s, the computer science field of artificial intelligence began to affect substantially the architectures of many business enterprises. The first wave of AI work concentrated heavily on so-called "expert systems" which tended to be stand-alone models of human expertise in a particular domain. The models were developed primarily as production systems (with rule-based representation of knowledge), and they were intended to replace or augment the use of human judgement in the performance of certain tasks. A major shortcoming of this early work was its inability to link directly with stored corporate databanks -- a shortcoming attributable to the incompatible types of representation used in both the AI systems and the database systems (McCarthy 1987). This problem should be attacked from both sides, and indeed the increasing use of semantic network representations (like scripts) in AI systems represents progress toward half a solution. The advent of events-based accounting systems would represent considerable advancement from the other end, because its representation methods coincide closely with semantic networks. A prototype system called CREASY is currently under development. This system will enable intentional reasoning; where by the use of only the table intensions (column headings) the system can reason about business phenomena represented in the database. In order for such reasoning to be feasible, the REA pattern must be followed completely.

System Adaptability. A fourth benefit of semantically modeled systems is that the systems are easier than non-semantic systems to be changed over time to reflect changes in the underlying business processes or in the organizational structure. For example if two companies merge, they must combine their information systems. If a company adds a new line of business and/or drops a different line of business, it must adapt its information system accordingly. Because semantically

modeled systems use meaningful terms that are commonly understood by all business users, and because the systems are structured in such a way that objects are easily added to or removed from the model, business changes can be translated into system changes.

Summary of Information Age. This section on the Information Age has given several examples that show that in many areas of business the changes wrought by computers have required and/or made possible fundamental changes in corporate strategy. Companies have found it strategically advantageous to initiate transactions electronically, to access outside data from online sources, and to globalize their firms and markets. Many have speculated that it would be advantageous to investors to be able to access corporate financial information via an online database as opposed to waiting for printed financial statements. A common concept underlying most of these newer strategies is the idea that information must be timely and flexible. Unfortunately the typical double-entry accounting system is not conducive to providing information in such a way. Thus, a change is needed in accounting strategy, to a system such as REA accounting that can provide information which is both timely and flexible.

The Crisis in Accounting Systems

Cushing (1989b) describes the evolution of accounting in terms of Kuhn's theory of the evolution of scientific disciplines (Kuhn 1970). He identifies double-entry bookkeeping as the major current paradigm of accounting. The Agrarian Age, since no one accounting system was uniformly agreed on and adopted, could be looked at as a pre-paradigm stage for accounting. He notes that in the Mercantile & Industrial Age a central feature of accounting was that "it existed almost exclusively to provide the managers of businesses and other organizations with information relevant to managing the daily operations of their enterprises. Thus, accounting methods were chosen primarily to satisfy the needs of management." He applauds the resiliency of the double-entry bookkeeping system for more than four centuries in the absence of any uniformity constraints. However, Cushing suggests that the onslaught of government intervention which began in the early 1900s in the form of accounting regulations, has created what Kuhn refers to as anomalies (observable facts that are unexplainable within the existing paradigm) that render double-entry bookkeeping unsuitable for the newer Information Age. In his words "Is double entry the only way to address accounting's more general problem of making sense out of the economic performance of individuals or groups responsible for the utilization of economic resources? Double entry may have been well-suited to the bookkeeping problems of 16th century merchants, but is it equally well-suited to the accounting problems of large, complex corporate enterprises in the 20th century?" He too is suggesting that the changes in business organizations and in technology since the Mercantile & Industrial Age require a similar change in accounting systems. Cushing describes this need for change as being what Kuhn would call a "Crisis" stage in accounting history, which could be resolved in various ways. Cushing is not the only contemporary accounting researcher to notice the crisis of accounting. Burton and Sack (1991), note that the focus in today's accounting world is on the provision of an idea of the earning power of the firm, and away from the objective of accountability. Burton and Sack (1991) caution that in attempting to meet this objective of information usefulness to investors, accountants have become trapped in a mode of "vertical thinking" as opposed to "lateral thinking". They borrow the definitions

of vertical and lateral thinking from Edward de Bono (1985, 1988), whom they refer to as a management guru.

> "Vertical thinking is defined as the thought that goes into improving one's current lot -- making one's hole a better place, while lateral thinking focuses on the creation of new holes" (p. 118).

They claim that accountants have imposed on themselves the constraint of double-entry bookkeeping as reported on by Pacioli in the fifteenth century, and by the typical financial statement presentation containing single valued point estimates expressed in currency units. They suggest that by keeping that constraint in place accountants can only try to improve their current hole, and that in order to create a new hole accountants must be willing to challenge these constraints. Their complaint seems to be the result of the inability of traditional DCA accounting to meet the goal of information usefulness without sacrificing the objective of accountability. Our description of Mercantile and Industrial accounting systems illustrates that when accountability was the main goal, DCA accounting in the form of double-entry bookkeeping worked well. When information usefulness became important, the DCA system fell short. Instead of looking for a new accounting model (a new hole, as Burton and Sack suggest) accountants merely imposed new standards and rules onto the old model. This action has not only failed to meet the objective of information usefulness, it has put at risk the requirement of accountability.

Burton and Sack's (1991) concern that accounting research consists mostly of vertical thinking rather than lateral thinking is an echo of Cushing's (1989b) contention that accounting research is in danger. They criticize accounting research as not having enough innovation, and state that because of this, "The impact of accounting research on courses is negligible. Its impact on the practice of accounting is less." (p. 122). Such a claim supports Cushing's contention that accounting research is in a stage of crisis. This crisis has been recognized by numerous other researchers beginning shortly after the accounting regulations began to proliferate, and continuing into the present. In the early twentieth century, accountants began to see that the traditional double-entry accounting system was becoming unable to meet all of the objectives of accounting data. Accountants who were trying to make accounting information reflect as well as possible the earning power of firms (per the government's mandates) were doing so at the expense of the accountants who wanted information to make internal decisions. Many external users have questioned the ability of the accounting information as provided in typical financial statements to even adequately reflect the earnings power of firms. Hawkins (1968) quotes Professor L. Vann Seawell of Indiana University as saying in 1959 "It is impossible for me to avoid a conclusion that corporate reporting to shareholders is in some respects a financial fantasy" (p. 277), based on the lack of a satisfactory definition of "generally accepted accounting principles" upon which corporate financial statements are based. He claims that the result has been no general agreement among practicing public accountants as to the proper accounting treatment applicable in many important areas of financial reporting. This is evidence that while the double entry system has proven to be excellent for recording the give and take nature of transactions, the addition of other considerations and conventions puts a strain on this system.

IV. REA ACCOUNTING AS AN INFORMATION AGE PARADIGM

Databases seem to be the key to meeting the current information needs of management, investors, and government or social agencies. Each of them needs accounting information in different formats and at varying levels of aggregation. The REA accounting model provides the structuring templates from which databases can be developed that will allow accounting and non-accounting objectives to be met. REA accounting can be used in conjunction with electronic commerce, and provides a high degree of integration between accounting, purchasing, production, and other departments. REA accounting offers a solution to the problem of restating financial information in conformance with multiple sets of standards. All data are entered and stored in elementary form. All aggregations of the data take place in separate views. Thus there can be a view for preparing US financial statements that will organize the transaction level data in accordance with U.S. GAAP. The same system can contain an international view that will organize the transaction level data into financial statements that meet international accounting standards.

Financial reporting is not the only aspect of the global economy that requires more information flexibility. Management accounting is more difficult at the international level because of the quantity and variety of information needed. International transfer pricing, cost allocation between international segments and exchange rates are just a few of the facets of accounting that are more complex than those found in a typical domestic corporate environment. Danos and Measelle (1990) believe that to cope with the complexity and diversity of global organizations, decision making should be decentralized and lines of authority should be less formal. This will require that information be decentralized as well, in order to support such decisions in an efficient manner. This decentralization would be difficult to achieve with a traditional double-entry system. Firms would likely implement a distributed database of information separate from their accounting system, with the parts of the database being stored closest to where they are most often needed, but accessible from all locations that may need them. This technique would be similar to many existing companies' support of decision making. Many firms keep one or more databases of information separate from their financial accounting system, in order to support cost accounting and other managerial decisions. A single distributed database is more desirable because it would eliminate the data inconsistencies that are inevitable in multiple databases.

Cushing (1989a) is excited about the possibilities in accounting for the use of databases. He surmises that "Database disclosure may provide society with an opportunity to more fully achieve the promise of the information age.... Enhanced access to accounting data would facilitate the evolution of accounting research toward a more scientific basis." (p. 50). However, he warns that in order to achieve this promise, "the soundness of the double-entry model that has circumscribed accounting thought for over 500 years would likely be severely tested." (p. 50). There is no doubt that many will resist changing from the traditional double-entry system. It is this resistance to change that Beaver and Rappaport (1984) claimed would be the major obstacle to implementing database financial reporting. They point out that the accountant's transformation of raw cash-flow data imposes costs for those analysts who prefer to use the company's cash flows before the application of accrual accounting procedures. They suggest that an electronic financial database could be developed which could produce conventional financial statements as well as other analyses. For instance, users could prepare financial statements under many different accounting assumptions. They could compute multiple net income figures and could even merge data from a specific company with industry data. However, they note that this "let the

user choose" approach will change the present corporate reporting system enough that it "no doubt will be vigorously debated. It is already technically feasible. If it does not come to pass, the reason probably will be political, not technological." (p. 16).

The resistance to change described by Beaver and Rappaport is evident when one examines the common applications of computers today. Most accepted uses of computers to date have been simple automation of tasks whose nature hasn't really changed. For example, the switch from typewriters to computers for secretarial tasks has become widespread. Word processing does not really change the nature of typing. The keyboard looks much like a typewriter, with just a few more keys. It requires the user to learn some commands, but rewards them for doing that by making things like correcting mistakes or rearranging text much easier. Much less acceptance has been given to computerized schemes that involve more drastic changes in the way people behave or do business. It has taken much longer than expected for tools such as electronic mail and electronic data interchange to gain support. We must find a way to overcome this resistance to change, because both of the key factors that demand a change in accounting methods are present today. Technological developments made it possible, and changes in information needs made it necessary for the agrarian accountants to stop using clay, sticks, and mere lists of assets, and instead become industrial accountants, using pencil and paper or bookkeeping machines and double-entry accounting. Recent technological developments have made it possible, and newer forms of business organizations and strategies have made it necessary to again change the way accounting is done. This change needs to be away from the use of DCA accounting systems (whether manual or computerized) and toward the use of semantically modeled accounting systems such as REA accounting. REA accounting can provide information in virtually unlimited useful formats, without jeopardizing the accountability foundation.

V. SUMMARY -- THE CASE FOR CONCEPTUAL ACCOUNTING MODELS

As we said at the outset, our discussions in this paper have centered on different types of accounting systems, and we have followed the evolution of such schemes through the agrarian age, the mercantile and industrial age, and the information age. We introduced the Wola people and the story of Margaret and Mary near the start of our paper in an attempt to show people that accounting can be done in a substantively different way from double-entry-methods. The give-and-take concept organizes Wola society, but to us it also organizes commercial economic activity. To summarize our arguments, let us state the following:

> We consider that the primary purpose of an accounting system is tracking the events that affect economic resources. Commerce fundamentally involves "give-and take" activities where one gives some resource up in the paired expectation that some other resource will be received in return. The REA accounting model is a conceptual representation of this scenario as is the traditional DCA accounting model which involves double-entry on either side of the basic equation of **ASSETS = LIABILITIES + EQUITY**. The architecture of these parallel systems is illustrated in Figure 10. In very limited economic decision-making situations, there is little advantage to conceptual modeling because of the extra effort involved in learning its unfamiliar ideas. As systems become more technologically advanced however, the artifactual overhead associated with the use and maintenance of DCA systems becomes burdensome. For technological reasons

discussed already, database accounting concepts provide a better infrastructure for modern information system architectures. The marketplace trend seems to be moving away from the DCA systems and toward REA systems (see David, McCarthy, and Sommer 1996 for a more complete discussion). However, much progress remains to be made to achieve a full REA system with all of its advantages.

Earlier in the paper -- right after the Wola example -- we mentioned four specific advantages that accrue to semantic modeling of economic phenomena. We will end by reiterating those benefits in their more general format.

1. Semantic models encourage standardized use and definition of information structures across organizational boundaries. This is the traditional database rationale, and it allows accounting data to be integrated and used with that of marketing, manufacturing, distribution, and others. In a cost-benefit sense, this particular advantage supplies enough of a reason to use conceptual methods because the payoff is usually significant and relatively certain. The major barriers to implementation in current corporate systems involve overcoming the organizational inertia associated with entrenched accounting software (especially where it uses bookkeeping naming constructs) and overcoming the software applications backlog.

2. Conceptual models make intellectual complexity manageable by using natural primitives that abstract to generalized descriptions of structures which in turn cover many thousands of cases with as few exceptions as possible. In any complex computer system, the mass of detail quickly overwhelms potential users, and they must find abstractions that make understanding, review, and use of the system tenable goals. This is especially true with disaggregate transaction processing systems such as that shown with M&M where the detail initially seems staggering. The well-defined methods of semantic abstraction and relational retrieval mitigate this complex use. An experimental use of these complexity management facilities has been proposed by Gal and McCarthy (1991) who propose to use them for internal control specification in highly-complex transaction processing systems.

3. Conceptual models allow for the possibility of system-based inference and learning. To the extent that the abstraction and reasoning processes of humans can be captured in the semantic specification of an information system, that system will be capable of responding to incomplete or ambiguous questions, of estimating or filling in missing data values, and of completing or altering mis-specified plans. This kind of inferencing will be especially important for knowledge-based decision support systems which have objects that correspond exactly to the types of accounting entities (i.e., events, agents, and resources) seen in an REA database.

4. Conceptual models allow for greater system adaptability. The use of system primitives which closely mirror the underlying phenomena leads to a narrow semantic gap between the system and reality, and thus make it easier to adapt the system when the reality is changed.

Double-entry accounting really cannot participate fully in the conceptually-oriented information structures of today. It maintains a view of economic phenomena that many decision-makers still need, but it should be kept as just that: a view as opposed to a guiding principle of architectural organization. System designers who insist on subjecting economic phenomena to classification on accounts within the bounds of a company's enterprise schema (that is, its basic definitions of its information objects) are simply taking steps toward isolating that data from integrated and varying use.

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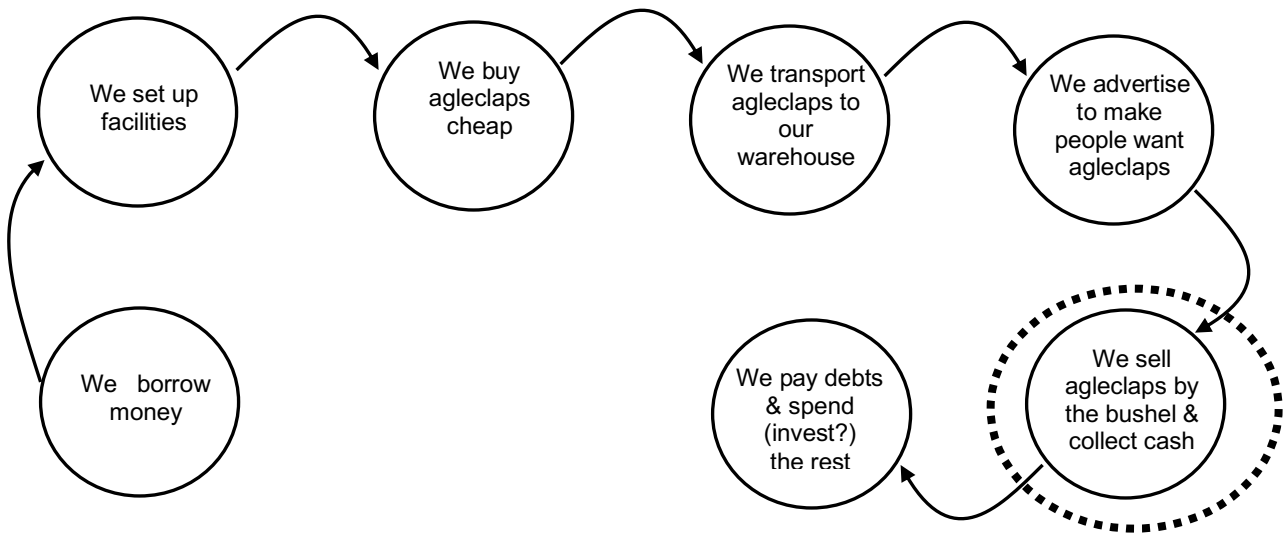

SCRIPT – The story of M&M Enterprises
SCENES – Buy, sell, spend, etc.
ROLES – Customers, employees, vendors, etc.
PROPS – Cash, inventory, buildings, etc.

Figure 1 -- M&M Script

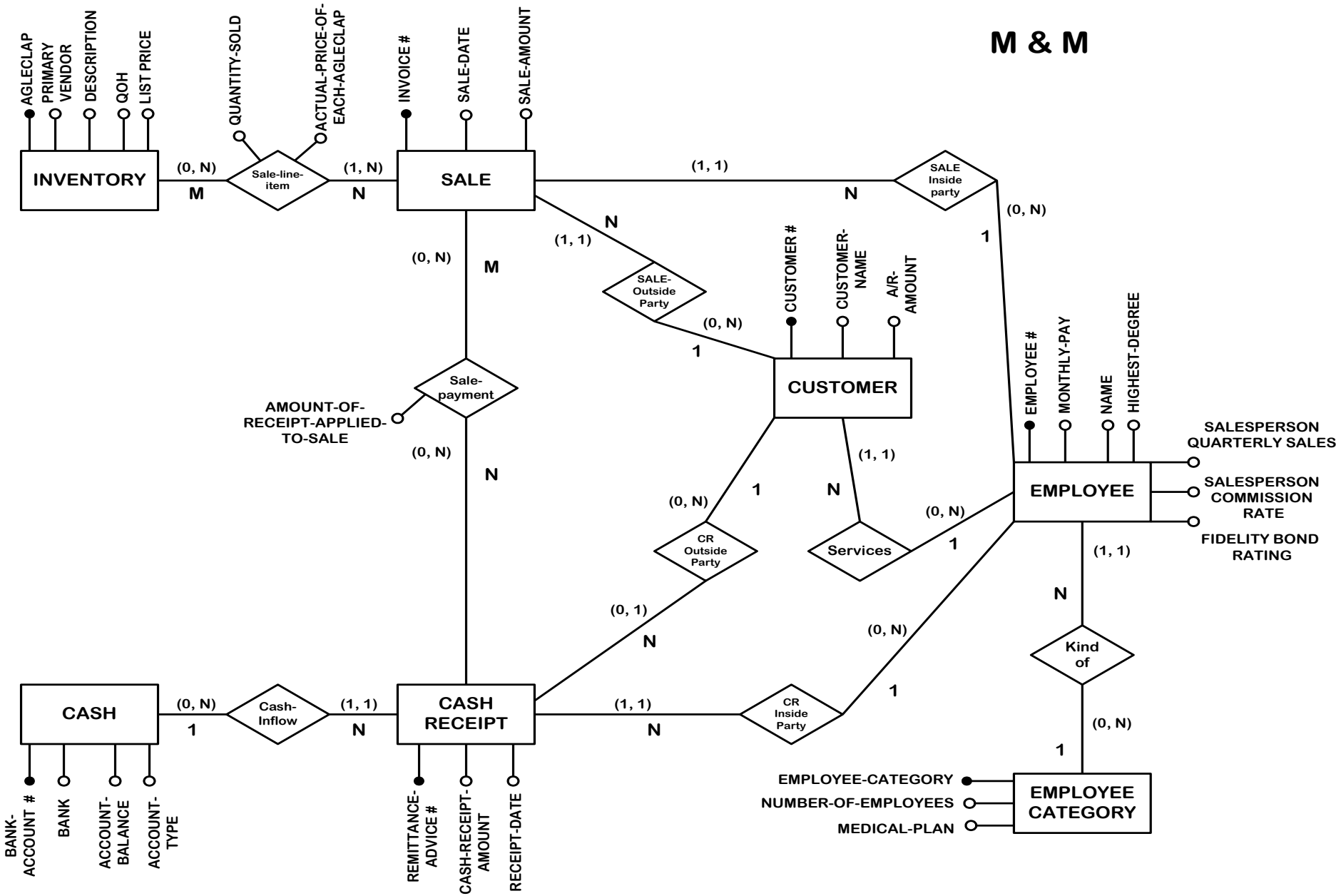

Figure 2 -- Revenue Cycle Sub-script (in Entity-Relationship format)

Figure 3 M&M Database Tables

CASH

Bank Account #	Bank	Account Balance	Account Type
BA-6	BOSTON-FIVE		CHECK
BA-7	SHAWMUT		CHECK
BA-8	SHAWMUT	$75,000.00	DRAFT
BA-9	CHARLESTOWN		CHECK

CASH RECEIPT

Remittance Advice #	Receipt Date	Cash Receipt Amount	Bank Account #	Customer #	Cashier Employee #
RA-1	July 25, 1991	$1,666.00	BA-6	C-2	E-39
RA-2	July 26, 1991	$10,000.00	BA-7	C-2	E-39
RA-3	August 15, 1991	$7,200.00	BA-7	C-1	E-39
RA-4	August 15, 1991	$32,600.00	BA-7	C-5	E-39
RA-5	August 25, 1991	$1,666.00	BA-6	C-2	E-39

CUSTOMER

Customer #	Customer Name	A/R Amount	Salesperson Employee #
C-1	BILL		E-12
C-2	MICK	$6,668.00	E-10
C-3	KEITH		E-10
C-4	CHARLIE		E-99
C-5	RON		E-10
C-6	ROGER		E-99
C-7	JOHN		E-99
C-8	SCOTT		E-12
C-9	EDDIE		E-10

EMPLOYEE CATEGORY

Employee Category	Number of Employees	Medical Plan
CASHIER	2	PHP
EXEEXECUTIVE	2	PHP
SALEPERSON	4	WAUSAU

EMPLOYEE

Employee #	Employee Name	Highest degree	Monthly Salary	Salesperson Quarterly Sales	Salesperson Commission Rate	Fidelity Bond Rating	Employee Category
E-10	CAROL	MBA	$4,000.00		10%		SALEPERSON
E-12	BOB	BA	$3,000.00		12%		SALEPERSON
E-13	LARRY	PHD	$800.00			Z	CASHIER
E-39	MOE	HS	$1,000.00			AA	CASHIER
E-78	ALICE	BA	$2,000.00		15%		SALEPERSON
E-99	TED	MBA	$2,000.00		10%		SALEPERSON

INVENTORY

Agleclap #	Description	List Price	QOH	Primary Vendor
A-1	BIG- A	$2,500.00	10	V-6
A-2	DELUXE - A	$3,500.00	12	V-3
A-3	POCKET- A	$1,500.00	15	V-2
A-4	LITTLE - A	$700.00	100	V-6
A-5	MICRO- A	$4,000.00	20	V-3
A-6	FROZEN- A	$8,000.00	30	V-8

SALE LINE ITEM

Invoice #	Agleclap #	Quantity Sold	Actual Price
INV-1	A-1	3	$2,000.00
INV-1	A-4	2	$600.00
INV-10	A-4	10	$3,000.00
INV-10	A-5	1	$2,000.00
INV-11	A-2	4	$6,000.00
INV-12	A-3	12	$2,000.00
INV-2	A-6	2	$5,000.00
INV-3	A-1	1	$2,000.00
INV-3	A-3	6	$1,000.00
INV-3	A-5	2	$4,000.00
INV-4	A-6	2	$5,000.00
INV-5	A-2	2	$3,000.00
INV-5	A-4	2	$300.00
INV-5	A-6	2	$5,000.00
INV-6	A-2	10	$3,500.00
INV-7	A-5	3	$3,000.00
INV-7	A-6	2	$7,000.00
INV-8	A-1	3	$2,000.00
INV-9	A-2	2	$3,000.00
INV-9	A-6	1	$3,500.00

SALE

Invoice #	Sale Date	Sale Amount	Customer #	Salesperson Employee #
INV-1	July 7, 1991	$7,200.00	C-1	E-12
INV-10	August 23, 1991	$32,000.00	C-7	E-99
INV-11	August 24, 1991	$24,000.00	C-9	E-10
INV-12	August 25, 1991	$24,000.00	C-1	E-12
INV-2	July 21, 1991	$10,000.00	C-2	E-10
INV-3	July 22, 1991	$16,000.00	C-5	E-10
INV-4	July 26, 1991	$10,000.00	C-2	E-10
INV-5	July 31, 1991	$16,600.00	C-5	E-10
INV-6	August 15, 1991	$35,000.00	C-3	E-10
INV-7	August 21, 1991	$23,000.00	C-4	E-99
INV-8	August 22, 1991	$6,000.00	C-6	E-99
INV-9	August 22, 1991	$9,500.00	C-8	E-12

SALE PAYMENT

Invoice #	Remittance Advice #	Amount Applied
INV-1	RA-3	$7,200.00
INV-2	RA-1	$1,666.00
INV-2	RA-5	$1,666.00
INV-3	RA-4	$16,000.00
INV-4	RA-2	$10,000.00
INV-5	RA-4	$16,600.00

Figure 4 -- The M&M Story

ONCE UPON A TIME, Margaret and Mary decided that the worldwide market for agleclaps was underdeveloped……..etc., etc., etc……..

LATER ON,

ONCE UPON A TIME, with Invoice #1, Bill bought two little agleclaps each costing $600 and three big agleclaps each costing $2,000 for a grand total of $7,200. On the 15th of the following month of August, he paid for these items with a check.

ONCE UPON A TIME, with Invoice #2 on 21 July, Mick bought two frozen agleclaps at $5,000 each. Mick decided to spread his payments for this sale over the course of six months, so he made his first installment of $1,666 on July 25th and his second on August 25th with the next one due on September 25th. Mick loved his first frozen agleclaps plus he figured that he got a great deal at five grand because they actually listed at $8,000. After having his agleclaps just five days, he bought two more at the same price. M&M wouldn't extend him any more credit (his sales rep Carol thought he looked untrustworthy) so he had to pay cash for his second set.

ONCE UPON A TIME, Ron bought the following items from M&M on Invoice #3

One big agleclap @ $2,000	$ 2,000
Two micro agleclaps @ $4,000	$ 8,000
Six pocket agleclaps @ $1,000	$ 6,000
	$16,000

Ron really enjoyed his agleclaps, so a week and a half later on the 31st of July, he sampled the rest of the M&M line for about the same amount of money by purchasing a couple of deluxe, frozen, and little agleclaps. He paid for both invoices on August 15th with remittance advice #4. Moe received Ron's check for $32,600 and deposited it into the company's checking account at the Shawmut bank.

LATER ON THAT SAME MONTH, Keith and Charlie heard about these great agleclaps from Bill, Mick, and Ron, so they decided to try some for themselves. Keith bought $35,000 worth and Charlie $23,000. Both men intended to pay on September 15.

YACKETY-YAK, YACKETY-YAK…….(the rest of the story)…….

Figure 5 -- Accounting Through The Ages