Charting Results So We Can Understand and Communicate Them

The Standard Celeration Chart in Examples

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Agenda

- Introduction and Background
- Rationale and Principles
- Illustrative Examples
- Questions and Discussion

Reasons for Measurement
*Also TYPES of Measurement*

- Validation
- Accountability
- Decision-making

If you have data for making decisions, you’ve generally got the other two covered.

The Foundation of Measurement is
*Counting with Standard Units!*

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All Performance Occurs in Time
So Don’t Ignore The Time Dimension

Choose Time Intervals to Support Your Decision-making Frequency

- **Count per minute** each day to monitor skill learning
- **Count per day** to monitor on-the-job behavior
- **Count per week** to manage at the front line
- **Count per month** for executive decision-making
- **Count per year** for macro economics and long-term strategic planning.
Percentages are **Dangerous!**

- Can you *show* me a performance of 100% correct?

- \(100 + 20\% = 120\). *What is 120 - 20\%?*
  
  *(The answer is 96!)*

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**Percentage is NOT a measure of Performance.**

A given percentage increase is **not equal** to the same percentage decrease.

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100% Accuracy or Quality

*As Good as It Gets?*

?? “Overlearning” ??

We can’t see changes in behavior beyond accuracy-only

Percent correct is not a measure of performance. It is a *dimensionless quantity!*
NO Ceiling with Time-based Measurement!

The only upper limits are physiological or environmental.

Count per time is a true measure of performance.

Ratio is Quality or Accuracy

Days

Count per Time

The difference between experts & beginners is ...

Frequency comparison on some components and prerequisites of elementary skills (based on an unpublished pilot study conducted by Frances George and Deborah Pease).
But we can’t tell the difference with percent correct!

Rule About Percentages

Have you ever seen a budget or a balance sheet without the actual dollar amounts?

If you use percentages or ratios, ALWAYS show the original counts, too.
Multiply / Divide Charts Work Best

- Performance multiplies, it does not add.
- Multiply/Divide charts allow us to see and quantify trends independent of levels.
- Multiply/Divide allows us to see and quantify ratios and variability (bounce, range) independent of levels.
- Multiply/Divide allows us to see accuracy and productivity independently, but simultaneously.

Ogden Lindsley invented the Standard Change Chart
(aka Standard Celeration Chart)
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Accelerating trends multiply per week (or month, year, etc.)

Decelerating trends divide per week (or month, year, etc.)

(ac- or de-)celeration period
Ratios look the same independent of level. Use them to describe accuracy, bounce, deficits, PIPs, spread, change, or business ratios.
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Accuracy or quality can occur at different levels and change with different patterns.

We would only see ONE picture on a percentage graph for these six completely different patterns!

Celeration period is a week
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- Celeration period is a month
- Celeration period is six months

- Standard Celeration

**A Learning Chart**

Sample of individual practice card learning using 30-second measurements each day for two weeks. Correct responses (*) per minute accelerated by about x3.0 per week while errors plus skips (x) decelerated by about /2.6 per week over the course of the program.

By the end of the program, the trainee was making about 40 correct responses for every 1 error and was responding at over 80 correct per minute—a fluent level of performance on basic facts.
Practice Accelerates Performance

Count Per Minute

Calendar Days

(start-day was 06/15/1980)

12-16 year-olds write digits (control for total time per week)

Count Per Minute

RFloor

Performance duration can affect both frequency and celeration.

Kim A. See/Write by 2's
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**Scheduling Errors per Day in a Casino**

Multiply or Divide per week

/ 1.5 per week

**Impact on Job Productivity**

- PART-TIME FLUENCY TRAINED GROUP 2
- TARGET
- PART-TIME NON FLUENCY TRAINED GROUP 1
The new-hire group trained using a fluency-based program accelerated call handling by about $x1.4$ per week for the two weeks after training, while those trained without the fluency program were flat ($x1.0$) or decelerated slightly ($/1.1$) over the two-week measurement period. By the end of the two-week period, the fluency-trained representatives performed at about $x1.6$ (or 60%) higher than the nonfluency group.

**Productivity on the Job**

Group productivity measures in a customer call center with (*) and without ( ) fluency-based new-hire training.

**New Selling Method**

Shows monthly revenues of a small contracting firm in its initial years of business. It’s hard to see a clear trend, and the bounce is so great that we can’t really tell much about the effect of the new selling methodology. If we were to try to fit a trend line to the data, it would have to be a curve.
Revenues per month for a Consulting Start-up

Revenues per month for an independent consultant’s practice over a period of thirty months.

Revenues multiplied by about x1.4 (or increased by 40%) per six months on average. During the second year, changes in the sales process divided monthly variability from more than x50.0 to about x3.2, resulting in more predictable cash flow.

Over the course of the thirty months, revenues multiplied by around x4.0 from around $8,000 per month to over $30,000 per month.
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Projecting a Revenue Trend

- After more than two years of attempting to improve revenues at a weight loss clinic, management still held the optimistic opinion that revenues would "stabilize" within a few months.

- Using standard charting methods, the Consultant predicted that the trend would continue downward if no changes were made in marketing, sales, or program implementation.

- Revenues in thousands of $ were dividing by about 1.6 per six months.
After No Decision.....
The decelerating trend continued steadily, with no intervention by management, with very little change in month-to-month “bounce” until the very end when falling revenues forced closure of the clinic.

Using the same charting methods to plot revenues and enrollment at nearly 40 clinics around the country, the Consultant predicted annual revenues with less than a 5% error, while the CFO, using sophisticated computerized statistical models, predicted revenues at nearly twice actual year-end results.

Clients Per Month Turn Up
After two years trying to build a client base with referrals and word of mouth, a massage practitioner began distributing a brochure at potential contact points for female professionals.

Client volume turned up and multiplied x 1.6 (or plus 60%) per 6 mos for the next year to reach her goal of 40 to 50 appointments per month.

The effect was a clear turn-up in trend (or acceleration) with little change in “bounce.”
New Pro-active Manager

Change in Market focus

XYZ New Members per Month

New Book

XYZ Press Book Revenues ($) per Month

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Summary

- The foundation of measurement is counting.
- We need standard units to count — like science and accounting.
- All performance occurs in time, so don’t ignore it. (Frequency - count/time - is a universal measure.)
- Percentages are dangerous.
- We look for changes in trends, levels, and/or variability (“bounce”). We should be able to see them separately.
- Most graphs (and tools that produce them) are stretch-to-fill or fill-the-frame. This leads to distortion, inefficient and even biased communication. (“Lying with graphs”?)
- The Standard Chart family allows us to rapidly visualize and make decisions about trends, levels, and bounce.

Thank You!

And please check the handout for more information.
Value of the Standard Celeration (Change) Chart

Ogden Lindsley invented the Standard Celeration Chart (also known as the Standard Change Chart) during the 1960’s to improve analysis and sharing of results among educators who used systematic data-based teaching methods. By creating a single graphic format that could be used to monitor the frequency and trend of *any* countable behavior, accomplishment/output, or organizational result, he reduced the time needed to share a chart from around 20 minutes to 2-3 minutes. This was a huge improvement in communication efficiency and it also turned out to be a big advance in analytic power.

The chart has been used in scientific research, teaching, and organizational management by tens of thousands of people since that time. “Celeration” is a term referring to either acceleration or deceleration – the rate of change in whatever is being measured. What is standard about these charts is that they represent trends or rates of change (accelerating or decelerating) as *standard visual angles*. And because they are “multiply/divide” charts up the left (versus “add/subtract” or equal interval), they depict ratios or multiply/divide relationships between levels as standard visual distances. One need not know the technical details underlying the Standard Celeration Chart to use it. Once you become accustomed to its standard visual features, directly reading trends, levels, and variability (“bounce”) becomes simple and intuitively obvious.

We are in a sort of transition now, from paper versions of the charts, which have been used for decades, and computerized versions of various kinds that are not quite ready for prime time. Excel and other computerized charting tools produce “fill-the-frame” or “stretch-to-fill” graphs by adjusting both scales up the left and across the bottom based on the particular set of data being displayed. This distorts the data and prevents simple visual evaluation of changes and trends – even allowing “lying with charts” for those so inclined. The distances and angles that represent differences in level and rates of change, respectively, vary from one such fill-the-frame chart to another. We are working on easier-to-use computerized versions of the standard chart and they should be available in the coming months.

Read Measurement Counts!

The double meaning of my column’s name at www.PerformanceXpress.org is that measurement is important, and that the foundation of measurement is counting standard units of things or dimensions. Over the last two years I have included a number of standard chart examples, and lots of rationale, in the column. You can see past columns by going to the site and clicking “Back Issues” at the lower left.

What to Count

To measure performance improvement we can count three kinds of things:

• **Behavior**: We can count instances of behavior that we define as important to measure. (A good guideline for defining behavior, by the way, is that it is a repeatable action – a verb.) For example, we can count instances of customer service people saying “Thank you” to their customers (positive) or instances in which they use inappropriate language (negative). We can count occurrences of specific types of safe or unsafe behavior in the workplace. We can count correct and incorrect responses in testing, certification, or other learning or assessment situations. We can count many different types of behavior. However, for us Human Performance Technologists, it’s essential that the behavior we count produces or contributes to valuable accomplishments or job outputs.
• **Accomplishments** or **Job Outputs**: As Human Performance Technologists we’re interested in the valuable accomplishments or job outputs that contribute to organizational or business results. (A good guideline for defining an accomplishment, by the way, is that it is a *thing produced by behavior – a noun.*) For example, we can count accepted and rejected proposals, transactions completed, widgets, handled calls, tables served, items that meet quality standards and those that don’t, as so on. We can also count certain types of intangible job outputs such as decisions, which are harder to capture but nonetheless valuable outputs of jobs or processes. For us Human Performance Technologists, *it’s essential that the accomplishments or job outputs that we choose to count (including the outputs such as poor quality products that we want to reduce or eliminate) produce or contribute to the desired results for the business or organization.*

• **Business Results**: When we speak of *business results* we usually mean things like dollars in revenues or profits, customers, people who say they like our company, and so on. These measures represent goals of the organization or of its major sub-organizations and processes that indicate success in the market or in financial or operational terms. In the end, improving these counts is our reason for existence since increasing behavior or accomplishments is not valuable unless it ultimately improves business results. In many cases, after we count these things, we then create derivative calculations such as market share or profit margins – ratios or percentages of the original counts. But it’s always important to remember that the counts themselves are what’s important, and *that we will not fully understand those ratios or percentages if we are not also looking at the original counts.* (For example, profit as a percentage of revenue changes over the lifetime of the organization as it grows from start-up to maturity, usually in direct relation to the actual dollar amount. So knowing the actual revenues is critical for evaluating profit percentages or ratios.)

**References / Web Links**


To purchase paper charts: Behavior Research Company, P.O. Box 3351, Kansas City, Kansas 66103, Fax orders or to request price list 913-362-5900
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