Behavioral Development Bulletin
2015, Vol. 20, No. 1, 6–23

1942-0722/15/$12.00 http://dx.doi.org/10.1037/h0101032

Stages of Investing Generated Using the Model of Hierarchical Complexity

Michael Lamport Commons
Harvard Medical School

Christine Spencer Thexton
Harvard University

Most theories and studies of decision making are a-developmental. However, there is ample evidence that there are differences in behavior on many decision-making tasks between children and adults. This article asserts that within adults there are differences in behavior on many decision-making tasks and discusses investment as a decision-making task where differences in adult behavior can be analyzed. It presents an argument that stage theory can predict investment behavior. The major properties of investment behavior are (a) how many variables a person can look at and (b) whether a person can compare systems and understand that regulations are incomplete and not consistent. We propose that the rational theories of investing fail because most economic theories assume perfectly rational players in the market place. One of the major reasons that private investors do terribly in managing and investing money is the inadequate stage development of the investors on the task of investing.

Keywords: stages of investing, Model of Hierarchical Complexity, decision making, behavioral economic models, fraudulent advice

Most theories of investing fail because traditional economic theories assume perfectly rational players in the marketplace when we know that people do not act rationally (for examples, see Kahneman, 2011). In fact, most private investors do terribly in managing and investing money in their 401k and IRA accounts. They do poorly investing money in general. For example, Hanlon (2014) reported that over a 10-year period, the "average" investor earned just 2.6% on their investments. Many turn to financial advising companies or stock brokers, who set themselves up to offer help and advice based on the assumptions that (a) People are rational but uninformed, and therefore offering them advice makes sense, and (b) the financial advising and brokerage companies are experts and therefore qualified to give advice. Until recently, however, financial advising companies continued to suggest that people invest in mutual funds, and some advisors still suggest individual stocks, instead of Exchange Traded Funds (ETFs). Over time, mutual funds and individual stocks have not been shown to produce better results (Treynor & Kay, 1966). As a result of this current situation, many investors of all kinds do even worse than the mutual fund providers and almost always do worse than the indexes. That is to say almost no one does well in investment strategies over the long run.

This article suggests that the reason that most people do not do very well in investing is because understanding the global economic system, and how best to invest in it, is actually a very difficult task. The purpose of the article is to make this point explicit by using the Model of Hierarchical Complexity to generate stages of investing. These stages will show how few people there are that understand general principles of investing. These principles of investing are not new but at what stage they may be understood is.

Michael Lamport Commons, Department of Psychiatry, Harvard Medical School; Christine Spencer Thexton, Department of Economics, Harvard University.

The contributions of Patrice Miller toward clarifying the arguments being made in this article are gratefully acknowledged.

Correspondence concerning this article should be addressed to Michael Lamport Commons, Department of Psychiatry, Beth Israel Deaconess Medical Center, Harvard Medical School, 234 Huron Avenue, Cambridge, MA 02138-1328. E-mail: Commons@tiac.net

Plan of the Article

To describe individual stages of investing, the article will first start by describing a few central concepts from the field of economics. It will then introduce the Model of Hierarchical Complexity and the Stages of Investing based on that Model. This discussion will make it clear that there are 10 major investing principles that must be understood for somewhat effective investing to take place. These principles cannot be understood until a stage called Metasystematic. In our work, roughly 1.7% of the population (Commons, Miller, & Giri, 2014) has been shown to solve tasks at that order of hierarchical complexity. Toward the end of the article there will a discussion of downward assimilation of principles to lower stages, stage, bias, and self-deception found in investment advisors and finally a proposal that disruptive innovation makes prediction of future economic trends impossible.

Basic Economic Models and Assumptions

As long as humans have existed, they have been concerned with the production, distribution, and consumption of goods and services. Whereas among early humans, goods and services were exchanged in small, face-to-face "markets," today, the global economy is comprised of a large system of intertwined, interrelated, and correlated markets. Nevertheless, a market is a mechanism which allows people to trade. People allocate resources through a price mechanism and bid-and-ask matching. This process functions so that those willing to pay a price for something may meet those willing to sell for that price. Understanding markets, therefore, is a key to understanding investing.

Markets are thought to be governed by an invisible hand that guides the market to equilibrium, where supply equals demand (Sullivan & Sheffrin, 2003). Although this theory was original proposed by Adam Smith (1776), this and other principles Smith proposed still guide economists today (Davis, Figgins, Hedengren, & Klein, 2011). The relationship between a supply curve (Marshall, 1890) and a demand curve form a system of equations whose solution predicts the price of a good or service as shown in Figure 1. As will be shown later, only about 20% of the population understands this solution even when taught it.

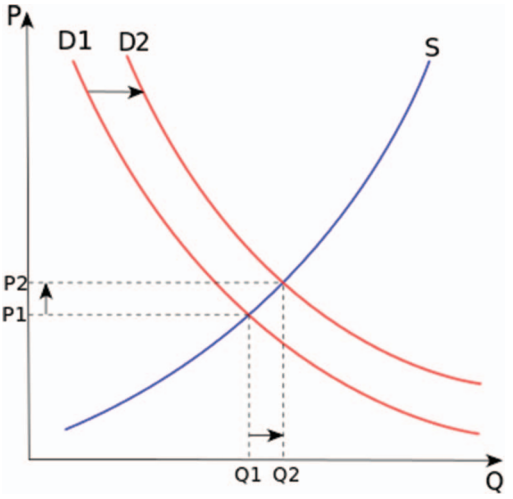

Figure 1. The price P of a product is determined by a balance between production at each price (supply S) and the desires of those with *purchasing power* at each price (demand D). The diagram shows a positive shift in demand from D_1 to D_2, resulting in an increase in price (P) and quantity sold (Q) of the product. See the online article for the color version of this figure.

A second important idea for understanding investing is also an older idea, first introduced by Malthus (1798, reprinted 2004). Although Malthus' work was primarily concerned with population growth over time, he nevertheless enunciated a key principle relevant to economics (Gilbert, 2004). This is that there is a tradeoff between long-term and short-term effects. A considerable amount of work in psychology suggests that children and those who are less developed are more likely to choose short term rewards, even if those are smaller, while adults, and those who perform at a higher developmental stage tend to choose longer term rewards (for an example applied to children, see Mischel, Shoda, & Rodriguez, 1989).

In addition to the law of supply and demand and Adam Smith's theory of the invisible hand, there is another basic economic theory that is important here. The "Efficient Market Hypothesis" (EMH), as partly introduced and reviewed by Fama (1970), along with the behavioral version by Kahneman (2011), states that at any given time, prices fully reflect all available information. If markets are efficient, as defined by this hypothesis, then buying and selling securities in an attempt to outperform the market will effectively be

a game of chance rather than skill. What the EMH implies is that if individuals knew every piece of information available about every individual, corporation, bank, financial institution, et cetera, then there would be a realization that there is no need to try to 'beat the market.' If everyone understood the EMH, they would also understand that history tells us there is no need to try to beat the market, because with patience, the market will beat itself and increase.

One other important piece of information that an investor needs to understand is that there are many players in an economy. There are individuals, financial advisors, corporations, businesses, banks, other financial institutions, and the government. There are quite a few players that fall under the category of 'financial institution' and they are credit unions, stock brokerages, mutual funds, hedge funds, insurance companies, pension funds, trusts, endowments, and bonds among others. Each of these players interacts with a variety of other players, creating systems that may interact with other systems. As individuals' developmental stage increases, they better understand each player, how the players interact, the systems, and how the systems interact as well.

In short, it appears that development has been shown to affect the understanding of economic ideas in a number of areas. It would seem, therefore, that a developmental theory of investing could be productive.

When it is boiled down to the basics, the decisions one makes in an economic setting are based on expected utility. Expected utility is only understood conceptually at higher stages to be discussed below. But reinforcement value is understood even at the low stages so that choices are made that benefit the chooser. Utility can be defined as the value obtained from each economic decision. Expected utility is just that, the expected value of the return on investments or other economic decisions and can simply be defined mathematically as: $E(U(X)) = P(X = x)^{*}U(x)$. Translated into English, this formula says that the expected value of an outcome, X, written as $(E(U(X))$, is a function of the probability of winning that gamble $(P(X = x))$ times the value of to be obtained by that gamble, $(U(x))$. The keys to the mathematical application of expected utility of an obtained outcome such as money are the slope and concavity of the graph. An upward slope means that the person believes that more is better. A concave curve means that the person is risk-averse. The degree of risk-aversion can be measured by the concavity. Risk-aversion is the tendency for people to increasingly choose the 'safer' option with a potentially lower return. Arrow (1971) found that the more money one has, the less risk-averse they are because the additional increase in money has a much smaller increase in utility. The opposite is true when one has less money. Then one is more risk-averse because the same additional increase in money has a much larger increase in utility and the same loss in money larger decrease in utility. An example of an expected utility curve is shown in Figure 2.

Basic economic decision-making rests on these fundamental concepts and models no matter what developmental stage the person has reached because these concepts are based on basic behavioral tendencies observed in both human and nonhuman animals. Whether or not the person making the decision understands and applies these concepts as economic theories and models to real world decision-making is deter-

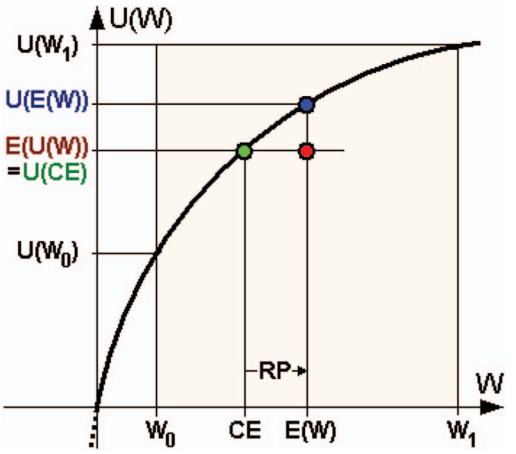

Figure 2. Utility function of a risk-averse (risk-avoiding) person. CE = Certainty equivalent; E(U(W)) = Expected value of the utility (expected utility) of the uncertain payment; E(W) = Expected value of the uncertain payment; U(CE) = Utility of the certainty equivalent; U(E(W)) = Utility of the expected value of the uncertain payment; U(W0) = Utility of the minimal payment; U(W1) = Utility of the maximal payment; W0 = Minimal payment; W1 = Maximal payment; RP = Risk premium. http://en.wikipedia.org/wiki/File:Riskpremium1.png. See the online article for the color version of this figure.

mined by developmental stage (Commons, 2005). As the person reaches higher stages, they increasingly understand and apply these theories and concepts to investment decision-making. To quantify such stages and levels of development, we use the Model of Hierarchical Complexity (Commons, Trudeau, Stein, Richards, & Krause, 1998).

Stages of Investing Using the Model of Hierarchical Complexity

Most rational theories of investing fail because economic theories assume perfectly rational players in the marketplace when we know that people in general do not act rationally (Kahneman, 2011). The financial companies assume that people need help because they are rational but uninformed. Most of these private investors do terribly in managing and investing money in their 401k and IRA accounts, and investing money in general. Many of them do even worse than the mutual fund providers and almost always do worse than the indexes. That is to say almost no one does well in stock picking over the long run.

One of the major causes behind the failures of investing is the inadequate stage of development of the investors on the task of investing. The Model of Hierarchical Complexity is used to determine behavioral stage. The MHC orders tasks in terms of Hierarchical Complexity. A task is defined as more hierarchically complex when (a) the higher order action is defined in terms of the actions at the next lower order, (b) organizes these lower-order actions, (c) in a nonarbitrary way. The MHC explains the stages of development with a stage name and number that corresponds to the order of hierarchical complexity of the task it correctly completes. The stages characterize behavior from infancy through adulthood. It will be shown below that investment strategies vary at each stage and therefore only at some of the highest stages do investors begin to make decisions that increase the probability of better overall investment returns.

To fully apply the Model of Hierarchical Complexity to economic investing strategy, we must use the definitions of the behavioral developmental stages to classify different economic principles will be used. This will aid in assigning an Order of Hierarchical Complexity by evaluating investing actions and decision-making.

Pre-Investment Stages

Preoperational Stage 7

The discussion starts with some of the earlier stages, during which some of the precursors to later investing behavior develops. At the Primary Stage 7, a person has no notion of probability. They also do not see the value money without explicit training. At this stage however, people and children do know about buying and their choice behavior follows the "matching law" of Herrnstein (1970). The proportion of their choices matches the proportion of the obtained value of the consequences for those choices.

Primary Stage 8

A person is now capable of simple arithmetic and is able to add, subtract, multiply, and divide numbers. They understand that money is valuable but does not yet know how to make a fair trade. At the Primary Stage, they only know what the other person values or what they value, but not both at the same time. They have no understanding of a market but may be told what the price of something should be.

Concrete Stage 9

A person performing at the Concrete Stage 9 not only performs the basic arithmetic operations, including the distributive law (multiplying $3 \times (4 + 5)$, but also makes deals between themselves and a few others. They use low stage investment strategies that include listening to the advice of very local authorities such as family, friends, *The Economist*, Fox News, CNC, and Bloomberg among others. These people suffer long term because they view investments as deals with other persons therefore their performance depends on the "kindness of others" and how good at investing the others are. This means they depend on the knowledge, skill, and analysis of others. They do not understanding that investments involve an institutional relationship. As a result of this strategy, they can be more subject to scams and high pressure sales tactics.

Early Investing Stages

Abstract Stage 10

As developmental stage increases, individuals possess the skills, knowledge, and understanding of the lower stages, as well as a new set of skills, knowledge, and understanding that allow the jump to the higher stage. At the Abstract Stage 10, the decision-making process on investment strategy is heavily influenced by outside sources. A person at the Abstract Stage follows the crowd as they buy low and sell high because that is what others are doing. They listen to others to find a "highly rated" investment advisor and then do what their advisor says no matter what the performance. This directly leads to large fees, low returns, and a high likelihood of losing money. They do not yet understand ratios and percentages in the context of interest rates and percent fees on mutual funds, nor do they understand percent inflation and why the return on bonds may not keep up with inflation.

The "Wealth Effect" (Darby, 1987; Jelveh, 2008; Zubin, 2008) is an economic term where an increase in perceived or actual wealth leads to an increase in spending, or vice versa with a perceived or actual decrease in wealth. Temporary wealth changes have a smaller effect on consumption changes than permanent wealth changes. With the wealth effect people psychologically associate higher net worth with having more disposable income. This is evident at Abstract Stage 9 where big gains in portfolio values attributable to bull markets make people feel secure about their wealth, so they spend more of it. At this stage, people tend to invest more at the height of markets and overconfidence, caused by the wealth effect, leads to bigger losses when the market crashes. People also pull money out at the bottom of the market. They make overcorrections that are similar to those made by novice sailors. If one tries to turn too quickly, one will find that most times one ends up turning too far across the wind. One's instinctive reaction is to turn back the other direction, most times ending up head to the wind instead. The process of *overcorrecting*, both in investing and on the water, is the result of risk-aversion. This leads to smaller overall gains when the markets go backup. If the wealth effect is too strong, meaning people overcorrect for changes in the markets by selling too much when the prices are low and buying too much when the prices are high.

Formal Stage 11

This is the last stage considered a 'low stage' in the developmental levels of investment decision-making. This is because the Formal Stage is the last stage at which the person only pays attention to one variable at a time. For example, many such individuals, who we can call "risk-averse," will only look at risk and try to minimize it. For example, they may invest savings in banks at interest rates substantially below the rate of inflation. People cannot be self-identified as "risk-averse" or "risk-seeking" until they understand the concept of risk, which makes Stage 11 the first stage at which one can attach a risk-averse label to the individual.

Other times the individual at the Formal Stage will only look at value. This explains why some people play the lottery—because the prizes are so large. If those who open small businesses only look at opportunity in the form of value ("I can make so much money selling this new product!") they will almost always fail. These businesses may be initially profitable but cannot respond to shocks such as raises in rent, legal issues, or inadequate cash flow because the individual did not consider other variables that effect businesses, such as risk or the need for capital when opening the small business.

Higher Investing Stages

Systematic Stage 12

Transitioning to high stages of development in the decision-making process for investing requires the consideration of two or more variables at the same time. At the Systematic Stage 12, therefore, one can have a two-input variable system consisting of both risk and value (or return on investment). Investors understand the tradeoff between risk and return. By the definition of the Systematic Stage 12, solving two equations in two unknowns is a hallmark. Because risk has a functional equation and return (value) has a different functional equation, the price is found by solving these two equations. Although not everyone at the Systematic Stage necessarily formally solves these equations, their actions show that both are being considered. Investing essentially requires at least

understanding a two input variable system consisting of risk and value: (a) the monetary value of the assets to be gained and (b) the risk of the random walk of value in the market. Information on value, for example, a dividend, is much more widely available than on risk, for example, the safety of the dividend. The dividend is quite public whereas risk is something that has to be estimated. The estimations are based on simplistic models, such as the variability of the stock.

A well-known result is that with greater risk come greater returns. The issue at the Systematic Stage is how much risk one can stand as an individual, a company, or a country. Risk-averse people will take the certain return, instead of taking a risk that could give them more than the certain but larger return. Most people are risk-averse rather than positive-seeking utility seeking. Nevertheless, because they can understand the relationship between taking in a larger degree of increased risk and obtaining increased value, individuals performing at Systematic Stage 12 are slightly less risk-averse than those performing at Formal Stage 11. That is, people performing at the Systematic stage more overtly consider utility, expected utility, and how risk awareness and risk-aversion affects their behavior.

A popular investing strategy among investors at this stage is the diversification of investments. Diversification is the process by which investors aim to reduce risk by investing in a variety of different assets. The idea of diversification is probably quite old. It can be found, for example, in a statement of Sancho Panza to Don Quixote: "Tis the part of a wise man to keep himself today for tomorrow, and not venture all his eggs in one basket." (de Cervantes, 2003).

By becoming cognizant of risk, people also begin to consider the actions and choices of others in their risk assessment and decision making process. One thing that this leads to is that people will consider the behavior of the entire market or of markets in making assessments of risk, not just of their individual investments. At this stage, it is also necessary to understand margins as a way to look at risk in terms of the debt equity ratio. A way to look at what one can take on margin safely can be calculated as follows in this example. To start with, one takes the gross value of the portfolio. One then takes 40% of the gross value, because in this example we are assuming a 60% possible drop in portfolio value. That 40% is then multiplied by the margin rule, 70%, to protect against margin calls. After multiplying 0.4×0.7, you get roughly 0.3, which means that one can have 30% of the gross value on margin. The better an individual understands margins, the better they is able to assess risk. Taking into account risk and other players is a skill that grows as the individual reaches each higher Order of Hierarchical Complexity. Even if one can choose one's level of risk and the value that might result, this strategy alone ultimately also will result in failure too often. Next, it is explained why.

Metasystematic Stage 13

To make the transition from Systematic Stage 12 to Metasystematic Stage 13, there needs to be an understanding of systems of risk and values across of related systems. The Efficient Market Hypothesis states that at any given time, prices fully reflect all available information (Malkiel, 1973; Desai, 2011). Taking advantage of the EMH requires an understanding of a range of economic systems and the properties of those systems.

When individuals understand that markets consist of systems of risks and returns and they are able to compare multiple systems, that skill places them at the Metasystematic Stage 13.

Those few who make the transition from Systematic Stage 12 to Metasystematic Stage 13 apply at least the following 10 propositions. The crucial aspect of the metasystematic stage is that the properties of systems are explored. The simplest way is to compare or coordinate two systems based on the properties of those systems.

Investment Principles That Are Now Understood

1. Rate of return. Everything comes down to the obtained long-term rate of return on investments. A complete account of rate of return should be the percent gain per year derived from not just income but also valuation of the investments. Calculating the raw rate of return is the percent gained of an item's value, dividends and other income derived from the item per year. There are other kinds of value that may be considered such as the first derivative of the raw rate of return, which is how fast the growth or reduction in the rate of return. One might want to correct this value by considering the rate of inflation or the Consumer Price Index (CPI). This rate of return should be maximized, with

sanity, which means that one should not try to have perfect maximization, but one should aim to do the best possible. One has to understand the properties of systems to compare them or to coordinate them in the ways described. To understand why this is difficult consider two things. First is that growth curves need to be logged because of decreasing marginal utility of money or value as a function of total value. Second, growth curves need to be de-cumulated to get at yearly percent growth rate for each particular investment. Each of these transforms a system. The value of money becomes linear when the log of money is used. This system of logged metrics is compared to other systems to see that it is the best. The metric is used to compare where the sources of the rate of return is considered important, that is, income versus increase in value of an asset.

2. Diversification. Investors are like insurance companies in one regard. They are buying risk and like insurance companies they need a large enough pool of investments so as to reduce the risk. Take portfolio theory which underlies diversification. The goal of diversification is to lower risk. The variability of the change in a stock price is one measure of risk. Variability may be represented by the standard deviation (*SD*) of a price. Investing in a portfolio of stocks, bonds, commodities and property rather than a single holding reduces variability by *n*, or the number of different types of investments in the portfolio. This reduced variability is because *SD*/*n*. The Standard Error of the mean, *SD*/*n*, is much smaller than *SD*. This requires understanding and comparing the following three systems: (a) what variability is, (b) how it is measured, and (c) why it is measured that way.

To show why these comparisons are Metasystematic Stage 13, the properties of the three systems are laid out next. This is done in some detail here so that it is clear to the reader the order of hierarchical complexity of the tasks that need to be completed. In scoring the any tasks for order of hierarchical complexity, this should be done. The first system for measuring variability is based on the mean deviation, MD. This involves summing the absolute values of the deviations from the mean, and dividing by *n*. The MD (mean absolute value of deviates) has a set of properties that do not need to be enumerated in detail here. The second system is based on the variance (which is the sum of the squared deviations from the mean, divided by *n*) and its square root, the standard deviation or *SD* Fisher (1920) countered Eddington's argument that MD was a better way to represent variability with a mathematical argument that *SD* was more *efficient* than MD under ideal circumstances. Many commentators now accept that Fisher provided a complete defense of the use of *SD* (e.g., Aldrich, 1997; MacKenzie, 1981). Hinton (1995) also shows that *SD* is a better measure than MD.

Fisher had proposed that the quality of any statistic could be judged in terms of three characteristics. In the Model of Hierarchical Complexity, these are the properties of the systems that are to be compared here. First, the statistic, and the population parameter that it represents, should be "consistent" (i.e., calculated in the same way for both sample and population). Second, the statistic should be "sufficient" in the sense of summarizing all of the relevant information to be gleaned from the sample about the population parameter. Third, the statistic should be "efficient" in the sense of having the smallest probable error as an estimate of the population parameter. Stephen Gorard (2004, September) noted that Fisher asserted that both *SD* and MD meet the first two criteria (to the same extent). According to Fisher, it was in meeting the last criterion that *SD* proves superior. When drawing repeated large samples from a normally distributed population, the standard deviation of their individual mean deviations is 14% higher than the standard deviations of their individual standard deviations (Stigler, 1973). Thus, the *SD* of such a sample is a more consistent estimate of the *SD* for a population, and is considered better than its plausible alternatives as a way of estimating the standard deviation in a population using measurements from a sample (Hinton, 1995, p. 50). That is the main reason why *SD* has subsequently been preferred, and why much of subsequent statistical theory is based on it.

After settling on *SD*, one may examine a portfolio has *n* items. The number of items, *n*, thereby reduces the risk from *SD* to *SD*/*n*. The second metasystematic stage 13 comparisons are when system 2 with *SD* is compared to system 3 which has *SD*/*n*. This chain of metasystematic Stage 13 comparisons shows that system 3 is to be preferred over all the other systems.

The way diversification has been achieved has dramatically changed because the instruments of more modern investing are constantly being developed. The means of making trades has changed from shouting bids, to telegraphs, then phones and now computers. The display of trades and their aggregation speeded up the process. An example of the changes that have taken place can be seen by looking at the mutual fund and its descendent, the Exchange Traded Fund. Their development depended on the way in which trades are made and recorded. Mutual funds could only be traded at the end of the day when the value of their assets could be gleaned from the closing value. But with computers and electronic transmission in digital form, the value of a group of assets could be almost instantly assessed and displayed. This made index funds (ETFs) possible. They decreased the reliance on a specialist who placed those trades and stock broker who recommended what should go into a balanced portfolio.

3. Correlation of markets. There needs to be an appreciation that markets are highly correlated in their movements. This includes all the various stock exchanges, commodity markets and bond markets and currencies. Even though there is a tendency for all markets to rise during the same time period, it is still true that markets in which there is more risk are associated with higher returns over a 10- to 20-year period. In general the market returns are as such: The DOW Jones goes up the least; The SP500 next; The NASDAQ third; The flat NASDAQ fourth; The Russell next (See Table 1; It is just for one period).

4. Understanding basis for rate of growth. The rate of growth of an index is somewhat related to the growth of the GDP of the countries and regions: Africa is growing the fastest of any region; Asia is second; third is Brazil. But many U.S. companies also have big investments and operations in a range of emerging markets. General Motors does half of its business in China. An economy as a whole is a system; the main indicator of the rate of growth of that system is GDP. The indexes that represent the most capitalized publicly traded investments also are a system. Looking at the correlation of these two summaries of growth uses a property to relate growth of two quite different systems, a metasystematic action.

5. Understanding timing. It is impossible to time the markets. There are a large number of reasons for this. What causes large market downturns mostly changes with each downturn. How long the downturn lasts also varies. The political responses to the change in market conditions are also variable. The best one can do is to: Buy when everyone says to sell; Sell when everyone says to buy. There is almost always "Hysteresis" (Blanchard & Summers, 1986), which consists of overshoot and undershoot by investors both at the top and at the bottom. If you were to ask almost any adult what the basics of investing are, you would most likely hear "buy low, sell high" as the most common response. The reason for this has to do with developmental stage. At the Abstract Stage 10, people tend to follow the crowd—and the crowd *should* buy low and sell high. But they do just the opposite. On the way down, people sell to ostensibly avoid further losses. There is accelerated selling as the market nears the bottom. This is because there are different thresholds for different risk-aversion tendencies. Most people's threshold is reached near the bottom. On the way up, most people over discount risk because they are not looking at the long run. This is true even though long run loans to do investing are less risky at the top than short run loans. The individual investors largely trade this way because this is the way they were taught to trade.

Table 1
Performance of Other Domestic Stock Indexes: Return Percentage

Name	As of date	YTD	13 week	3 year	5 year
NASDAQ Composite PR	01-29-15	−1.11	2.95	18.47	16.88
Russell 2000 TR	01-29-15	−1.16	4.16	15.79	16.14
S&P 500 TR	01-29-15	−1.73	2.49	17.86	15.90
DJ Industrial Average TR	01-29-15	−2.16	3.22	14.03	14.50

Note. YTD = year to date; PR = price change; TR = total return; DJ = Dow Jones.

6. Independence. There is a great deal of independence between what currently is and what will be. The economy has long term trends or "attractors." Chaos Theory is a model that integrates the "randomness" found in the short term moments of the market (System 1) with long term market trends (System 2). Hence, this is another theory that requires the Metasystematic Stage 13 to be understood. A more extensive account is presented by Görtz & Commons (in press). Markets are always moved by multidimensional factors occurring in an open, complex environment. The value of entities in the market change disproportionately to the changes in inputs. In chaotic systems, where there are multiple co-occurring flows (processes of ongoing change), the properties of the system itself can change (Strogatz, 2001). The output becomes much more unpredictable. In this case, the "outcome" of the system is the prices of individual market entities. These changes in turn affect regulations on how real human beings act. For example, property values that get close enough to the attractor values remain close even if slightly disturbed, meaning that the system tends to stabilize around this same pattern. In dynamical systems (Kolmogorov, 1991), an *attractor* is a set of properties toward which a system tends to evolve, regardless of the initial conditions of the system. This is why markets over the very long term appear to go up in a predictable fashion and in a chaotic fashion over the short term. (Rosario, 2006, p. 68).

7. Efficiency. The market is relatively efficient. This means that knowledge about investments is readily available to almost everyone. Over a period between 5 and 19 years, no one has shown how to beat the market averages. This embodies the understanding of the foibles of stock picking. People who understand this know that there are no experts so they do not pay for them nor for any reports, magazines, and so forth (Kahneman, 2011). The costs of paying experts lowers total rate of return and does not lead to better outcomes. Over the long run, Exchange-traded funds outperform managed mutual funds and hedge funds. They also outperform suggested buys and sells by stock brokers and newsletters.

One has to understand three systems to know this: No one has long-term insight into what business or property will succeed. First, unforeseen conditions that effect values change. One of the most difficult is to know what people will want in the future. Even slow-moving changes in the value of real estate go up and down as neighborhoods change. In the 1960s, who could have predicted that young professionals would want to move back into the cities, gentrifying them? The market system is much too complex for anyone to understand how all the forces will change values. Seeing only part of the picture biases one's choices.

8. Do not trade. The advisability of short-term trading is doubtful because timing in the market is unpredictable. There are two kinds of costs and one kind of perceived advantage. These costs and the illusory advantage have to be coordinated. First, consider the lost opportunity costs of not being fully invested. Second, consider the cumulative transaction costs. If one does very little trading, one does not have to pay brokers much. Third, people generally make their trading decisions based on market trends. But it illusory because one can miss opportunity when a bear market turns around, which is unpredictable. One buys near the top for the same reasons.

9. Leveraging. Most investments are leveraged to increase the rate of return on capital. That accelerates the positive gain in value when the market value is up and decreases it when the market is down. An example of the latter is that some people's houses went "underwater" during the downturn of 2008. But they also understand some benefits that may ensue from some degree of leveraging and also possible risks in terms of loss of principle. They are aware that the chance to lose more is higher if they are overleveraged, but they know that with certain financial instruments one can only achieve a decent rate of return by leveraging or buying futures.

For the stock market, historically over an 80-year period, the market never went down more 50% (Merriman, 2014). So leveraging 30% of one's market value of holdings at the "top" of the market is probably safe. This follows from never getting margin calls. The calculations are as follows: If the market goes down 50%, the 100% value becomes 50% of that original value. Then 70% of 50% is 35%. To be even safer, one might round this to 30% of total equity value.

10. Understanding value and its discounts. Until the Metasystematic Stage 13, people generally only have a vague notion of how people discount value over time. This applies not only to possible future rewards and punishments but also to past rewards as well. Hence they forget history.

To understand value, how it is discount with time, and how risk also discounts value, requires Metasystematic Stage 13 reasoning to integrate those three systems. Value and its discounts are organized into a single system. The degree to which various consequences are valued forms the basis (see Harrigan & Commons, 2014). What is valued is then discounted hyperbolically as a function of time to those consequences in the future as shown in the Appendix. Animals and people have different rates of discounting. Some forms of risk are shown to be hyperbolically discounted forms of time discounting.

What fails in the Metasystematic models, however, is that they are either inconsistent, incomplete, or based on insufficient histories. There is a lack of empirical checking of the models, use of wrong statistics and computer models with incomplete variable sets, and an overly strong belief that their coordination of systems will work in all cases or even be possible.

Paradigmatic Stage 14

At the Paradigmatic Stage 14, one understands the impossibility of making metasystems work because there are too many considerations that make the metasystems either inconsistent or incomplete. One understands completely that there is no entirely safe and productive way to invest, and through understanding this, one limits their own risk-aversion techniques. Also one forms paradigms such as economics that include multiple metasystems. These would include market place dynamics, discounting, and so forth. The dynamics of evolution, behavioral economics, and change in allocation are all seen as different "flavors" of the same process (Hodgson, 1993). Also, metasystems of development and evolution are seen as a paradigm.

Understanding systems and properties of systems is one thing at the Metasystematic Stage 13, but at Paradigmatic Stage 14, one understands that no system can be both complete and consistent. One also understands that as soon as they make a regulation, people figure out how to game it and get around it. Even with these considerations, no one knows the unintended consequences of such regulations such as how to minimize costs. For example, at the Paradigmatic Stage 14, one realizes that regulation needs to have goals that lead to progress not stagnation. Current regulations such as those about building codes keep innovation from being made in design and construction even though they are meant to protect society.

Because people understand that there is no entirely safe and productive way to invest, they limit their risk-aversion tendencies. Every metasystem to make investing safe and productive has its downsides, so why is regulation not a solution to the financial system? Based on the financial crisis of 2007 through 2008, it is safe to say that the financial system has gotten harder to regulate.

It can be said that the financial crisis of 2007 through 2008 was the result of poorly designed regulations. The biggest market crash of this crisis was the housing market. There were many bad loans made that did not require any down payment; in many cases not even proof of income was required. Such loans were packaged by brokerage houses into packages that received much too high a rating as compared with the individual loans the package contained. The rating agencies were not using data that went far enough back, to be statistically significant. Additionally, the rating agencies are paid by the companies they are rating, thus creating a conflict of interest that leads to higher than deserved ratings. The perceived path of the housing market led people to believe that the value of their own house could only go up (Simkovic, 2009). Fannie Mae and Freddie Mac, two government-sponsored enterprises (GSEs), bought many of these loans and because these loans were often packaged by people who were selling them and not buying them, Fannie Mae and Freddie Mac could make money on them if the instruments failed (Duhigg, 2008).

Cross-Paradigmatic Stage 15

When an individual reaches the Cross-paradigmatic Stage 15, they see the economic system and political system as being related and intertwined. They realize that both respond to "irrational" forces, and both have a form of market place with the economic market being faster and fairer. There is an understanding that political systems require a majority vote, while an economic system simply requires a collection of people who buy and sell the same set of goods and services. The economic system may change in less than a second but the political system changes at a very slow rate.

A second crossing of paradigms also takes place. That is that developmental stage and evolutionary stage which form two related paradigms

are crossed with the economic paradigm. The developmental stage paradigm is about changes within an organism's life span. The evolutionary stage paradigm is about changes in stage over evolutionary time (Harrigan & Commons, 2014). This article represents the use of developmental stage paradigm when crossed with the economic paradigm. This allows for understanding why discounting parameters change with stages of development. These discounting parameters include not only time to consequence discounting but also risk discounting. To a degree, individual and species differences in these discounting parameters have a developmental and evolutionary basis.

Discussion

Most people do not perform at a high enough stage to make money investing. This section will discuss some possible solutions. One obvious solution would be to better educate people so that they would on their own make some better decisions. The goal of such education is to allow individual investors to more clearly see the overall picture when it comes to investing and also to level the playing field so that individual investors have more of the information that is typically available to money managers and investors. This has already been happening to some extent, as various investing platforms complete to offer data analytic tools that consumers can use.

Another solution would be to also continue to have individual investors rely on the advice of others. For instance, one can engage in downward assimilation, that is one can be instructed on what to do without understanding why. Research has shown (e.g., Colby, Kohlberg, Gibbs, & Lieberman, 1983) that individuals may understand one stage above their own, even though they clearly do not explain that stage themselves or carry out actions at that stage on their own. Other research (Fischer, Hand, & Russell, 1984) has shown that with some kind of supportive structure, such as cueing or providing a model, people perform at least one stage higher. For example, at the abstract stage, they may follow advice on using a very low cost broker, even if they do not understand why the cost of the transactions reduces their rate of return. A person performing at the formal stage can be told to follow a policy of only buying ETFs. They would still have the bias of minimizing risk as most formal stage performers do. At the systematic stage, they could understand that buying a group of ETF's would decrease risk even more. Yet they would still be influenced by expert opinions. Command following may be done two stages below the stage of the command.

Addressing Specific Factors That May Interfere With Effective Investing

At the same time, it would be useful for investors and investing advisors to be made aware of several specific factors that affect investing decisions.

Are there too many choices? Is the problem only with the people who decide to invest their money and how they choose to invest it? Alternatively, could the problem lie partly within the market itself? One issue is that there may be too many types of investments from which to choose. When there are too many choices, people (and animals) have been shown to behave in ways that may not lead to the best outcomes (Schwartz, 2004). This might include having difficulty making any choices at all. For example, they might leave their money in low-interest savings account or always choose the same thing instead of sorting through all the choices to find something new. This appears like insensitivity to market forces. A remedy for this is to limit one's choices, for example, by buying a few ETF's such as the S&P 500, Nasdaq 100, Russell, and Emerging markets.

People do not consider the long term as effectively as the short term. Additionally, as discussed earlier in the present article, people have a strong tendency to overdiscount and not look at the long run (see the Appendix A, and Kahneman, 2011). Figure 3 shows that when one looks at the Dow Jones over a long period of time, its overall value increases. People have to be encouraged in various ways to pay more attention to these longer term tendencies. Currently, much of the information that is disseminated to investors by daily commentators on the news and also by other reports put out by stockbrokers and others is almost all completely short term. Investors are told the daily fluctuations of the various indexes, but rarely is this put into the context of the longer term. This kind of information misleads investors into thinking that these daily fluctuations have meaning, when almost always they do not. If instead, the information that was disseminated concentrated more on the long term trends, this would help many people to overcome this tendency to focus

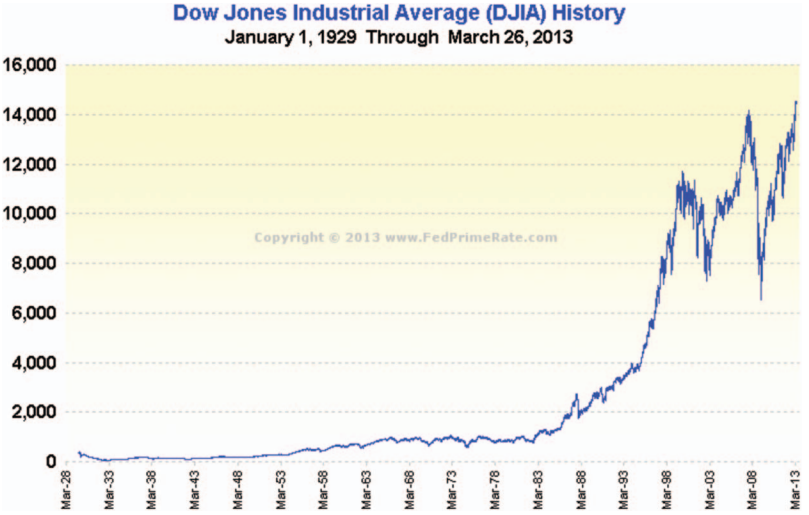

Figure 3. The graph shows that it is difficult for people to understand the performance of the market over the long run and also do not understand that if one transforms it to a log scale that rate of increase is more constant. What the investors do not consider is the long run performance of the markets. This graph depicts the Dow Jones Industrial Average from 1929 through March of 2013. As you can see, even with short run rises and falls the overall value of the DJIA increases over time. This should be taken into account by investors as an integral part of their money managing strategy. Also note that when graphed on a log-scale, the highs and lows of '88 and '08 are the same. From FedPrimeRate.com. Copyright 2013 by FedPrimeRate.com. Reprinted with permission. http://www.fedprimerate.com/dow-jones-industrial-average-djia-history.gif. See the online article for the color version of this figure.

on the short term. Reporting on the long term would not appear to be news because there is not usually a big event to report. The long-term trends do not change much Graphs such as the one shown in Figure 3 also need to be revised so that the information is presented in log form, rather than in terms of raw dollars. That would make it clear that the overall trend in the market over time was relatively constant, rather than one with a high degree of acceleration in recent years.

What the investors do not consider is the long run performance of the markets. This graph depicts the Dow Jones Industrial Average from 1929 through March of 2013. As you can see, even with short run rises and falls the overall value of the DJIA increases over time. This should be taken into account by investors as an integral part of their money managing strategy. Also note that when graphed on a log-scale, the highs and lows of '88 and '08 are the same.

What does risk aversion look like, and what can be done? Let us come back to the overreactions of risk-averse people to temporary market fluctuations. As discussed above, the process of overcorrecting in investing is the result of risk-aversion. The cost to the risk-averse person is that they tend to buy and sell at the worst times in terms of making money over the long run.

This can be counteracted somewhat by differentiating between how much risk a person can handle and how much risk they should take on as an investor. How much a person should take on is dependent on their financial state, liquidity, time horizon, and other personal factors. Such factors may be somewhat objectively appraised, and should be assessed particularly when making initial investment decisions. What the investing field in general could try and influence is the tendencies of investors to respond too quickly when risk appears to rise. Risk-averse investors may overreact to a temporary market change and sell at the wrong time. However, if ways could be developed to combat this tendency this could allow more investors to obtain better returns overall.

No precise prediction of the future is possible, only trends with up- and downside probabilistic limits. Investors may think they can be on top of

the market, but having all the information does not help because the past cannot predict the future in economic markets. For a large number of reasons, there is no real way of predicting the market. One of the reasons for this, particularly in recent years, is because of factors such as disruptive innovation and "black swan events" (see Appendix B for a discussion). Black Swans event are a metaphor for unpredictable events. These events may go beyond disruptive changes such as the development of the personal computer and Internet. They include events such as the September 11th attacks and the assignation that led to the outbreak of World War I. Disruptive innovation is "an innovation that creates a new market by applying a different set of values, which ultimately (and unexpectedly) overtakes an existing market" (Christensen, 1997). An innovation earns the title of 'disruptive' when it not only improves a product or service and expands the consumer range in unexpected ways, but then proceeds to lower the price. The disruption and displacement of the existing market can take years, but is not the same as sustaining innovation. Sustaining innovation advances existing markets and value networks, but does not create new markets.

Stage and Bias Applied to Investment Advisors: Self-Deception, Industry Self-Deception, and Bias

One might think that one of the solutions to the problems with investing is to hire professionals. After all, professional investors and mutual fund managers have access to information that is not easy for the public to access. That is not to say that it is impossible to find this information, but it is difficult and therefore most people would rather have someone do it for them. The professional investors to whom we entrust our savings and investments are very intelligent, or at least appear to be. So why do they give bad advice? "We define 'good advice' as advice that moves the investor toward a low cost, diversified, index-fund approach, which many textbook analyses on mutual fund investments suggest, see for example Carhart (1997)."

The results were revealing. In a Harvard and MIT study (Brinkerhoff, 2012; Mullainathan, Noeth, & Schoar, 2012), just 21 of 284 brokers contacted by researchers posing as clients recommended investing in index funds, which mirror broader market performance and carry the smallest fees. Lower Stage performers are much more likely to be biased by commissions and instructions (Commons, Miller, Li, & Gutheil, 2012). Their decisions often seem to be biased by how companies for which they work pay them. That is, if they work for a company that sells mutual funds, that is what they tend to recommend. If they work for a company with a wider range of possible investment products, they would tend to give broader kinds of advice. Perhaps advising would work better if people worked for companies that had no products or commissions for selling certain products, but were simply advisors. Then the incentives would be for them to become as effective at advising as possible. Their effectiveness could be tracked and they could publish statistics on how well their clients did over time.

With their additional information, one would think that the professionals would do better than the indexes but, in general and especially over the long run, they do not. Again, they have a tendency to make investment decisions that are lower stage. As for changing the stage of the money managers and investors, that would require a change in the curriculum of economics and the teaching methods. We know it is nearly impossible to change the current generation's way of thinking, so we must focus ahead to the next generation. The changes will need to include extending the curriculum to include a stronger emphasis on the history of the markets. We know that history does not predict the future, because of disruptive innovation, but that historical market gains provide valuable insight into long term investing. A focus on long-run effects and the perils of overdiscounting in our economy would also be necessary.

Assuming the education system is able to enact the changes we so desire in our investors, a higher developmental stage for investors and money managers will change their methods and reasoning. This higher stage, the Metasystematic Stage 13, involves understanding and comparing two or more systems at a time. People performing at Stage 13 understand the idiosyncrasies associated with stock picking, which causes them to question the market and the advisability of short-term trading. Armed with the realization that the market is relatively efficient, investors and money managers are more likely to look ahead to the long run and lower the rate of overdiscounting related investment errors. When considering long-term investing at Stage 13, investors now look back at the

historical market trends but also understand that history does not predict the future. The demand in the market develops in new directions.

References

Aldrich, J. (1997). R. A. Fisher and the making of maximum likelihood 1912–1922. *Statistical Science, 12*(3), 162–176.

Aristotle. (1984). *The complete works of Aristotle: The revised Oxford translation* (J. Barnes, Ed.). Princeton, NJ: Princeton University Press.

Arrow, K. J. (1971). The theory of risk aversion. In Y. J. Saatio (Ed.), *Aspects of the theory of risk bearing*. Reprinted in *Essays in the theory of risk bearing* (pp. 90–109). Chicago, IL: Markham Publishing Company.

Blanchard, O. J., & Summers, L. H. (1986). Hysteresis and the European unemployment problem. *NBER Macroeconomics Annual, 1,* 15–90. http://dx.doi.org/10.2307/3585159

Brinkerhoff, B. (2012, September 3). Harvard study: Are financial advisers giving 'good advice'? [Web log post]. Retrieved from http://www.bnl.co.nz/blog.html/harvard-study-are-financial-advisers-giving-%E2%80%98good-advice%E2%80%99.html

Carhart, M. M. (1997). On persistence in mutual fund performance. *The Journal of Finance, 52,* 57–82. http://dx.doi.org/10.1111/j.1540-6261.1997.tb03808.x

Carr, A. (2013). "Take it or leave it": Zuckerberg's approach to advising Instagram after acquisition Fast Company. Retrieved from http://www.fastcompany.com/3013447/take-it-or-leave-it-zuckerbergs-approach-to-advising-instagram-after-acquisition

Christensen, C. M. (1997). *The innovator's dilemma: when new technologies cause great firms to fail*. Boston, MA: Harvard Business School Press.

Christensen, C. M. (2003). *The innovator's solution: creating and sustaining successful growth*. Boston, MA: Harvard Business Press.

Colby, A., Kohlberg, L., Gibbs, J., & Lieberman, M. (1983). A longitudinal study of moral judgment. *Monographs of the society for research in child development* (Vol. 48). Chicago, IL: University of Chicago Press.

Commons, M. L. (July, 2005). *Adult developmental stages in behavioral economics and decision making*. Paper presented at the meeting of the Society for Mathematical Psychology, University of California, Irvine.

Commons, M. L., Miller, L. S., & Giri, S. (2014). A model of stage change explains the average rate of stage of development and its relationship to the predicted average stage ("smarts"). *Behavioral Development Bulletin, 19*(4), 1–11.

Commons, M. L., Miller, P. M., Li, E. Y., & Gutheil, T. G. (2012). Forensic experts' perceptions of expert bias. *International Journal of Law and Psychiatry, 35,* 362–371. http://dx.doi.org/10.1016/j.ijlp.2012.09.016

Commons, M. L., Trudeau, E. J., Stein, S. A., Richards, F. A., & Krause, S. R. (1998). Hierarchical Complexity of tasks shows the existence of developmental stages. *Developmental Review, 18,* 237–278. http://dx.doi.org/10.1006/drev.1998.0467

Darby, M. R. (1987). Wealth effect. *The new Palgrave: A dictionary of economics*. New York, NY: Palgrave Macmillan.

Davis, W. L., Figgins, R., Hedengren, D., & Klein, D. B. (2011). Economic professors' favorite economic thinkers, journals, and blogs. *Econ Journal Watch, 8,* 126–146.

Dawkins, R. (1989). *The selfish gene* (2nd ed.). Oxford, UK: Oxford University Press.

de Cervantes, M. (2003). *Don Quixote*. New York, NY: Penguins Publishing Group.

Desai, S. (2011, March 27). *Efficient market hypothesis*. Retrieved from http://en.wikipedia.org/wiki/Efficient-market_hypothesis

Duhigg, C. (2008, July 11). Loan-agency woes swell from a trickle to a torrent. *The New York Times*. Retrieved from http://www.nytimes.com/2008/07/11/business/11ripple.html?ex=&_r=0

Fama, E. (1970). Efficient capital markets: A review of theory and empirical work. *The Journal of Finance, 25,* 383–417. http://dx.doi.org/10.2307/2325486

Fischer, K. W., Hand, H. H., & Russell, S. (1984). The development of abstractions in adolescence and adulthood. In M. Commons, F. A. Richards, & C. Armon (Eds.), *Beyond formal operations* (pp. 43–73). New York, NY: Praeger.

Fisher, R. A. (1920). A mathematical examination of the methods of determining the accuracy of an observation by the Mean Error, and by the Mean Square Error. *Monthly Notices of the Royal Astronomical Society, 80*(8), 758–770.

Gilbert, G. (2004). *An essay on the principle of population*. Oxford, UK: Oxford University Press.

Gladwell, M. (2000). *The tipping point: How little things can make a big difference*. Boston, MA: Little, Brown.

Gorard, S. (2004, September). *Revisiting a 90-year-old debate: The advantages of the mean deviation*. Paper presented at the British Educational Research Association Annual Conference, University of Manchester.

Görtz, D. P., & Commons, M. L. (in press). The stage-value model: Implications for the changing standards of care. *International Journal of Law and Psychiatry*.

Hanlon, S. (2014, April 24). Why the average investor's investment return is so low. Retrieved from http://www.forbes.com/sites/advisor/2014/04/24/why-the-average-investors-investment-return-is-so-low/

Harrigan, W. J., & Commons, M. L. (2014). The stage of development of a species predicts the number of neurons. *Behavior Development Bulletin, 19,* 12.

Herrnstein, R. J. (1970). On the law of effect. *Journal of the Experimental Analysis of Behavior, 13*(2), 243–266.

Herrnstein, R. J., & Prelec, D. (1991). Melioration: A theory of distributed choice. *The Journal of Economic Perspectives, 5*(3), 137–156.

Herrnstein, R. J., & Vaughan, W., Jr. (1980). Melioration and behavioral allocation. In J. E. R. Staddon (Ed.), *Limits to action* (pp. 143–176). New York, NY: Academic Press.

Hinton, P. (1995). *Statistics explained*. London, UK: Routledge.

Hodgson, G. M. (1993). *Economics and evolution: Bringing life back into economic*. Ann Arbor, MI: University of Michigan Press.

Jelveh, Z. (2008, June 17). In praise of the wealth effect. *Upstart Business Journal*. Retrieved from http://upstart.bizjournals.com/views/blogs/odd-numbers/2008/06/17/in-praise-of-the-wealth-effect.html?p.=all

Kahneman, D. (2011). *Thinking, fast and slow*. New York, NY: Farrar, Straus & Giroux.

Kolmogorov, A. N. (1991). The general theory of dynamical systems and classical mechanics. [Soviet Series]. *Mathematics and Its Applications, 25,* 355–374.

MacKenzie, D. A. (1981). *Statistics in Britain, 1865–1930: The social construction of scientific knowledge*. Edinburgh, UK: Edinburgh University Press.

Malkiel, B. (1973). *A random walk down Wall Street*. New York, NY: Norton & Co.

Malthus, T. R. (2004). *An essay on the principle of population* (G. Gilbert, Ed.). Oxford, UK: Oxford University Press.

Marshall, A. (1890). *Principles of economics 1* (1st ed.). London, UK: Macmillan.

Merriman, P. A. (2014, December 29). 8 Lessons from 80 years of market history. Retrieved from http://www.marketwatch.com/story/8-lessons-from-80-years-of-market-history-2014-11-19

Mischel, W., Shoda, Y., & Rodriguez, M. I. (1989). Delay of gratification in children. *Science, 244,* 933–938. http://dx.doi.org/10.1126/science.2658056

Mullainathan, S., Noeth, M., & Schoar, A. (2012). *The market for financial advice: An audit study*. National Bureau of Economic Research. http://dx.doi.org/10.3386/w17929

Nevin, J. A. (2005). The inertia of affluence. *Behavior and Social Issues, 14,* 7–20. http://dx.doi.org/10.5210/bsi.v14i1.118

Nevin, J. A., & Grace, R. C. (1999). Does the context of reinforcement affect resistance to change? *Journal of Experimental Psychology: Animal Behavior Processes, 25,* 256–268. http://dx.doi.org/10.1037/0097-7403.25.2.256

Rosario, P. (2006). *Underdetermination of science part I: The relation between formal science and natural science*. Morrisville, NC: Lulu Enterprises Inc.

Schwartz, B. (2004). *The paradox of choice: Why more is less*. New York, NY: Ecco Press.

Simkovic, M. (2009). Secret liens and the financial crisis of 2008. *American Bankruptcy Law Journal, 83,* 253–296.

Stigler, S. M. (1973). Laplace, Fisher and the discovery of the concept of sufficiency. *Biometrika, 60*(3), 439–445.

Strogatz, S. M. (2001). *Nonlinear dynamics and chaos: With applications to Physics, Biology, Chemistry, and Engineering* (*Studies in nonlinearity*). Boulder, CO: Westview Press.

Sullivan, A., & Sheffrin, S. M. (2003). *Economics: Principles in Action*(p.). Upper Saddle River, NJ: Pearson Prentice Hall.

Treynor, J. L., & Kay, M. (1966). Can mutual funds outguess the market? *Harvard Business Review, 44,* 131–136.

Vaughan, W., Jr. (1981). Melioration, matching, and maximization. *Journal of the Experimental Analysis of Behavior, 36*(2), 141–149.

Vaughan, W., Jr. (1976). *Optimization and reinforcement*. Unpublished doctoral thesis, Harvard University.

Veblen, T. (1899). *Theory of THE LEISURE CLASS: An economic study of institutions*. New York, NY: The Macmillan Company.

Zubin, J. (2008, June 17). In praise of the wealth effect. *Upstart Business Journal*. Retrieved from http://upstart.bizjournals.com/views/blogs/odd-numbers/2008/06/17/in-praise-of-the-wealth-effect.html?p.=all

Appendix A

A Model of Value and Its Discounts

The value of a consequence is ΔA_m = the change in overall value of reinforcers delivered with no delay when the position in a sequence of reinforcers is ignored until satiation occurs. In equation 1, this is the perceived reinforcing value of event m. The ΔA_m is the immediate value of ith reinforcer as a measure of the sensitivity or value of reinforcement. We could have used V_A but because ΔA comes from Mazur's work, we will use it.

$$A_m = \sum \Delta A_m \quad (1)$$

The term, A_i, is also the special case of A_m. The index, i, is used to define the cycles: how far the delayed reinforcer is from choice. Hence, i is the index *of* the ith delivered reinforcer in a sequence of reinforcing events. In respect to the equation $\Delta V = \Delta A_i/\Delta t'$, $\Delta A_i = \Delta V^* \Delta t'$. In this sense, change in overall value of reinforcers delivered is proportional/depends on the discounted value ΔV. So if ΔV increases then ΔA_i also increases and vice versa. It will be shown that the Commons/Mazur discounting equation is just this difference equation.

$$\Delta V = \Delta A_i/(1 + k_1 d) \quad (2)$$

Note that by substituting $\Delta t - 1$ for d, one gets

$$\Delta V = \Delta A_i/[1 + (k_1 \times (\Delta t - 1))]$$

Let us define $\Delta t' = 1 + k_1 \Delta t - k_1$

Then $\Delta V = \Delta A_i/\Delta t'$, a simple difference equation, where

ΔV = Value.

$d = \Delta t - 1$, delay equals change in time minus 1.

Δd = Change in delay $(d_1 - d_2)$

Δt = Change in time. Note that for $t = 1$, reinforcement is not delayed (i.e., $d = 0$).

$\Delta t' = 1 + k_1 \Delta t - k_1$

k_1 = Sensitivity to delay

Sensitivity to Change in Delay

Major innovative scientists should also be somewhat insensitive to risk, making it possible to attack very difficult problems that no one else is doing and other problems that no one else even sees. Here risk is represented by how sensitive an individual is to a change in delay, usually increases in delay. This is the quantification of Vaughan's (1976, 1981; Herrnstein & Vaughan, 1980) melioration concept (also see Herrnstein & Prelec, 1991), which is represented by taking the differences between $\Delta A_i/\Delta d = \Delta(\Delta A_i/(1 + k_2 d))/\Delta d$ with respect to changes in time in the *second* difference equation. The parameter, new sensitivity parameter to this difference is k_2.

$$(\Delta A_i/\Delta d)/\Delta d = \Delta[\Delta A_i/(1 + k_2 d)]/\Delta d \quad (3)$$

Next, as will be shown, equation 3 represents a hyperbola. By definition, Δd is an expression referring to a difference between two variables: $d_1 - d_2$, where d_1 and d_2 are values in the delay. The denominator based on this difference is used to calculate a slope of the discounting function shown in equation 2. Through simple substitution and arithmetic, one can conclude that the value of $\Delta(\Delta A_i/\Delta d)\Delta d$ for any value is shown in the Appendix.

(*Appendices continue*)

Appendix B

Disruptive Innovation

Disruptive innovation is "an innovation that creates a new market by applying a different set of values, which ultimately (and unexpectedly) overtakes an existing market" (Christensen, 1997). This type of innovation is the reason history is unable to predict the future. An innovation earns the title of 'disruptive' when it not only improves a product or service and expands the consumer range in unexpected ways, but then proceeds to lower the price. It is important to now that disruptive innovation is not an immediate process. The disruption and displacement of the existing market can take years, but is not the same as sustaining innovation. Sustaining innovation advances existing markets and value networks, but does not create new markets (Christensen, 1997).

Technology was the initial source of disruptive innovation, so much so that Christensen (2003) used the term disruptive technology before altering the wording to 'innovation'. The change from 'technology' to 'innovation' was attributable to a realization by Christensen in is second book on the subject, *The Innovator's Solution*, that it is not the technological advance itself that changes the market. Instead, it is "the business model that the technology enables that creates the disruptive impact" (Christensen, 2003).

Technological changes are much more rapid that social changes, but less disruptive. This may seem contradictory to the above, but it is important to remember Christensen's claim that it is the business model not the technology itself that changes the markets. The constant advancement of technology produces a steady flow of technological innovations; therefore, each new step is rapid and nondisruptive to the markets (Veblen, 1899). How business models choose to use these ever changing technical innovations is what determines the weight of disruption on the market. Patents are an example of how technology is rapid and nondisruptive. Most of the patents granted are technological in nature and we do not see a major economic disruption each time a patent is granted, do we? No, we do not, and this is attributable to the nondisruptive tendencies of technological innovations within established companies. Disruptive change most often comes from startups.

A startup takes hold when there is a tipping point (Gladwell, 2000). Most startup begin with just a few people, usually one to three. The occurrence of such changes is not well modeled by relocation of resources or investments by current manager or employees. Hence, the new idea follows chaos theory not allocative economics discussed in the principles sections above.

Next the proposed theory of the mechanism for the rapid spread of an idea in cultural information is discussed. Such an idea is called a meme in the field of cultural evolution. Memes are cultural units of information. Dawkins (1989) idea is that memes spread by cultural infection. Even though it is a metaphor, we know from neural networks how such infection may precede.

Unlike the constant wave of technological innovation, social changes occur far less frequently, especially on a large scale. Social changes are far more disruptive than technological innovations and much slower to take effect. Think of the reasons we cannot change the way money managers and investors work right now, but instead have to change the way they are educated in the future. To back up Aristotle's

(*Appendices continue*)

belief that humans are essentially creatures of habit (Aristotle, 1984), there have been many studies conducted on habituation and habitual actions. It takes more time to change the way someone's mind works that it does to change the wiring and function of a technical device. Habits and human nature are the reasons social changes take much longer to take effect. However, the reason they have such an impact and disruptive effect is exactly the opposite of why technological innovations are not disruptive: social changes do not happen all that often.

The key to enacting social change is to prove that the new structure is better than the old structure. The Facebook/Instagram merger and acquisition that occurred in April 2012 is an example of one of the best transitions from old to new. As CEO of Facebook, Mark Zuckerberg's "hands-off approach is by design" (Carr 2013) in dealing with Instagram. Unlike in the past where acquisitions have simply been "folded into Facebook" (Carr 2013), Zuckerberg knew what potential Instagram held and knew he had to allow them to continue on their upward path. Austin Carr focused on the new relationship between Instagram and Facebook; a relationship of equal peers as opposed to a relationship of 'ruler and subjects.' Facebook did it right by financing and supporting Instagram with capital and infrastructure instead of absorbing them (Carr, 2013).

The key to Facebook's success with the acquisition of Instagram was the support offered instead of the changes required. This is a theory that can be applied to any sort of leadership position, from CEOs to coaches: there is a difference in making someone do something and making someone wants to do something. Aristotle also noted that people are driven by passion. Inciting someone's passion is a much more productive way to achieve a goal rather than implicit or explicit threats. To change the economic markets and the players within the market, namely the investors and money managers, we must prove to them that the new ways of investing are the better ways. This will be achieved through the updated academic curriculum that will train these future money handlers and also through logical arguments that concretely show the costs and, more importantly, the benefits of the new system. If we are able to teach these future investors the new ways before they become habituated to the current processes, we have a chance to add a bookmark to the book of economic history.

An important example is the raising of capital. It is even moving to the internet with cloud funding, reducing the power of investment banks and risk capital companies and even private investors. These models of investing lead to more flexibility and possibly more confidence and therefore a more risk-neutral outlook on investing. Markets are dynamic systems that have both properties modeled by negative feedback that creates stability and positive feedback that creates massive change and large swings in prices. As such they require metasystematic reasoning. The challenge for investors is that they cannot just learn formulas but have to understand the concepts behind them.

As an investor's move up in stage, their rate of return in their investments increases this is because they no longer fail to avoid the lower stage traps and poor decision making. But why do their experts fail to guide them well in their investment decisions? Strangely enough there are just two reasons. The most important is the advisors are not high enough stage of performance to know what they are doing. Self-interest and conflict of interest almost always favor trading, Mutual fund and advisors charge for their useless guidance. They are mostly self-deceived as to their expertise. Consider their advice as entertainment. If you thing this is too sever, make up a "fake" account that follows their advice and compare it to the averages. Remember hedge funds and mutual funds shut down regularly, which covers up their stupidity. There are even sadder reasons advice is so bad. Nevin's (2005; Nevin & Grace, 1999) Law of Behavior Momentum shows that as long people get paid a somewhat regular amount, changing the outcome does not influence their choices. The exception is when one is very rich or very poor so that the immediate payoff is not important. So being right some of the time keeps people believing in their own questionable advice.

Received August 6, 2014
Revision received August 20, 2014
Accepted August 24, 2014 ■