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Compound Thinking

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Abstract

Children are trained to count linearly: one, two, three, four, five, etc. Long before mathematics was invented, however, a subjective process of estimation was used to quantify and make decisions. If the ability to appreciate quantities in linear terms confers fitness advantage, that edge appears to have eluded Darwinian selection. Studies of the Amazonian Munduruсu indigenous tribe and preschool American children all suggest that humans are innately wired to use a compressed scale to understand magnitude – not unlike those depicted by logarithmic, exponential, or power-law functions. A compressed scale is biased toward achieving higher resolution at the lower end of the spectrum where smaller numbers reside, where discriminating subtleties in degrees of scarcity can provide the greatest benefit. Psychophysical studies assessing magnitude of subjective estimation of sensory inputs such as light intensity and sound intensity also reveal innate mapping of signals on compressed scales. From an adaptive perspective, a compressed scale of subjective estimation enables a wider dynamic range of sensory processing which is valuable in environmental signal interpretation. The hypothesis that selective pressures favored the cognitive adoption of a compressed scale for subjective estimation is consistent with the reality that natural phenomena generally unfold through iteration, yielding patterns of development that are best understood through the prism of compounding rather than the lens of linearity. Like an intellectual slide rule, modern mathematics reprograms children. It obligates

them to abandon their natural cognitive tendencies, which rely on compressed scales and estimation, and coerces them into adopting linear scales that provide uniform resolution along the entire scale. It resigns them to participate in a wholesale exercise of indiscriminate precision with respect to all things. This force-fed mental framework may help individuals thrive in the artificiality of our modern socio-cultural-economic landscape, replete with man-made straight lines and standardized tests. However, we believe that the conflict between our innate instinct to estimate on a compressed scale and our learned ability to quantify on a linear scale is a source of profound decision dysfunction in the modern world, particularly impairing the ability to assess the possibilities of outlier outcomes.

The vast majority of individuals, despite and probably due to training in linear mathematics, chronically underestimate the consequences of events such as the growth of the Internet and the current financial crisis. The interplay between iteration and recursion in such phenomena leads to unexpected unfoldings and cascades that defy explanation in linear terms. Palo Alto Institute is developing Compound Thinking™ as a curricular counterpart to linear mathematics for the School of the Future.

Article

Compressive versus Linear Scales: A Darwinian Perspective

Children are trained to count linearly: one, two, three, four, five, etc. Long before mathematics was invented, however, a subjective process of estimation was used to quantify and make decisions. Even today, the vast majority of everyday human interactions with the world depend on subjective estimation rather than objective mathematics. Just the simple act of walking to a door, for example, involves iterating the steps of subjectively estimating distance with respect to a visual landmark, taking a step, and then recalibrating appropriately.

If the ability to describe quantities in linear terms confers fitness advantage, that edge appears to have eluded Darwinian selection. Humans possess the ability to discriminate quantities from infancy, suggesting innate aptitude (J.N. Wood 2004) (Nieder 2004). Studies involving populations not exposed to Western mathematics suggest humans are hard-wired innately to estimate quantities on a compressive scale that places higher quantities at ever closer distances not unlike logarithmic, exponential, or power-law scales. (S. Dehaene 1999) When asked to place the quantity 10 on a line between the quantity 1 and the quantity 100, Mundurucu adults and preschool American children unexposed to mathematics place the quantity 10 near the middle. As American schoolchildren advance through each successive grade, they "improve" at spacing quantities, at a non-linear rate. By sixth grade, the reprogramming is nearly complete and children can space numbers evenly along a line scale. (Siegler & Booth 2004) (Dahaene, et al 2008).

A major adaptive benefit of estimating quantity on a compressive scale is relevance. A compressed scale is biased towards higher resolution at low quantities, where discriminating degrees of scarcity with respect to resources such as food would confer fitness advantage (Siegler 2003). The primary utility of discrimination skills among larger quantities, which emerges when children transform their compressed scales to linear scales after immersion in mathematics, may only lie in "estimating answers to arithmetic problems" (Siegler 2003). High resolution at low numbers is also important because we deal with low numbers more frequently than with high numbers. Furthermore, Banks and Coleman (Banks 1981) suggest that a compressed scale is superior to a linear scale in estimating percentage differences or ratios. Such ability may be associated with greater fitness: a battlefield general likely is more interested in knowing the ratio of enemy versus friendly forces rather than their exact numbers.

Interestingly, even for modern humans trained in mathematics, once the language of numbers is removed from quantities, their ability to discriminate among quantities reverts to that of humans untrained in mathematics. Studies show that we lose the ability to discriminate among quantities at about six — we can visually differentiate six dots from seven, but not seven from eight (Van Oeffelen 1982). If tasked with comparing the interval between the numbers 1 and 10 and the interval between the numbers 91 and 100, a student of mathematics would exclaim that the difference is an identical 9 for both sets. However, if shown a paper with 1 dot on the front and 10 dots on the back, and asked to compare the difference to a paper with 91 dots on the front and 100 dots on the back, the same student of mathematics would be able to distinguish the quantity difference in the first instance (high resolution at low quantities), but would not be able to do so in the second case.

Compound Sensing in a Compounding World

Psychophysical studies of magnitude of subjective estimation of sensory inputs reveal innate mapping of signals on compressive scales. Humans can detect sounds intensities ranging over a staggering 12 orders of magnitude precisely because they subjectively map the intensity along a compressive scale such as that described by decibels (Santos-Sacchi 2001). Similarly, humans can detect light intensity over a wide dynamic range, and they subjectively map the intensity along a compressed scale such as that described by lumens. In fact, cross modality matching studies reveal that both brightness and loudness are power functions with similar stimulus magnitudes (Marks n.d.). The human brain thus uses compressive scales in everyday perception to extract from its high-dimensional sensory inputs — 30,000 auditory nerve fibers and 106 optic nerve fibers — a manageable number of perceptually relevant features. From an adaptive perspective, a compressed scale of subjective estimation enables a wider dynamic range of sensory processing which is valuable in environmental signal interpretation, not unlike the Richter scale for earthquakes.

Visual acuity, depth perception and spatial resolution all operate on a compressive scale. When you look down a street, the streetlights appear to be closer and closer together as they get further and further away. Again, lower resolution at greater distances and higher resolution at lower distances makes sense. It matters less if a predator is 400 or 500 feet away, than if it is four or five feet away. As Hermann Ebbinghaus, the first person to describe the learning curve and the forgetting curve observed, even the rate at which we learn and forget is exponential. (Ebbinghaus 1885)

Selection pressures for compressed scales of subjective estimation are consistent with the reality that natural phenomena generally unfold through an interplay of iteration and recursion, resulting in compounding rather than linear trajectories of development (Wolfram 1984). When we step out of the city to take a stroll in nature, we leave an urban landscape of artificially rendered linear rigidity and enter an organic realm populated with elegant curved forms created by self-organization, iteration, and fractal emergence (Mandelbrot 1982). When compounding phenomena approach a natural constraint limits are reached, returns diminish and decompounding can result. An animal population that outgrows its environment's ability to support it must stabilize or decrease in size. In a similar fashion, a successful, rapidly growing start-up company eventually grows large enough that the market can no longer support continued growth at the same rate. Economic cycles represent periods of compounding and decompounding.

Open up any scientific journal, and you will find natural phenomena tracing curves within man-made, straight-line graphical axes. Two cells first become four, then eight, then sixteen, then thirty-two, and so on. Eventually the curve may turn and form an S-curve as limits are reached. The curve may follow some pattern—perhaps exponential, logarithmic, or power law—but never turns linear.

Decision Dysfunctions

Like an intellectual slide rule, modern mathematics reprograms children, turning their cognitive framework for quantification away from utilization of compressed scales and towards employing linear scales that demand equal resolution for all amounts. This acquired paradigm may help individuals thrive in the artificiality of the modern socio-cultural-economic landscape, replete with man-made straight lines and standardized tests. However, it is not surprising that dysfunctions in decision-making occur given the potential for mismatch between a particular situation and the paradigm chosen to understand how to approach it.

For example, most consumers would drive an hour to save $100 on a $200 pair of shoes, but not to save $100 on a $20,000 car. Given our innate compressive scale, with low resolution at high numbers and high resolution at low numbers, the $100 discount is barely perceptible on a $20,000 purchase, and substantial on a $200 purchase. In fact, businesses take advantage of this phenomenon all the time by tagging on small fees to large purchases. Auto dealers, banks, mortgage companies, hotels, and restaurants have all found that incremental added fees are a useful way to increase revenue – after someone has committed to a large purchase, additional incremental costs become viewed as "rounding errors". Consumers succumb to "impulse buys" at retail checkout counters, added options at automobile dealerships, and extended warranties on appliances for the same reason – low resolution at high numbers.

The above pair of cases highlights the differences between linear and compound thinking. From a linear thinking standpoint, $100 would constitute the same absolute amount of money in both cases. It represents a larger percentage of the cost of the shoes than of the cost of the car, so the hour spent driving may be justified in the former scenario and not in the latter.

However, if this issue is approached not only using a compressive scale but also considering residual value, the $100 savings on the car clearly carries more value. What truly matters is how much money is left over after the purchase, and what percentage of that amount the $100 represents.

If you start with $30,000 in the bank, and you buy a car for $20,000, you have $10,000 left; whereas if you buy the shoes for $200, you have $29,800 left. The extra $100 in your pocket is more valuable if you buy the car than if you buy the shoes. It has more value as a percentage of your net worth, since 100 is a higher percentage of 10,000 than it is of 29,800. So in the case of the car purchase, the $100 savings has a threefold greater impact on remaining net worth.

Smaller numbers may illustrate the point even better: Whereas a $9 dollar loss on a $100 base and a $9 loss on a $10 base represent the same change on a linear scale, on a compressive scale, a $9 loss on a $100 base may barely merit a mention, but a $9 loss on a $10 base would set off alarms—intuitively an evolutionarily more relevant response.

A compressed scale may also be a better way to understand the subjective estimation of aging. The current convention is to ascribe age chronologically and linearly: one, two, three, four, etc. But what if we instead marked age as the fraction of life remaining at the end of each year? For the sake of simplicity, let's assume 100 years is the human lifespan. The first year of life is very inexpensive: it only costs you 1% of your lifespan and 99% of your life remains ahead of you. When you are fifty years old, a year is still inexpensive, representing just 2% of the rest of your life. You spend that year, and you still have 98% of your life left. At age 90, however, a year of time spent uses up 10% of your remaining time. Finally, the year you start at 98 would represent 50% of your remaining life. Each passing year represents an ever-scarcer resource.

Perhaps our subjective sense of time also reflects the ratio of a time interval relative to our cumulative experience—a different form of compression. An illusory sense that a decade in adult life passes quicker than a summer of our youth has been universally reported:

> *Sweet childish days, that were as long As twenty days are now.*
> —William Wordsworth, "To a Butterfly"

Indeed the same incremental year lived doubles the experience of a one year-old child, but only adds 2.5% to that of a 40-year-old's. With each successive year, the same one- year interval represents an ever-shrinking percentage of new time relative to the cumulative time experience. A 40-year-old only has about 7.5% new time experience left when the percentage of new experience is summed from age 40 to age 80; no wonder the higher decades of our life seem to pass in a blur. Perhaps the best way to expand our subjective sense of time as we age is to continually seek profoundly different experiences rather than repeating prior routines. Three months of the same routine feels like a single day, yet a single day of an unfamiliar experience, such as SCUBA diving, may subjectively feel like a month.

The most profound decision dysfunction wrought by the preponderance of linear thinking in a naturally compounding world is the systematic underestimation of the probability of outlier events. As Stanford economist Paul Romer notes, "People are reasonably good at forming estimates based on addition, but for operations such as compounding that depend on repeated multiplication, we systematically underestimate how quickly things grow." (Romer 2007) We believe pervasive linear mathematical training partially accounts for the ontology of Taleb's "Black Swan" phenomenon (Taleb 2007). It is also useful in understanding the frequency and size of events to consider the sand pile model. Studies conducted using computer models of sand piles show that as a sand pile builds up there are lots of little tumbles, more small avalanches and only a few large avalanches. If there hasn't been an avalanche for a while, the pile gets steeper and steeper until a sizeable event occurs. It turns out that avalanches that are about twice as large occur half as frequently (Bak 1996)., illustrating yet another reason why we don't anticipate compounding effects on a grand scale. We expect stock market cycles, but consistently fail to comprehend the swiftness and magnitude of outlier extreme movements in either direction. Additionally, the early part of a compound curve resembles a linear curve, and perhaps lulls linear thinkers into projecting further linear progressions.

Natural and man-made events that unfold iteratively and cascade recursively generate compounding outcomes that repeatedly appear to elude the forecasts of linear thinkers. Examples are ubiquitous. The vast majority of individuals, despite and probably due to training in linear mathematics, underestimate the compounding growth of web pages, links, ideas, patents, and scientific papers in the information age. Even John Maeda, president of the Rhode Island School of Design, admits that in the late 1990's he thought that "making home pages on something called the World Wide Web was a silly idea, which would never catch on" (Rawsthorn 2009). Linear thinking also leads to underestimation of the impact of the cascading nature of system failures. Most economists and political leaders failed to see that the 2005 U.S. housing market decline would precipitate a credit crisis, begetting a financial crisis which then triggered the epic socio-economic upheaval of 2009.

Compound Thinking, Natural Insights, Best Practices

Consideration of natural systems from the perspective of compound thinking can also lead to unique insights as to how to best interact with these systems. The human body is an obvious example of a natural system, and uncompensated failures of elements within this system can produce cascading effects: arthritic knees impair exercise capacity, which predisposes patients to cardiovascular disease and stroke that further prevents exercise in a feed-forward manner. Even as we age chronologically one year at a time, biologic aging at the end of our lives occurs at an accelerating rate each year, as anyone who has seen a loved one deteriorate in health can attest. It is ironic that we celebrate milestones of aging linearly by blowing out candles each year while our physiologic capacity to blow out those candles decreases at a compounding rate each year (McClaren, et al. 1995). Cognitive capacity as measured by mental performance similarly declines at a compounding rate, while dementia increases at a compounding rate (Ott 1998), Physical performance shows a similar compounding rate of decline. The statistics of high performance athletes generally decline at a rapid rate after sustained high levels during the peak of their careers (Bortz and Bortz 1996). Cumulatively, the compounding of failures at the molecular, cellular and physiologic levels contributes to the compounding rise of disease pathology and the economic cost to treat them as people age. It is almost as if biologic aging on a chronologic scale should be seen as one, two, three...seventy, eighty, hundred, one fifty, etc.

Compound thinking enables the conclusion that if patients are actually aging and deteriorating at an accelerating rate, perhaps annual check-ups should be replaced by routine check-ups at ever shorter intervals as people age. Taken to its logical conclusion, patients may eventually need to be monitored on a daily basis, and ultimately continuously, which is basically what is done in hospital intensive care units. It seems that during the intervening period from when a person is healthy to their final days in the intensive care unit, routine monitoring of patients should have been occurring at a compounding rate to match the pattern of accelerating biologic decline. But doctors cling to a rhythm of annual check-ups whether the patient is 25 years old or 75 years old—a byproduct of arguably faulty linear logic.

Compound Thinking: Implications for the School of the Future

In summary, it appears humans have innate sensory and cognitive capacities that are well-adapted to detect contextual changes in the environment that naturally occur in a cascading, compounding fashion. Once exposed to conventional mathematics, humans become facile with the deployment of linear models that allow them to count by ones with ease, but not to calculate a mortgage without a calculator. Like language, mathematics is a human cultural invention. Mathematics has evolved from simple practices of counting and measuring into increasingly complex systems for representing the quantity, structure and quality of physical objects. There is no doubt linear mathematics skills afford an adaptive advantage in modern human society, although the benefits of mastering linear mathematics are partly self-fulfilling — human cultural institutions, including those of finance and education, were themselves founded on modern mathematics. However, as recent developments have vividly illustrated, overreliance on linear thinking may predispose humans to profound decision dysfunctions, particularly with respect to underestimating the probabilities of upside and downside outlier events that occur as interlinked variables cascade. Compound ThinkingTM may therefore be particularly important when approaching problems either involving massive scale or spanning a range of orders of magnitude.

The School of the Future

We are introducing a new subject, Compound Thinking™, as a curricular cornerstone of the School of the Future—to counterbalance mathematics in the modern hegemony of linear thinking. Training paradigms can address the reprogramming needs of adults rooted in linear thoughts, as well as the development needs of children to complement their exposure to linear mathematics. Existing tools could be repurposed for the Compound Thinking curriculum; games such as ScrabbleTM and bowling are founded on compound scoring. Other pastimes such as Mancala encourage cascade thinking as part of their game play.

The Palo Alto Institute is developing novel teaching tools to train Compound Thinking™ skills in the hopes of keeping society on a compounding learning curve.

Works Cited

Banks, W.P., & Coleman, M.J. "Two subjective scales of number." *Perception & Psychophysics 29(2)*, 1981: 95-105. Bortz, W.M. 4th, &

Bortz, W.M. 2nd. "How fast do we age? Exercise performance over time as a biomarker." *Journals of Gerontology Series A: Biological Sciences and Medical Sciences, 51(5)*, 1996: 223-225.

Dahaene, S., Izard, V., Spelke, E., & Pica, P. "Log or linear? Distinct Intuitions of the number scale in Western and Amazonian indigene cultures." *Science 320 (5880)*, 2008: 1217-1220.

Dehaene, S., et al. "Core Knowledge of geometry in an Amazonian Indigene Group." *Science 311*, 2006: 381-384.

Dehaene, Stanislas. *The Number Sense*. New York: Oxford University Press, 1999.

Gordon, P. et al. "Numerical cognition without words: Evidence from Amazonia." *Science 306*, 2004: 496-499. Izard, V., & Dehaene, S. "Calibrating the mental number line." Cognition, 106, 2008: 1221-1247.

Mandelbrot, B.B. *The Fractal Geometry of Nature*. New York City: W.H. Freeman Company, 1982.

Marks, J.C., & Stevens, L.E. Steven's *Power Law in vision: Exponents, intercepts, and thresholds.* Paper, New Haven, CT, USA: John B. Pierce Laboratory and Yale University.

McClaren, S.R., M.A. Babcock, D.F. Pegelow, W.G. Reddan, and J.A. Dempsey. "Longitudinal effects of aging on lung function at rest and exercise in healthy active fit elderly adults." *Journal of Applied Physiology,* 78 (5), 1995: 7587-7595.

Nieder, A., & Miller, E. K. "A parieto-frontal network for visual numerical information in the monkey." *PNAS, vol. 101,19*, 2004: 7457-7462.

Nieder, Andreas, and Earl K. Miller. "Coding of Cognitive Magnitude: Compressed Scaling of Numerical Information in the Primate Prefrontal Cortex." *Neuron, 37*, 2003: 149- 157.

Ott, A, & Breteler, MMB et.al. "Incidence and Risk of Dementia: The Rotterdam study." *American Journal of Epidemiology*, 147 (6), 1998: 574-580.

Pica, P., et al. "Exact and approximate arithmetic in an Amazonian Indigene Group." *Science 306*, 2004: 499-503.

Santos-Sacchi, Anthony F. Jahn & Joseph. *Physiology of the ear*. Singular, Thomson Learning, 2001.

Shepard, R.N., Kilpatrick, D.W., & Cunningham, J.P. "The Internal Representation of numbers." *Cognitive Psychology 7*, 1975: 82-138.

Siegler, R. S., & Booth, J. L. "Development of numerical estimation in young children." *Child Development, 75 (2)*, 2004: 428-444.

Siegler, R.S., & Opfer, J. E. "The development of numerical estimation: Evidence for multiple representations of numerical quantity." *Psychological Science, 14 (3)*, 2003: 237- 243.

Taleb, Nassim N. The Black Swan: *The Impact of the Highly Improbable*. New York: Random House, 2007. Teghtsoonian, R. "Stanley Smith Stevens: 1906 - 1973." Journal of Personality and Social Psychology 28, 2001: 15104-15108.

Van Oeffelen, M.P. & Vos, P.G. "A probabilistic model for the discrimination of visual number." *Perception & Psychophysics, 32(2)*, 1982: 163-170. Watts, D.J. "A simple model of fads and cascading failures." Center for Nonlinear Earth Systems, 2000. 1-12.

Wolfram, S. "Cellular automata as models of complexity." *Nature 311*, 1984: 419-424.

Wood, J.N. & Spelke, E.S. "Chronometric studies of numerical cognition in five-month- old infants." *Cognition, 97*, 2004: 23-39.

Price and Money: Wag the Dog?

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Milton Friedman famously claimed, ‚Inflation is always and everywhere a monetary phenomenon. Does this relationship also hold in reverse?

Decades ago, when everything and everyone from unions to cartels was blamed for inflation, Friedman rejected the conventional wisdom and posited on the basis of empirical data that money supply drives price levels. He argued that prices increased not due to price and wage increases, but because the federal government made the supply of money grow faster than the real economy created value. This groundbreaking theory, while highly controversial and almost revolutionary at the time, appeared to be vindicated by the "Great Inflation" of the 1970's, and has since become the core tenet ofmonetarism and modern policymaking. However, in a mark-to-market world, price may act insidiously to drive money supply and amplify boom-bust cycles.

Despite the copious amounts of money printed by the U.S. government through the fall of 2008, asset prices continued to fall precipitously. Relying on the assurance that Ben Bernanke would avert deflation by printing money, as indicated by Friedman's theory, investors betting on hyperinflation were caught leaning the wrong way. Few recognized that credit contraction caused by price declines would annihilate money in a mark-to-market world. The contraction of total money supply overpowered the printing presses of monetarism, and cataclysmic deflation ensued. The Fed has long downplayed the role of asset prices in monetary policy. Yet it is apparent that in a credit-based economy that appraises assets on a mark-to-market basis, asset price inflation creates money and asset price deflation destroys money.

Imagine a marginal transaction that raises the price of an asset — say a house sells in San Francisco for 10% more than it sold for a year earlier. All similar homes in that neighborhood get marked up. Credit institutions then willingly lend against these houses at their new market value – their mark-to-market prices. In this way, small increases in price create vast amounts of collateral, which in turn beget credit, liquidity, money velocity, and eventually total money. The net effect is that the appreciation of asset prices leads to an expansion of the total money supply.

As price increases lead to an increase in the amount of money available to bid on assets, such as our house in San Francisco, these perverse incentives promote further inflation in a "feed-forward" manner: anticipation of future price increases prompts higher bidding. The irony here is that as assets appreciate in price, they actually become more of a bargain, since these assets become scarcer relative to the money supply available to purchase them. This secondary effect is purely monetary and independent of the feed-forward effect of expectations regarding inflation. The potential explosiveness of the vicious cycle of per unit inflation and increase in total money supply is mitigated by human innovation that renders scarce assets more abundant through production i.e., more houses get built.

Conversely, as asset prices decline, the mark-to-market basis of the credit valuation precipitates a dramatic reduction of collateral, leading to a contraction of credit, liquidity, money velocity, and eventually total money. In our example, as houses sell for less all homes are assumed to be declining in value, banks are less willing to lend, and markets eventually freeze up as money is no longer available for buying homes. Price declines and consequent contraction of money creates a feedback loop. No matter how inexpensive they get, homes sold today aren't bargains if they're going to be cheaper tomorrow. Although the price tag of an asset might be lower, the decreased availability of money for bidding would also cause assets to become more expensive relative to the money used to buy them. Counter-intuitively, as assets fall in price, they may become less of a bargain.

This phenomenon may help explain the seeming contradiction in purchasing behavior that people have pointed out during this recent deflation. The world seems to be on a half-off sale, yet few parties are behaving as if the deal is a bargain. Asset investors note that assets are falling in price, yet lament the paucity of money to support bids.

When multiple asset classes deflate simultaneously, the feed-forward effect of price declines on total money supply can be dramatic. When asset prices in emerging markets and U.S. equity markets joined the housing markets in decline, American policymakers followed Friedman's script and immediately began to increase money supply to combat the specter of deflation. Many investors similarly weaned on monetarist theory reflexively shorted the dollar and took long positions on commodities.

As these trends gained momentum, inflation lurked during the first half of 2008 due to rocketing commodity input prices. Notably, faith in monetarist policy amongst investors actualized the monetarist credo that an increase in money supply would cause inflation...for a while. Alas, commodity prices peaked in summer of 2008 and soon joined other asset classes in decline, and through the end of 2008 and the beginning of 2009, asset prices continued to fall precipitously in spite of the continued printing of money by the U.S. government.

A mark-to-cost model for asset appraisal, such as that seen for capital gains tax treatment, would substantially mitigate the insidious feed-forward effect of asset price movements on total money supply. In a cost-based appraisal system, only the house actually sold would be marked up in value; the other houses in the neighborhood would continue to be valued at their purchase prices until sold, and no money would be loaned against their "market value."However, since a mark-to-cost model would be difficult to implement — it would not accurately reflect long term trends, such as a house in San Francisco owned for over a hundred years with a cost way below the market average — a more moderate solution such as asset valuations based on historical trend lines may be more practical. Under this scenario, banks would use an appraisal rate based upon the historical appreciation of homes in the neighborhood, over some set number of years to value the home for lending purposes, rather than the market value at any given moment in time based only on the most recent sales.

This change would seem problematic for America — we are a debtor nation, both to ourselves and to other countries. Stabilizing total money supply at low levels of money velocity could leave the country with insufficient total money to pay off our debts. It would seem that the U.S. remains on an implicit path to print enough money to allow us to inflate our way out of the current crisis, and at some point this policy will create the illusion of success. Eventually, however, the issues discussed above will once again resurface. Price increases will beget the whole cycle of money creation again, initiating the next boom-bust cycle.

The risks involved in implementing a new model for pricing assets may be high, but the risk of ignoring the issue may be a lot higher.

A Balanced Diet

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The concept of the importance of eating a balanced diet took on major cultural significance in this country when the U.S. Department of Agriculture released its first Dietary Guidelines for Americans in 1980—a response to an increase in heart disease amongst Americans in the 1960's. The Guidelines are updated every five years to incorporate the latest advances in medical and scientific research, based on the recommendations of the 11-member Dietary Guidelines Advisory Committee, a group of widely recognized nutrition and medical experts. The U.S. government directly or indirectly feeds approximately 54 million people daily according to these guidelines — including over 25 million school children. These numbers are not lost on those in the food, agriculture, and diet industries, who are all busy promoting their particular points of view. They work to install members to the committee whose support they can count on, ostensibly in order to ensure that the committee itself has a 'balanced' view of diet and nutrition. In such a politically charged environment, what do we end up with? A 'balanced' diet indeed, with a little something on everyone's plate.

While the experts disagree on what constitutes a diet balanced for optimal health, most presume the need for 'balance', and the importance of consuming a wide variety of different foods. The guidelines have changed over time, with the recent addition of an emphasis on physical activity to offset caloric consumption. The debate remains largely centered, however, over which foods reside at the top and which languish at the bottom of the food pyramid, rather than the validity of the approach itself.

If one looks to nature for support the entire premise of the need for a balanced diet comes into question. One has to wonder how much of a role the 'balanced diet' theory plays in contributing to the morbid obesity epidemic in America today.

Some benefits of a balanced diet, such as the acquisition of essential vitamins, amino acids, and minerals seem relatively irrefutable. However, if a balanced diet confers adaptive advantage, such an edge appears to have entirely eluded Darwinian forces. Most species have actually evolved specialized dietary preferences, and in many cases have evolved behaviors, anatomy, and physiology to consume a skewed, rather than a balanced diet. An anteater's long, slender head tapers to a narrow snout, and its tongue can extend up to 24 inches—ideally designed to extract from their nests the ants and termites on which it chiefly feeds. Most Microchiroptera, or "little bats", have teeth designed for prey, use echo-location to target flying insects, and can scoop up insects in their wings and tail membranes, transferring them to their mouths in mid-flight. On the other hand, Megachiroptera, or "big bats", sport teeth designed to grind plant parts, use their keen eyesight to spot the fruit they eat from the sky and have long and strong thumbs with curved thumbnail-like claws which they use for climbing around in trees and for gripping fruit.

Indeed, evolution appears to have selected for the ability to use a specialized dietary niche to satisfy all of the body's needs. Contrary to the assumption that muscle mass correlates with dietary protein, bovines feed largely on plants, yet exhibit ample muscle mass. The unique design of a four-chambered stomach filled with resident microbes allows cows to digest low quality forage such as grass and then turn it into high-quality meat and high-protein milk. Wild felines feed almost exclusively on proteins, yet represent paragons of aerobic performance, defying the belief that carbohydrate consumption enhances athletic capacity. The cheetah is the fastest runner on the planet.

Almost no species on earth consumes a balanced diet. While a diet of meat, along with gathered fruits, vegetables and nuts, was the norm for most of human history, the ratios varied greatly from place to place and season to season. We know for a fact that humans don't NEED a balanced diet: The Inuit/Eskimo people have lived for generations in great health eating virtually no plant matter, while vegetarians around the world thrive on a meatless diet.

Providing the body with adequate protein, carbohydrate, fat, vitamins, mineral salts and fiber is imperative to proper function. However, the decision to obtain these nutrients through a balanced diet may also carry underappreciated health risks.

Most species that consume selective diets likely rely on taste fatigue — a taste- driven loss of desire to ingest a particular food — to regulate intake. Additionally, a constant taste stimulus will be perceived as decreasing in intensity, while sensitivity to that stimulus is also decreased—the first bite always tastes better than the last. Studies have shown that the more distinct foods (and tastes) that are on a plate, the more the diner will eat. A balanced diet with a variety of foods available at every meal may thus promote overconsumption, as dietary variety subverts taste fatigue.

Diets vary tremendously across cultures and within cultures. Perhaps no country in the world has a greater variety of foods readily and cheaply available than the United States of America: Chinese, Mexican, Italian, Japanese, Indian and the list goes on and on. Would we consume as much if we were restricted even to just one of the above — if we had Icelandic food every single night?

Diets skewed towards particular food groups, such as the Atkins' high-protein diet, are sometimes espoused, but perhaps health benefits relate less to the balance or skewness of a diet according to taxonomic classifications and more to the qualities of a specific food, independent of its taxonomic classification. Any regimen that restricts the dieter to a limited variety of food likely also benefits from the principle of taste fatigue.

Other popular dietary wisdoms such as saving dessert for the end may also contribute to obesity by promoting calorie packing. When we give our children a balanced meal with a variety of foods from all the food groups, and make them clean their plates before they can indulge in dessert — a calorie-laden taste sensation they can't resist no matter how full they are — we get fat kids.

Any discussion of the causes and cures for America's obesity epidemic must include other important factors, such as a relative disinclination towards exercise. To be sure, there are also many reasons why we might overeat, ranging from supersized portions to depression. However, while a balanced diet is an intuitively appealing notion, with its benefits apparently supported by published data, the reality is that the need for a balanced diet has no clear basis in science. We may just be balancing our way to obesity.

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