

Accounting Rods: New Visibility with Analog Financial Statements by DSG/3000

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Synopsis

In recent years the investment community, the government and the accounting profession have focused attention on the meaningfulness and intelligibility of financial statements, to match their accuracy and timeliness.

Computers have made a major contribution to the issue of accuracy and timeliness. Computers are beginning to make a contribution to the issue of meaningfulness and intelligibility.

A team of development engineers and performance engineers at Hewlett-Packard have devised an HP3000 implementation of financial statements -- traditionally presented in digital form -- in analog form using the Vernacular of the Rod as conceived by the musician/teacher Georges Cuisenaire and adapted for accounting statements by Dr Irwin Jarrett.

Cuisenaire, with the native mode of the human CPU and I/O subsystems being analog, evolved the Vernacular of the Rod to facilitate understanding the analog-to-digital conversion fundamental to mathematics, the second degree of abstraction of Aristotelian epistemology.

The application of computer graphics to produce financial statements and ratios in this vernacular provides visibility into the health, performance and trends of a business enterprise that is both efficient and effective because of its intuitive nature -- an interesting blend of vintage psychology and the leading edge of computer business graphics technology.

Speed and Comprehension Out of Synch

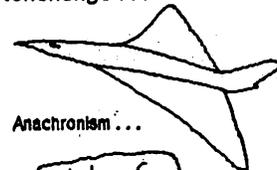
Faster than the Speed of Time

If you're near Heathrow about 10 o'clock in the morning, you can hear a jet roar in the distance. If you look over in the direction of the airport you can see the Concorde Supersonic Transport climb, bank to starboard, undroop its nose and disappear quickly into the West.

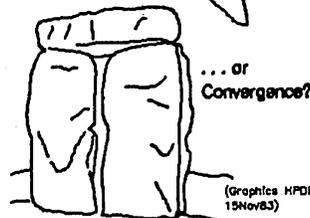
It will touch down at Kennedy in New York *an hour ago*. *Not an hour from now*. An hour ago. It will get to New York in under four hours. That's faster than the time will get there. Faster than the speed of time.

That's fast. The Concorde even *looks* fast. Even when its sitting in a hangar. Next time you're on your way to Cornwall stop by the Royal Naval Fleet Air Museum at Yeovilton in Somerset, a couple of hours west of London. The original Concorde is there where you can walk up and touch it, go inside, see the incredible array (12 tons) of instrumentation used in debugging it (3000 sensors).

(That's about 50 miles from the mysterious prehistoric edifice at Stonehenge ...



Anachronism ...



... or
Convergence?

(Graphics HPDRAWn
15Nov83)

... just like the British to put those two together. That must have been what they had in mind when they

Invented the word "anachronism." Or maybe, if you believe some of the theories about Stonehenge, the word "convergence").

The Staging Area for the 21st Century

Anyhow, that's the way it is here in the mid-80's, the Staging Area for the 21st Century. *Fast.*

And if you think the SST's fast then *take a look at our computers.*

We've got a laser printer that prints 45 pages a minute. It's got a feature that prints these pages 4-up on a single physical page. That's the equivalent of over 10,000 lines a minute on a impact printer. *Fast.* (Actually, we position it as a mid-range performance printer - so it's *not* the fastest in the world).

If the average annual statement of an average sized company is 20 pages, you could print 2 of them every minute, or 8 of them a minute if you stacked them 4-up.

But Who Can Read That Fast?

If you take your top speed-reader accountant or investment analyst or acquisition lawyer or stockholder and give her two annual statements a minute to read, you have a problem.

If the Concorde gives you jet lag, you might call this computer lag or maybe computer (user) lag.

Our computers are so fast they can give us *more information in a shorter time than our physical and mental learning facilities can handle.*

Even If We Could, What Does It Mean?

We've come a long way from the Era of the Green Eye Shade. Computers have eased the crisis that we used to have at the end of every accounting period when we'd try to close. It took an army of bookkeepers working through the night, trying to find that penny off, wading through the lower level constructs, building up to the final statements.

Computers have brought relief to the speed and accuracy issues of closing and producing financial statements. So much relief, in fact, that folks interested in the accounting profession -- like the American Institute of Certified Public Accountants, the Securities and Exchange Commission of the Federal Government, stockholders, lending institutions and other creditors -- have started to focus on making the statements more meaningful and intelligible.

The goal is to take an annual report that is timely and accurate and gives full disclosure, and get it into a form that the ordinary prudent person can look at and get a correct message from without being an attorney or professional accountant and without spending an excessive portion of her lifetime mulling the numbers.

Some Thought on Thought

Our Native Mode: Analog

A couple of thousand years ago, in Greece, a fellow named Aristotle started thinking about thinking. How do we get to know things?

Now later such thoughts on thinking got compiled into a science they call Epistemology. As time passed, some interesting components evolved, like:

Actually, it's not thinking but dreaming.

Actually, you can't know anything for sure -- except that you can't know anything for sure.

Actually, you can't know anything for sure -- including that you can't know anything for sure.

I must think so I can infer that I exist so I can publish my book on Ontology.

Etc.

Unfeathered Risible Biped With Opposing Thumb

But Aristotle came too early to get into all this (except maybe the dreaming part that Plato seems to have told him about) so *he thought he thought.* And the way he thought he thought went something like this:

All knowledge comes thru the senses. We see, feel, smell, hear "things." As "objective reality" [whatever that may be, if anything] impinges on our sense perceptors, we capture and internalize "objective reality" in several "degrees of abstraction." Let's look at some of these:

The first degree of abstraction from "reality" is an image, a picture: I close my eyes and think "person" and I "see" this figure with head and arms and legs and all that.

The second degree of abstraction is mathematical: I think about that "person"

and if I strip away color, shape, arms, legs and other image components, I end up with an attribute we call "quantity." I'm aware of one-ness (or two-ness if I "image" two people or "n-ness" if I "image" n people).

There's also a third degree of abstraction that deals with "person-ness" or "substance" and gets into metaphysical gropings like "unfeathered risible biped with an opposing thumb" and other feeble generics -- but that can get to be quite a wicket, so we'd better stick with the first two for getting at accounting reports.

A Picture's Worth a Thousand . . .

Now those of us who think a picture's worth a thousand words probably have a little Aristotle in us. (The "picture" maps to the first degree of abstraction.)

And if a picture's worth a thousand words, it's probably worth at least a few dozen numbers in your typical annual report.

But let's not jump ahead without looking at an important link in the chain to analog financials.

From Greece to Belgium

Let's leave Aristotle and move a few hundred miles northwest and a millennium or two later.

There was a musician in Belgium named Georges Cuisenaire (1891-1976) who was a school teacher. One day he found one of the young children in his class crying over his math book. He just *couldn't learn it*. This touched Cuisenaire so that night he brainstormed the problem in search of a better way to teach math concepts.

He tried cutting some wooden rulers into a variety of proportional pieces. He color-coded the rods and from his musical background developed the "keyboard for mathematics."

The Vernacular of the Rod

He took the rods to school with him and started experimenting. With the "little colored sticks," or "rainbow rods" as they were later called [4], he found the children were "learning by doing, learning by experience," getting to the second degree of abstraction (the quantitative) with very powerful analog images in the first degree of abstraction. The students moved out of a passive role into an active role, with their sense of sight and their tactile sense busy in the process -- one of the basic techniques of modern educational psychology.

When 5-year-olds were able to do matrix algebra through the instrumentality of Cuisenaire rods, the methodology had established that a natural gateway to the digital world of the second degree of abstraction was an analog world somewhere this side of the first (specific image) degree of abstraction --

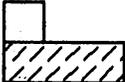
maybe about a 1.5 degree of abstraction (generic image).

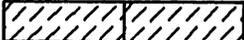
The children could intuitively "see" and "feel" greater-than, less-than and sums. A rod placed on top of another left a void at the end -- the remainder of subtraction. With a natural extensibility there came factors, commutation, fractions and base-10 concepts. The analog of the proportional rod seemed to be a natural facilitator for getting at the digital concepts. They were not memorizing formulas. They were *perceiving relationships*.

Here are some of the basics of the Cuisenaire® Rod Methodology:

 one  $1 + 1 = 2$

 $1 + 2 = 3$

 one over three = $1/3$

 $2 * 3 = 6$
 $6 / 2 = 3$
 $3 * 2 = 6$

 $6 - 4 = 2$

(Graphics HPDRAWn
15Nov83)

The youngsters were able to "see" addition, subtraction, multiplication, division, factors, fractions, commutation, permutation. They were *perceiving relationships*.

® Cuisenaire Company of America, Inc, 12 Church Street, Box D, New Rochelle, NY 10805.

Getting It All Together for Financial Statements

... And Then on to the Land of Lincoln ...

In Springfield, Illinois, Dr. Irwin Jarett, a CPA, business graphics expert and accomplished lecturer, was investigating the problem of meaningful and intelligible financial statements. As a CPA, Dr. Jarett was not only knowledgeable of the technical derivation and implications of conventional financial statements but also sensitized to the importance of making them a vehicle of effective communication for their expanding audience.

With this background, Dr. Jarett brought together his extensive knowledge of business graphics, the current computer technology supportive of this discipline, and the Vernacular of the Rod that Cuisenaire had used so effectively in the disciplines of music and mathematics.

The resulting synthesis is a GMIS (Graphics Management Information System) that makes a positive contribution to the goal of meaningful and intelligible financial statements [3].

In addition to the concepts of communicating quantitative information reinforced with analog imagery, Dr Jarett's GMIS offers a structure, a systemic approach to the capture, flow and formatting

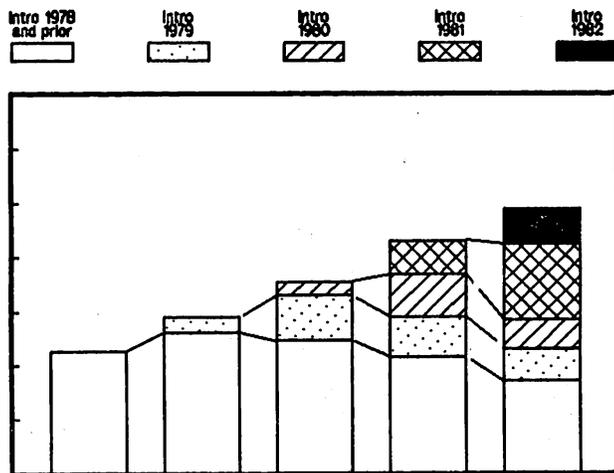
of the amorphous data into an orderly and digestible product.

A DSG/3000 Implementation

Here you'll see some of the concepts of the Jarett Method used in a DSG/3000 (Decision Support Graphics) implementation on the HP3000 computer. You'll see portions of an actual annual statement from a *real company*. *It's not very randomly selected* but perhaps one most of us have heard of and maybe have some interest in.

Of Rods and Laser Beams ...

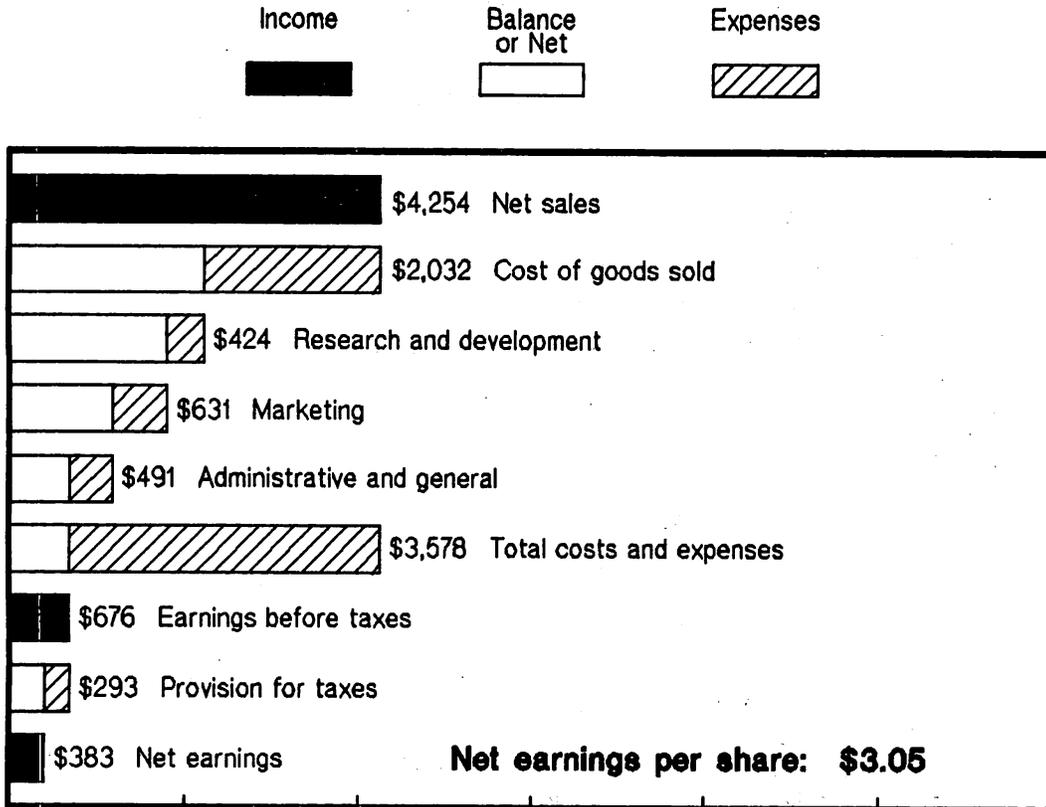
You'll see the statements presented in the Vernacular of the Rod. The final product is integrated via TDP/3000 (Text and Document Processor) and hardcopy generated through the text and graphics capabilities of the HP 2680 Laser Printer to produce in a single operation the document you have in your hand. To give you a hint as to what company we've *unrandomly* selected and an example of the time-series format of the rods, here's a product aging chart:



Product Aging: 1978-1982 Orders by Introduction Group
Graphics by DSG/3000 15Nov83

Hewlett-Packard Company

Statement of Earnings for Year Ended October 31, 1982



Millions (except Earnings per Share)
(graphics by DSG/3000 15Nov83)

The Income Statement

Here's the income Statement with the analog rod to help give meaning to the numbers. Without looking at the numbers, you can see the big revenue rod get whittled down by a variety of the costs of doing business.

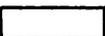
About half is for the labor and material and burden that it takes to make the product. A tenth goes into R&D as you would expect in a company whose success is based on a steady stream of innovative

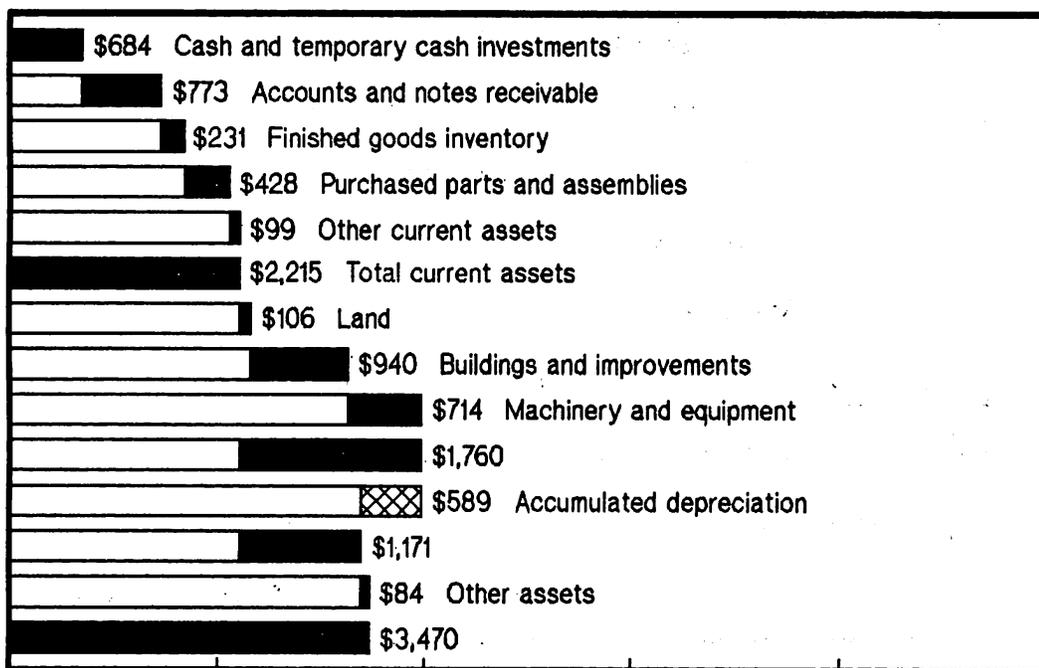
quality products in one of the most creativity-driven industries in human history. A sixth goes into Marketing -- getting the product into the hands of the customer and supporting it for a good return on the customer's investment. About a seventh goes into G&A, and half of what's left to taxes.

In a glance you can get a reasonably good first-order calibration on components and relativities in the income Statement, the Anatomy of the Dynamics of a business enterprise.

Hewlett-Packard Company

Balance Sheet as of October 31, 1982 - Assets

Balance or Net	Assets	Offset
		



Millions
(graphics by DSG/3000 15Nov83)

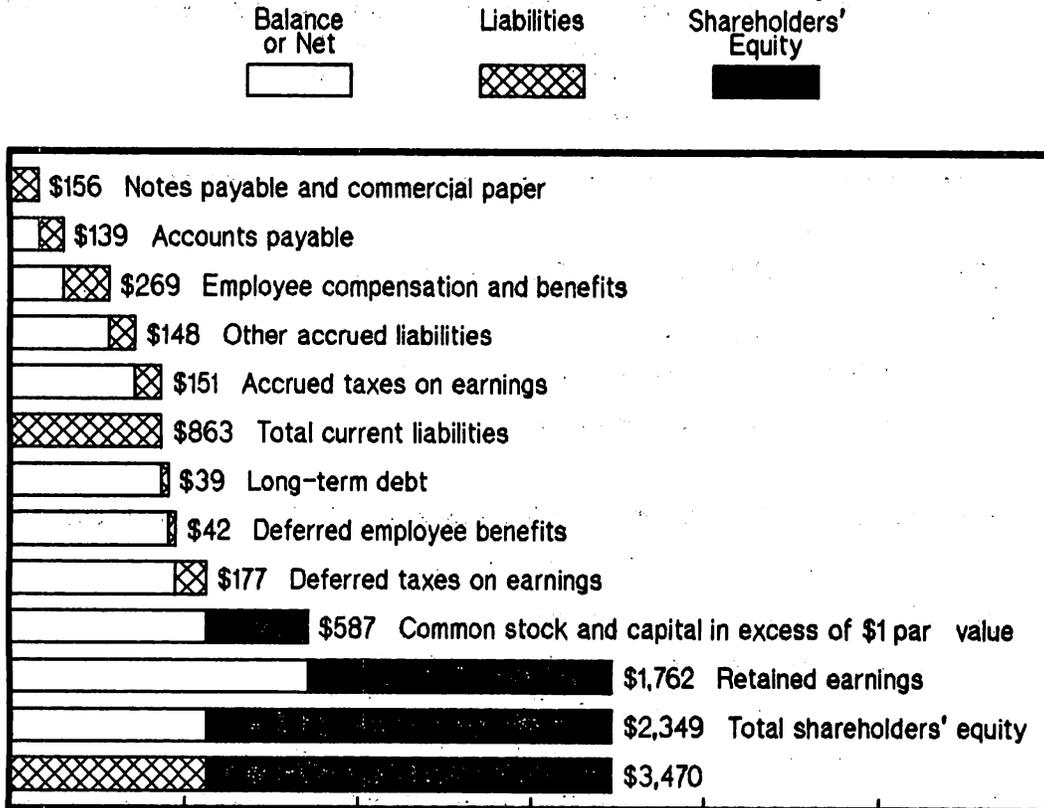
The Balance Sheet

Now for the Anatomy of the Statics of a business enterprise, let's look at the Balance Sheet. Here we can see, again at a glance, not just that it balances -- but some of the relativities of assets and liabilities,

things owned versus things owed, things more current and temporary and things more long-term and permanent. We can see basic components in proportion, and groups of components, to get a feel for how it's going even before looking at the numbers.

Hewlett-Packard Company

Balance Sheet as of October 31, 1982 - Equities



Millions
(graphics by DSG/3000 15Nov83)

In the Balance Sheet we can get a message from both the big rods and the little rods. Finished goods inventory is about 1/15 of total assets, reflecting a constant pressure to keep that number no greater than is necessary to give good service to customers. About 1/5 of the total assets is in equipment, reflecting a serious commitment to productivity.

On the equity side, a noticeably small rod carries the caption "Long-term debt" (about 1% of total assets), and a big rod is captioned "Retained earnings" (about 1/2 of total assets). This reflects the conservative "HP Way" of financing an aggressive growth program (15-30% a year over the past 5 years), staying "out of the bank" and providing growth funds from earnings.

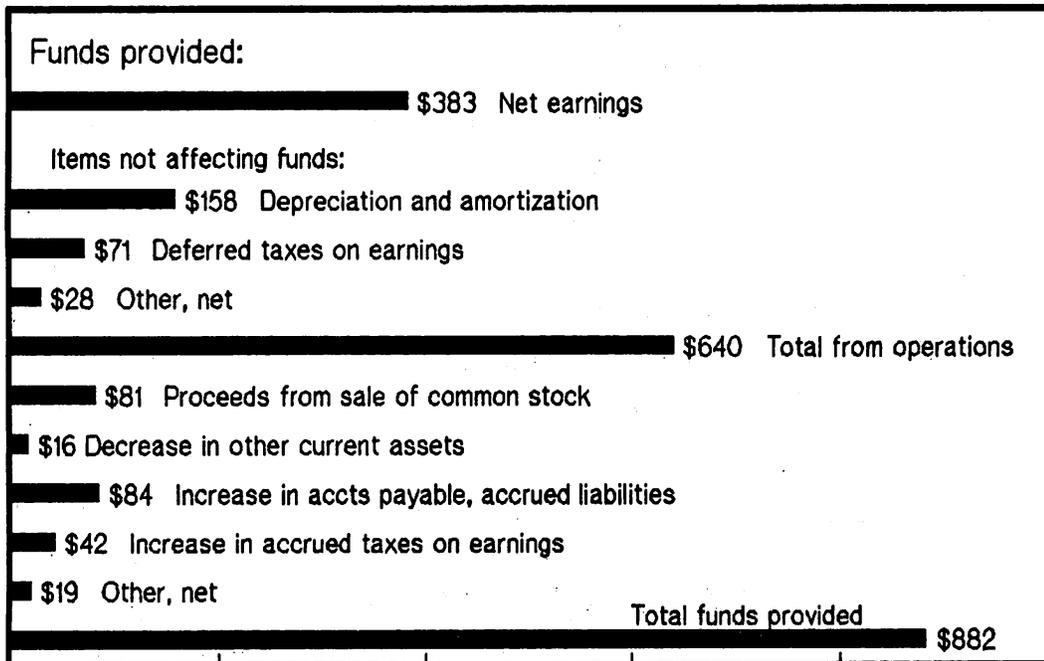
Hewlett-Packard Company

Changes in Financial Position -- Funds Provided Y/E 10-31-82

Funds
Provided



Funds
Used



Millions

(graphics by DSG/3000 15Nov83)

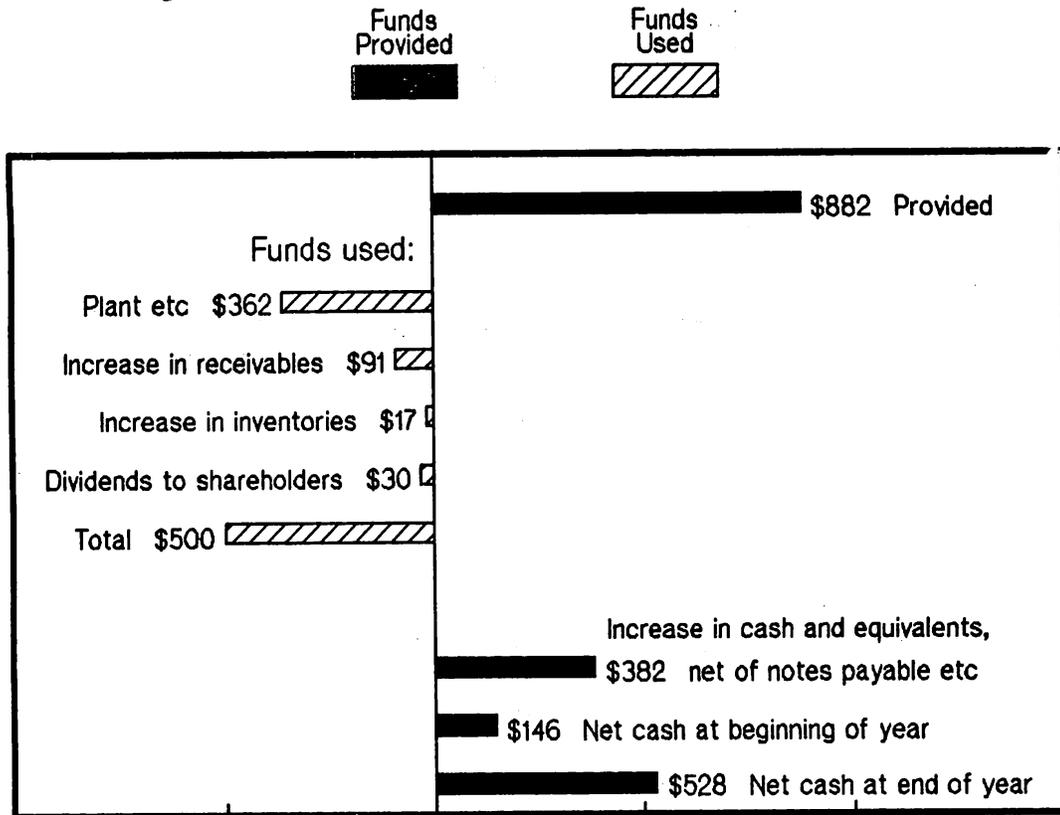
The Statement of Changes in Financial Position

After the funds-provided section there's a variation from using the rods in a components or

parts-of-the-whole format. In the second section you can see variations around a zero point, with funds provided on the positive side and funds used on the negative side.

Hewlett-Packard Company

Changes in Financial Position -- Funds Used Y/E 10-31-82



Millions
(graphics by DSG/3000 15Nov83)

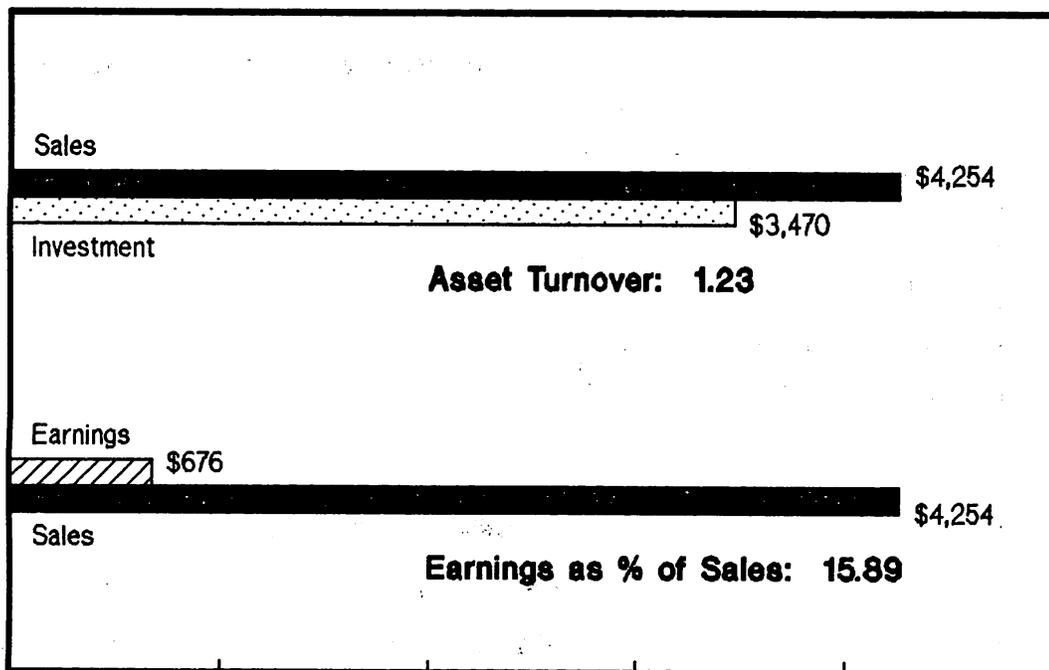
Some numbers the rods point up here include the big one for investment in property, plant and equipment. This indicates that the growth in sales and earnings we saw earlier is not a transient aberration but a

planned phenomenon of foundation and substance. The accounts and notes receivable rod reflects some recent leasing and credit innovations to support customers in their productivity investments.

Hewlett-Packard Company

Asset Turnover and Earnings:Sales for Y/E October 31, 1982

Total Investment
Sales
Earnings



Millions (except ratios)
(graphics by DSG/3000 15Nov83)

Beyond the Basics

In addition to using the rods in the basic financial statements of the annual report, the technique can give new visibility in other sectors. This is an example of fractional and division rods in action.

The duPont Company has traditionally rated as a well-run company. The duPont system of financial control is considered classic and is a standard component in many finance and accounting curricula in universities across the country [1].

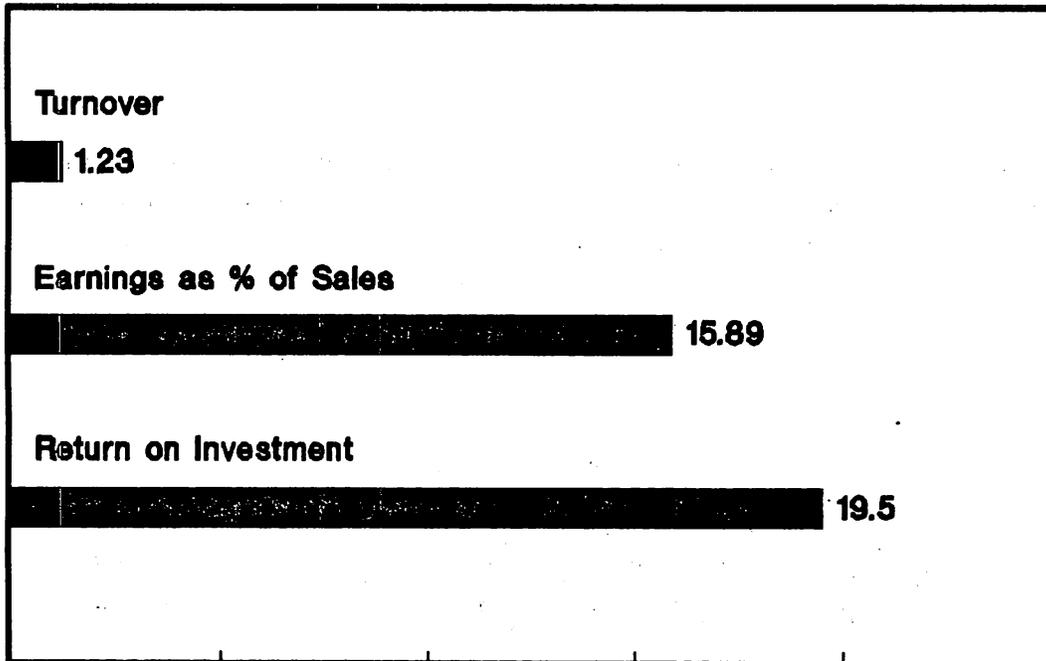
The system focuses on a measurement called Return on Investment (ROI). A business enterprise exists primarily to make a profit. To make this profit, it uses assets. It's the profit you make on the assets you have that are the factors in ROI.

If you don't control your expenses, you cut into your margins and hurt your ROI. If you try to brute-force it with assets, your asset turnover goes down and your ROI can take a beating. If you cut into your marketing and R&D expenses for short-term expediency, you can hurt your sales and therefore your earnings and therefore your ROI.

Hewlett-Packard Company

Return on Investment for Year Ended October 31, 1982

ROI
Components



Turnover times and percents
(graphics by DSG/3000 15Nov83)

The Anatomy of ROI

Here's a macro anatomy of ROI:

Combine your current assets with your permanent investment to get your total investment.

Divide your sales by total investment to get asset turnover.

Subtract cost of sales from sales to get earnings.

Divide earnings by sales to get earnings as a percent of sales.

Multiply this percent by the turnover rate to get Return on Investment.

You can see it here in the Vernacular of the Rod.

Conclusion

You've seen some DSG/3000 examples of the Jarett Method in action with some of the key financial statements used to show the health and trends of a business enterprise. You've seen the analog of gross income get reduced by the analog of the various sectors of expense typical of a manufacturing concern. As these various components take their toll, you are intuitively aware of relative impact from the relative size of the analog.

You've seen working capital ebb and flow; you've seen the Balance Sheet do just that, with a graphic analog reinforcing the numeric representation.

The Cuisenaire[®] Vernacular of the Rod is a vehicle to *transform data into information*. It's intuitively meaningful. The Jarett GMIS is a structure and discipline for implementation. And DSG/3000 is a productivity tool in using the Vernacular of the Rod to give new visibility to financial statements.

Bibliography

- [1] Brigham, Eugene F, and J Fred Weston, *Managerial Finance* (New York: Holt, Rinehart and Winston, 1966).
- [2] Finney, H A, and Herbert E Miller, *Principles of Accounting* (Englewood Cliffs, N J: Prentice-Hall, Inc, 1965).
- [3] Jarett, Irwin M, *Computer Graphics and Reporting Financial Data* (New York: John Wiley & Sons, 1983).
- [4] March, Rosemary, "Georges Cuisenaire and His Rainbow Rods," *Learning* (November 1977), pp 81-86.

About the Author

Sam Boles is a Systems Engineer in the Systems Performance Center at the Hewlett-Packard computer facility in Cupertino, California. With HP for seven years, Sam's computer experience started back in the AUTOCODER days of the 1401/1410, migrated thru the 360/370 era, and now focuses on HP hardware and software performance characterization. Sam earned his MS at UCLA in Information Systems.

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